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FIVE

Human vs. Animal Relation to the Environment:

A Bergsonian-Whiteheadian Perspective on Uexküll's Concept of "Umwelt" and Cassirer's "Animal Symbolicum"

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UEXKÜLL'S CONCEPT OF UMWELT¹

IN HIS *THEORETICAL BIOLOGY*, first published in German in 1920, Jakob von Uexküll (1864–1944) developed a highly complex theory that might be described as “biological Kantianism.” Starting from Immanuel Kant’s thoughts about the nature of space, time, causality, and apperception he suggested a unique approach to most elementary biological concepts such as “organism,” “perception,” “environment,” “evolution,” and “adaptation,” which radically differs from Darwinism and Neo-Darwinism, as well as from the work of all influential theoretical biologists up to the present time. The concept of “Umwelt” was introduced in Uexküll’s famous book *Umwelt und Innenwelt der Tiere (Umwelt and Inner World of Animals)* in 1909. There, he makes a clear distinction between the terms “Umgebung”—which I translate as “surroundings”—and “Umwelt.”² The German word “Umwelt” contains the terms “um” and “Welt,” the English translations of which are “around” and “world.” In German, however, “Welt” implicitly signifies a manifold that is meaningful to a living being because it lives within it. Features of the physical surroundings that are relevant to the organism with respect to its self-preservation and reproduction constitute

its Umwelt. An organism will incorporate those relevant aspects of its surroundings into its life world. In other words, “Umwelt” refers to those features of a living being’s surroundings that are meaningful to it.

Animals as Subjects

The function circle describes the Umwelt as a unity that is constituted by the world-as-sensed and the world of action. The function circle represents the organism as a subject that meaningfully integrates objects into its Umwelt. According to Thure von Uexküll, Uexküll’s elder son, the function circle of his father can be seen as a semiotic activity in which the process of semiosis is manifest.³ Indeed, as Jakob von Uexküll says, “one can speak of functional cycles as meaning cycles, whose task is determined to be the utilization of carriers of meaning.”⁴

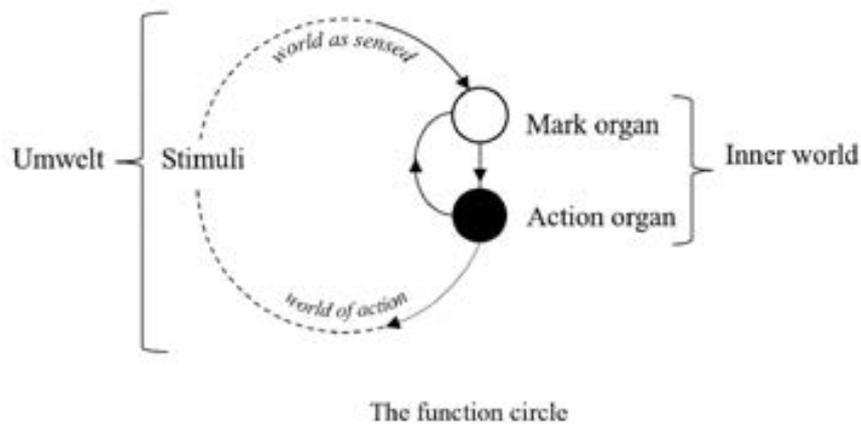


Figure 1 The function circle

The indications of which the world-as-sensed consists are not mere copies of features of external entities. Rather they are constructed in a nontrivial cognitive process as spatially, temporally, and spatiotemporally localized features of the perceived world.

Many indications are combined into a *thing* (*Ding*).⁵ A thing is a coherent unit of indications that occupies a moment and a place or a direction in space. It is an instantaneous datum of experience. Things are events rather than persistent entities. Animal and human subjects synthesize things unconsciously.⁶ The unconscious creative process also creates another kind of cognitive entity—*objects* (*Objekte*). An object is

an enduring thing, a thing extended in time. It is an enduring sequence of data of experience that occupies a particular spatiotemporal region in the subject's perceptual-space-time. Objects constitute higher units of experience than things.⁷ Objects can be involved in lawful causal relations. Uexküll calls objects that possess a *framework* (*Gefüge*), merging their parts into organized whole *implements* (*Gegenstände*). Implements are objects in which "the parts stand in the same relation to the whole as the individual sounds to the melody."⁸ Implements are organized wholes of data of experience. They might represent artificial or natural entities. The only natural implements that Uexküll knows are representations of organisms, parts of organisms (cells, tissues, organs), and groups of organisms.

Things, objects, and implements are not ontological but epistemological concepts. The world-as-sensed and the world of action of both humans and most animals is constituted by these three kinds of cognitive entities. According to Uexküll things, objects, and implements are differently complex products of one and the same unifying process, the so-called *apperception process*.⁹ The apperception process lies at the root of all perception:

Whatever the perception, the activity is of the same kind; different qualities are constantly being associated into unities. The power of the subject (*Gemüt*) that exercises this apperceptive activity is for ever creating new structures; in its very nature, it is a formative force (*Bildungskraft*).¹⁰

Uexküll's epistemologically founded biology of subjects is anchored in the assumption that the laws forming our attention and thus creating the *Umwelt* of our own subjectivity can also be recognized in animal subjects.¹¹ Uexküll makes clear that the apperception process, although lawful, cannot be mathematically described.¹² For this and other reasons biology cannot be reduced to physics.¹³

Uexküll's conviction about the non-reducibility of biology to physics is supported by Kant's concept of *pure* or *original apperception*, which is the underpinning philosophy of the Uexküllian apperception process. In his *Critique of Pure Reason* (*CPR*) Kant introduces pure apperception as a spontaneous a priori activity of the *subject* that synthesizes the manifold of our representations to a unity.¹⁴ Pure apperception is an operation of what Kant describes as 'understanding' (*Verstand*):

Combination does not lie in the objects, however, and cannot as it were be borrowed from them through perception and by that

means first taken up into the understanding, but is rather only an operation of the understanding, which is itself nothing further than the faculty of combining a priori and bringing the manifold of given representations under unity of apperception, which principle is the supreme one in the whole of human cognition.¹⁵

The unity of perceived data in all our representations “can be executed only by the subject itself,”¹⁶ i.e., by a transcendental factor that can never be an empirical content of human representations. Unification of representation requires unity of consciousness. The logical consequence is:

[T]he unity of consciousness is that which alone constitutes the relation of representations to an object, thus their objective validity, and consequently is that which makes them into cognitions.¹⁷

Since Kant’s term “understanding” refers to the *a priori* faculty of reason to combine representations and to transform their manifold into a coherent unity of apperception, it is a technical term and must not be confused with the common meaning of that term in everyday language.

Although Kant intended his theory of pure reason to provide a theoretical grounding for Newtonian physics, his conviction that the unity of experience is executed only by the subject goes against the objectivism and anti-transcendentalism which characterizes contemporary physics and the physics of Uexküll’s time. From the materialist perspective, only a human or animal brain can cause the unity of human or animal experience. Both Kant and Uexküll would reject this contention, because according to both Kant and Uexküll brains are not transcendental factors but physical entities that can be sensually experienced in cognitive acts. Brains are not *a priori* principles but *a posteriori* data of perceptions.

Uexküll extended Kant’s theory of human subjectivity to a general biological theory that applies to both human and animal subjects. He considers human and animal subjects to be transcendental; they are considered spatially nonlocalizable unities of apperception. The apperception process unfolds lawfully and determines the synthetic process of perception. *For that reason the apperception process can be considered the central category of subjectivity.* In this sense it is comparable to the striving of “actual occasions,” as Whitehead describes the most elementary entities of reality in his metaphysics, to complete themselves as subjects.¹⁸ Both Whiteheadian actual occasions and Uexküllian apperception processes are synthetic activities or, more aptly, *agents of concretion.*¹⁹

*Continuity and Discontinuity between Human and Animal
Spontaneity of Cognition*

Uexküll's intellectual closeness to Kant suggests that he implicitly thinks of the apperception process as a spontaneous activity. For Kant, spontaneity is, in contrast to receptivity of (sensual) intuition (*Anschauung*), a cognitive faculty only of understanding (*Verstand*) and reason (*Vernunft*).²⁰ Since the meaning of "intuition" in Kant's works refers to sensual perception, it must not be confused with the meaning of this term in contemporary everyday language or in this chapter. The autonomous ability of the subject to form concepts makes thinking possible. Spontaneity and receptivity complement each other and produce cognition or knowledge, which arises only from the connection of (sensual) intuitions and thinking. Kant's famous quote "thoughts without content are empty, intuitions without concepts are blind"²¹ perfectly characterizes the synergy of spontaneity and receptivity. It characterizes every human cognitive act as a spontaneous synthetic activity in which particular sensual representations become merged with general concepts.

From a Kantian perspective the most essential feature of human subjectivity consists in a specific connection of spontaneity and receptivity that is the very essence of pure apperception:

The I think must be able to accompany all my representations (*Vorstellungen*); for otherwise something would be represented in me that could not be thought at all, which is as much as to say that the representation (*Vorstellung*) would either be impossible or else at least would be nothing for me. That representation that can be given prior to all thinking is called intuition (*Anschauung*). Thus all manifold of intuition has a necessary relation to the I think in the same subject in which this manifold is to be encountered. But this representation is an act of spontaneity, i.e., it cannot be regarded as belonging to sensibility (*Sinnlichkeit*). I call it the pure apperception, in order to distinguish it from the empirical one, or also the original apperception, since it is that self-consciousness which, because it produces the representation I think, which must be able to accompany all others and which in all consciousness is one and the same, cannot be accompanied by any further representation.²²

The spontaneous activity of pure apperception is a self-determined factor of cognition. As such it makes human freedom possible. According

to Kant, freedom is a faculty of practical reason. This means that it can be assigned only to subjects which are not only able to make *moral judgments* about real or hypothetic situations but, above all, to conceive those judgments as their own thoughts: the “I think” must accompany all their representations and thoughts. This ability, however, can hardly be ascribed to animal nonhuman species. The “I think” is not a sensual representation but itself a thought that, as with all thoughts, can only be produced by rational beings that operate with concepts, i.e., by beings endowed with symbolic capability. Thus, from a strict Kantian perspective it is difficult to assign freedom to animal subjects that lack the ability to operate with concepts and thus to produce thoughts, at least in our human understanding of thinking, not to speak of conceiving them as their own products. Uexküll’s biology cannot account for creativity, which, in the strict meaning of that term, applies to *human* freedom. Nevertheless, this does not exclude other forms of freedom, beside human freedom. Kant’s idea “thoughts without content are empty, intuitions without concepts are blind” must undergo a radical reinterpretation. That spontaneity and receptivity complement each other and produce cognition may also be seen to apply to animals.

It seems clear that Uexküll’s theory of meaning displays latent semi-otic aspects in that organisms operate and interpret *signs* that are related to entities or events of their Umwelts. In an essay written by myself and Arthur Araujo, drawing on Uexküll’s *Theoretical Biology* (1926) and *A Foray into the Worlds of Animals and Humans* (1934), we suggest that *organisms are interpreters of signs*. Ascribing the ability of interpretation to animals requires the introduction of an extended concept of spontaneity that is not limited to the rational usage of human concepts and symbols. We suggest that Uexküll’s perspective is compatible with a general biological form of transcendental spontaneity, a form of spontaneity more fundamental than Kant’s pure apperception, which applies only to human consciousness.²³ According to Uexküll, spontaneous processes merge a manifold of signs (signals) that are correlated with particular entities of the animal’s Umwelt to form units of meaning. Those units are acts of experience, i.e., they are qualitative phenomena and not mere epiphenomena—they are complexes of *qualia*. In other words, animals, especially the most primitive ones, do not reflect rationally about the meaning of their perceptions. Their behavior is responsive to feeling. As Whitehead would say, apart from (animal) feelings there is no interpretation in the (animal) world. If this is true, *biological spontaneity synthesizes signs (signals) to units of feeling that*

have their own unique complex mental structure of qualia. Such a structure can be seen as the *mental pole* of a Whiteheadian actual occasion.²⁴ Most importantly, Whitehead's concept of *concrecence* opens a new way of conceiving the process of amalgamation of signs to a complex feeling beyond antiquated substance ontology and physicalistic metaphysics. In contemporary philosophy of mind literature it is a commonplace understanding that qualia cannot be reduced to physical states. Hence, it is not possible to explain the synthetic process that generates those qualia by referring to mere physical factors, i.e., to spatiotemporally localized entities or events, such as brain processes. Consequently, not only human but also animal interpretation cannot be reduced to processes that are determined by the physical interactions between the sense organs of the organism and its physical surroundings (Uexküll's *Umgebung*). Following Kant, Uexküll claims that the apperception process generates the unity of human ego.²⁵ I suggest that the more basal biological apperception process that creates the unity of experience as a coherent qualitative phenomenon can be attributed even to primitive animal experiences. Thus, even if the Uexküllian animal subject lacks the ability to create and use human concepts, animals can still be understood as sources of *creative* spontaneous processes that display a *rudimentary form of freedom*. The basal biological apperception process that synthesizes the unity of any process of experience must be creative because—as being a specific form of the Kantian apperception activity—it cannot be determined by any physical factors, i.e., by sensually experienceable entities. Thus it must occur spontaneously and manifest an elementary form of freedom that could be described as “proto-freedom.”

There are similarities and dissimilarities between animal and human forms of spontaneous cognition. As human beings, we have the unique ability to experience and express our selves through language. Humans are the only animals able to create abstract concepts and put them to use in our daily lives. Kant's fundamental insight “The *I think* must be able to accompany all my representations” still expresses the most essential truth about the human mind, because the “I think” mostly unconsciously penetrates all our cognitive acts and forms them. In addition, this insight applies only to human subjectivity because it is true only for beings able to operate with linguistic terms. We are the only known biological beings that do not only have a self but also an abstract ego. *Only human subjects can develop abstract egoity.* This doesn't, however, mean that the human self is restricted to abstract ego. We share with animals the spontaneous,

creative, and deeply unconscious activity of merging a manifold of signs into units of meaning. The nonverbal cognitive activity in adults (dreams, altered states of consciousness, spontaneous insights, etc.) and young children without faculty of speech proves that those processes are not primarily determined by language skills and abstract concepts.

CASSIRER'S UNDERSTANDING OF THE HUMAN AS ANIMAL SYMBOLICUM AND BERGSON'S CRITIQUE ON HUMAN INTELLIGENCE

In his book *An Essay on Man*, published in 1944, Ernst Cassirer (1874–1945) considers Uexküll to be “a defender of the principle of the autonomy of life”: “Life is an ultimate and self-dependent reality. It cannot be described or explained in terms of physics or chemistry.”²⁶ Uexküll’s primarily epistemological approach to biology, according to which animals and humans are subjects that build “a world in itself,” emphasizes the *mediatedness of cognition*.²⁷ This idea, together with the introduction of the apperception process as a synthetic activity governed by *a priori* forms, had to attract Cassirer’s attention since he was strongly influenced by the mathematically-scientifically oriented Neo-Kantian “Marburg School.”

However, with respect to human cognition, Cassirer expands Uexküll’s function-circle by a component, “which appears to be the distinctive mark of human life.”²⁸ In humans, between the “world-as-sensed” and the “world of action” we find a “third link,” which is the world of symbols.²⁹ The human lives “in a new *dimension* of reality,” in a “symbolic universe,” parts of which are language, myth, art, and religion.³⁰ The human “cannot see or know anything except by the interposition of this artificial medium.”³¹ Thus “instead of defining man as *animal rationale* we should define him as an *animal symbolicum*.”³²

Nonhuman animals understand and use signs. Nevertheless, Cassirer makes a distinction between signs and symbols. Animals with highly developed nervous systems are able to express emotions, such as rage, terror, desire, playfulness, and pleasure by means of gesture. But *animal communication lacks symbols, which are signs with an objective reference or meaning*.³³ According to Cassirer “(t)he difference between *propositional language* and *emotional language* is the real landmark between the human and the animal world.”³⁴

This difference, which makes humans the only “symbolic species”³⁵ of Earth, characterizes also the specific difference between human and animal

intelligence. As Cassirer argues, animals possess “a practical imagination and intelligence, whereas man alone has developed a new form: a symbolic imagination and intelligence.”³⁶

Cassirer highlights three crucial differences between human language and animal usage of signs. *First*, he illustrates that symbolization is “a principle of *universal* applicability,” since everything can be denoted.³⁷ Other than signs used or interpreted by animals, which represent specific entities, situations, or emotions, symbols are not restricted to particular cases. *Secondly*, Cassirer explains how a symbol is “extremely variable [. . .] (whereas) a sign or signal is related to the thing to which it refers in a fixed and unique way.”³⁸ Whereas any one individual sign or signal refers to a certain individual entity or process, a specific idea or thought may be expressed by using quite different symbols or combinations of symbols. *Thirdly*, Cassirer identifies human language as able “to isolate relations—to consider them in their abstract meaning.”³⁹ By using an adequate symbolism humans are able to abstract from particular entities and to study their spatial and other relations to a degree that is far beyond animal cognitive faculty. Geometry and algebra are the classical examples of the human’s ability to study universal relations in abstraction from related entities. Without the preliminary step of human language, mathematics would not be possible.

Biologic Relevance of Symbolic Systems: a Central Cause of Discontinuity between Human and Animal Evolution

Language is a main causal factor that has influenced the evolution of the human brain.⁴⁰ In addition to brain evolution, linguistic development directed physical activities in specific ways and changed humans’ dietary habits. This has decisively influenced the evolution of our whole body; for example, hands, teeth, muscles, and our digestive system. The form of our skeleton and the structure of our muscles, bones, sinews, and nerves has evolved to such an unprecedented degree that human beings’ dexterity, coordination, and complex motion abilities far exceed those of other animals. Just as no animal can write, there are no animals able to perform a ballet dance or synchronized swimming, play piano, or free-climb.

Beside natural language, the abstract languages of mathematics, philosophy, sciences and technology have exerted an enormous impact on human evolution. One need only think of how the Neolithic technique of stonecutting and ceramics, the invention of the plow, and the emergence of metal have formed agriculture and urban life, which themselves have critically

changed the route of our physical evolution. Of course, these new techniques and technologies require the invention of a specific terminology and thus the evolution of language. Through the scientific-technological revolution of the last centuries, abstract and formal symbolic systems have become exceedingly complex and have influenced our ongoing evolution. Since the *Weltanschauung* of that revolution has been influenced by Renaissance Platonism, and later by materialistic, dualistic, and empiristic philosophies, those philosophic traditions have had and continue to have a crucial effect on our evolution. Scholars of process philosophy, including the authors featured in this volume, hope to undermine the dualistic scientific-technocratic logic that has been so detrimental to planetary evolution and to offer new ways for understanding the natural world and our place within it, ways that contribute to rather than diminish the health of the planet.

Since Darwin's introduction of the concept of *sexual selection* in his work *The Descent of Man, and Selection in Relation to Sex* (1871) we know that the sense for beauty and the sexual attraction caused by it are powerful factors of both animal and human evolution.⁴¹ Our symbolic systems have guided our sexual selection in such a highly subtle way that it has scarcely been adequately recognized yet. For thousands of years the interpenetration of specific symbolic systems, such as literature, myths, and legends with music, dance, and forms of body beautification has played a crucial role in social events, such as celebrations and athletic contests in honor of gods, in which potential partners have met one another. In many cultures skills shown in those cultural events have been, and still are, an important factor for marriage. Due to the sexual revolution and liberation of the last century this tendency has been considerably intensified: one needs only to think of the millions of partnerships that began in dancing sessions, parties, and rock festivals in the last fifty years. If we consider that showing up to those events requires participation in complex networks of symbolic systems, the role of symbolic forms in erotic attraction becomes obvious.

Human Abstract Perception of Space and Time and Bergson's Concept of Spatialization

A direct result of the ability of human species to use geometrical and other mathematical symbolisms to focus on abstract spatial relation is the abstract perception of space. Unlike animals, which live in their individual concrete "perceptual space," humans are able to conceive the

idea of “abstract space” or “symbolic space” by a very complex process of thought.⁴² Since the time of Newton, physics has been based around abstract or mathematical space, which should not be confounded with the space of our sensual experience. Abstract space is conceived of as an entirely homogeneous extension that is a fiction of the human mind; it does not represent any physical or psychological reality. Cassirer considers the “points and lines of the geometer [. . .] [to be] nothing but symbols for abstract relation.”⁴³

Cassirer was familiar with the works of Henri Bergson (1859–1941), a process philosopher. In his first book, *Time and Free Will* (1889), Bergson reflects on the fact that within the field of mechanistic physics mathematical space is understood as an empty vessel, the parts of which are considered many simultaneously existing but distinctive and smaller empty vessels:

[It is the] clear idea of a homogeneous medium, i.e., of a simultaneity of terms which, although identical in quality are yet distinct from one another.⁴⁴

He thinks that this conception of space in mathematical physics has very deep roots and can be traced back to the beginnings of arithmetical thinking. According Bergson, there is an intrinsic connection between geometry and arithmetic. Bergson’s point of departure is that it is not possible to conceive the idea of addition in a universe in which there is time but no space:

It is certainly possible to perceive in time, and in time only a succession which is nothing but a succession, *but not an addition*, i.e., a succession which culminates in a sum. For though we reach a sum by taking into account a succession of different terms, yet it is necessary that each of these terms should remain when we pass to the following, and should wait, so to speak, to be added to the others how could it wait, if it were nothing but an instant of duration? And where could it wait if we did not localize it in space? We involuntarily fix at a point in space each of the moments which we count, and it is only on this condition that the abstract units come to form a sum.⁴⁵

Entities to be added are “parts of space, and space is, accordingly, the material with which the mind builds up number, the medium in which the mind places it.”⁴⁶ Simultaneous coexistence of entities to be added

is, however, not the only necessary condition for addition. Only entities considered to have one and the same essence can be added.⁴⁷ This condition is best fulfilled by entirely abstract entities, the essence of which is pure quantity bare from any quality. Clearly, numbers are those entities:

[T]he idea of number implies the simple intuition of a multiplicity of parts or units, which are absolutely alike.⁴⁸

A Newtonian understanding considers empty space as pure extension bare of any possible quality and thus as constituting an entirely homogenous continuum. Of course, this applies equally to all parts of empty space, i.e., to all its possible divisions into smaller empty spaces. Therefore *empty space and numbers are in some sense coessential*. There is an “inter-connexion between the notions of number and space.”⁴⁹ Since Bergson considers numbers, like all concepts, creations of the human mind, he claims that the abstract idea of homogeneous space grows out of an effort of human intelligence and concludes:

[T]he higher we rise in the scale of intelligent beings, the more clearly do we meet with the independent idea of a homogeneous space. It is therefore doubtful whether animals perceive the external world quite as we do, and especially whether they represent externality in the same way as ourselves. [...] This amounts to saying that space is not so homogeneous for the animal as for us, and that determinations of space or directions do not assume for it a purely geometrical form. Each of these directions might appear to it with its own shade, its peculiar quality.⁵⁰

From a Bergsonian perspective, the transition from animal experience of a spatially extended qualitative manifold to the purely quantitative, geometrical space characteristic of the most abstract forms of human experience constitutes a major discontinuity in the evolution of perception. This transition was driven by the human invention of specific symbolic languages that allow the mind to grasp and operate upon numerical, geometrical, and mechanical concepts.

Beside the experience of space, human symbolisms radically influence our experience of time as well. “When dealing with the problem of organic life,” says Cassirer, “we have, first and foremost, to free ourselves from what Whitehead has called the prejudice of ‘simple location.’ The organism is never located in a single instant.”⁵¹ The momentary state of an organism

cannot be described without taking that organism's history into consideration and without referring to its future. Cassirer understands memory to be a general function of all living beings, meaning that the organism preserves in its body material traces of past events and that these traces influence its future reactions. He makes clear, however, that human memory is something quite different. Other than in animals, human recollection cannot be described as an ideational return of past events as a faint copy of former experiences. It is rather "a rebirth of the past; it implies a creative and constructive process."⁵² Human memory is a *symbolic memory*, which is "the process by which man not only repeats his past experience but also reconstructs this experience. Imagination becomes a necessary element of true recollection."⁵³ In his second book, *Matter and Memory* (1896), Bergson emphasizes the creativity of the process of recollection as well.⁵⁴

In *Time and Free Will* the most central issue Bergson deals with is human experience of time through the lens of the conception of abstract space or, in other words, the *spatialization of time*.⁵⁵ Modern scientific thought, which has been influenced by physics, has a strong tendency to treat time as an infinite homogeneous medium. This reduction of time to pure and objective quantity bare of any experiential qualities is not limited to several subfields of physics but has been expanded also to the study of biological and psychological processes. It has also occupied the perception of time in everyday life as well as most humans' understanding and even experience of the temporality of their own mental and emotional life. Nevertheless, if psychical time were nothing but a sort of one-dimensional, totally homogeneous medium, we would have to consider our mental processes as successive events that occupy distinct positions in this medium, just as physical bodies in empty space do. In other words, the processes of our inner life would be sharply separated from each other and thus not interpenetrate one another at all. As Bergson, however, correctly claims:

States of consciousness, even when successive, permeate one another, and in the simplest of them the whole soul can be reflected.⁵⁶

This follows directly from Bergson's concept of *duration* that is not only the main pillar of his philosophy of time but also builds the basis of his metaphysics. The most essential feature of human consciousness is that our mental states penetrate one another so that their interconnection organizes them in such a way that each one of them reflects the whole temporal continuum of our experience:

Pure duration is the form which the succession of our conscious states assumes when our ego lets itself live, when it refrains from separating its present state from its former states. [...] it is enough that, in recalling these states, *it does not set them alongside its actual state as one point alongside another*, but forms both the past and the present states into an organic whole, as happens when we recall the notes of a tune, melting so to speak, into one another. Might it not be said that, even if these notes succeed one another, yet we perceive them *in one another*, and that their totality may be compared to a living being whose parts, although distinct, *permeate one another* just because they are so closely connected? [...] We can thus conceive of succession without distinction, and think of it as a *mutual penetration*, an interconnexion and organization of elements, each one of which represents the whole, and cannot be distinguished or isolated from it except by abstract thought.⁵⁷

Accordingly, the contents of our mental life are not distinct from one another like bodies in empty space that are clearly separated and therefore *countable*. Thus the idea of countability, so fundamental to modern sciences, is not possible within human temporality or duration. The duration of our experience constitutes a *heterogeneous continuum*: the stream of interconnected experiential qualities that “permeate one another.” These mental acts determine their own essence through their interpenetration. *The whole duration is a process that permanently transforms its own essence*. Thus, it is in the most radical sense of the word a *heterogeneous* multiplicity. In sharp contrast to the homogeneous continua constructed by abstract intelligence, heterogeneous continua constitute the most concrete continuum that we know. Because heterogeneous continua incessantly transform their own essence, they cannot be subject to any mathematical operation. Since the mental acts are internally related one to another, they cannot be separated from each other, so that duration can neither be increased by addition of distinct mental acts, nor divided by those acts. In other words: there are no “pieces of duration.” Thus, due to its radical heterogeneity, duration might be interrupted by an external cause but not divided by it. Duration is a creative continuum that continues itself.

Bergson assumes that the abstract considerations of space and time as homogeneous empty media are not equally fundamental and primordial and “that the idea of space is the fundamental datum.”⁵⁸ The abstract idea of time as a homogeneous and unbounded medium has been derived from abstract space:

Time, conceived under the form of a homogeneous medium, is some spurious concept, due to the trespassing of the idea of space upon the field of pure consciousness.⁵⁹

Therefore, Bergson makes a sharp distinction between two different kinds of reality: heterogeneous reality and homogeneous reality. The former is the reality of sensible qualities. The latter includes abstract space, scientific conceptions of time, mathematics, and other abstract constructions.⁶⁰

This latter [the homogeneous kind of reality], clearly conceived by the human intellect, enables us to use clean cut distinctions, to count, to abstract, and perhaps also to speak.⁶¹

Bergson's conception of "spatial" order has been widely understood in terms of *spatialization* in the field of philosophy. The concept of spatialization not only implies that "every homogeneous and unbounded medium"⁶² is spatial, but, even more, it allows us to reassess our scientific, economic, and other abstract theories through Bergson's above-discussed insights about the essence of spatial and homogeneous order. It is especially important in this context to consider that "if we notice that abstraction assumes clear-cut distinctions and a kind of externality of the concepts or their symbols with regard to one another," we shall understand that "the faculty of abstraction" in general is implicitly based on the abstract conception of a "homogeneous medium."⁶³ In other words, *all* our abstract concepts, symbols, and theories are to some degree specific manifestations of what Bergson calls "spatialization."

From a Bergsonian perspective, the human faculty of spatialization lies at the root of the discontinuity between human and animal life. As it is intrinsically and indissolubly connected with intelligence, spatialization can be seen as a main cause of the arising of human nature and the bifurcation of human species' evolution from the evolution of all other primates. As already noted, Bergson argues that "the higher we rise in the scale of *intelligent* beings, the more clearly do we meet with the independent idea of a homogeneous space."⁶⁴ Bergson's theory of the evolutionary relationship between intelligence and homogeneous space is unpacked in his best known book, *Creative Evolution*. In the second chapter of that book he makes his famous distinction between *instinct*, *intelligence*, and *intuition*.⁶⁵ As René Pikarski makes clear in the present book, whereas instinct and intuition are faculties of mental closeness between subject and object, intelligence is the capability for

cognitive and emotional distance between them. This is due to the indirect, mediated contact, by more or less abstract thoughts, of intelligent beings with nature. According to Bergson, intelligence is a mental faculty of not only humans but also of other living beings. Intelligence is an essential feature of vertebrates as well.⁶⁶ Humans, however, are the only species that has developed this ability to unprecedented heights. Human experience of space, time, matter, and other living beings has been shaped by our spatialized intelligence—first and foremost by our abstract scientific symbolisms that homogenize the intrinsic heterogeneity of all expressions of life.

At this point, it may be helpful to point out that in this chapter the terms “intelligence” and “intellect” have the same (Bergsonian) meaning that Alex Gomez-Marín and René Pikarski imply when they use these terms elsewhere in this volume. This is not the case, however, for Theo Badashi’s chapter. In Badashi’s references to “Nature’s Intelligence,” the “deep intelligence of the universe,” and “Cosmic Intelligence,” he ascribes to “intelligence” a radically different meaning that in many respects coincides with the meaning of “intuition” in the present chapter.

The increasing dissociation of human symbolisms from living nature that lies at the basis of scientific and technological rationality and that is a central topic of Bergson’s writings, seems to escape Cassirer’s attention. But, on the other hand, he emphasizes an aspect of time that is overlooked in Bergson’s writings: For an appropriate understanding of human relation to time the dimension of the future is even more crucial than the dimension of the past. Anticipation of future events and even preparation of future actions is an important factor in the life of animals with highly developed nervous systems. In humans, however, as Cassirer says, “(t)he future is not only an image; it becomes an ‘ideal.’” Only humans are able to conceive of an idea of the future. Our symbolic forms enable us not only to expect the future but to upgrade it to an “*imperative* of human life.” Cassirer calls our *symbolic future* a “prophetic future” because it is best expressed in the life of the great religious prophets.⁶⁷ These religious teachers did not simply foresee future events or warn of future evils. *Their prophecies were the exact opposite of auguries:*

The future of which they spoke was not an empirical fact but an ethical and religious task. [...] Prophecy does not simply mean foretelling; it means a promise. [...] Here too man’s symbolic power ventures beyond all the limits of his finite existence. But

this negation implies a new and great act of integration; it marks a decisive phase in man's ethical and religious life.⁶⁸

From a Bergsonian perspective, one could be tempted to say that there is an *essential* difference between, on the one hand, the theoretical or abstract idea of the future in which all adult and healthy humans are able to participate and, on the other, the prophetic future. A distinction that one frequently, and in respect to totally different issues, encounters in Bergson's books is that between "difference of nature" and "difference of degree." Whereas the theoretical idea of the future requires common human intelligence, only humans that have developed their intuition far beyond the level of the average human's intuitive abilities may be open to the prophetic future. The difference between both forms of foreseeing the future corresponds with the difference of nature between intelligence and intuition, as we will see later.

HUMAN UMWELT—AN ETHICAL IMPERATIVE

The human Umwelt does not merely have a threefold structure—"world-as-sensed," "world of symbols," and "world of action"—but rather these three dimensions indissolubly interpenetrate one another. Kant's famous slogan "intuitions without concepts are blind" anticipates Cassirer's insight that we cannot even see anything except by the interposition of symbols. Our conceptual denotation of objects essentially influences our perceptual experience of them. To be an animal symbolicum means to perceive the world through abstract "organs" formed by millennia-old cultures. This symbolic mediatedness necessarily increases the distance of human intellect from what Uexküll calls the "world-as-sensed" and the "world of action." Our highly entangled symbolic forms not only allow for understanding our world, *they also restrict our comprehension of what we perceive and how we affect our Umwelt*. Paradoxically, this distance from our Umwelt has made possible for us the extreme extension of both our world-as-sensed and our world of action through the aid of artificial devices, such as telescopes, microscopes, and particle accelerators. The development of these material devices is based on our most powerful, because most universal, instruments—our scientific concepts⁶⁹—which can be invented only within advanced symbolic systems.

The vast variance of our world of symbols extends the human Umwelt far beyond the Umwelts of animal species, which are limited by their

sensual perceptions. Each theoretical and technical discipline, all arts, and all political discourses constitute a meaningful world and hence an Umwelt. Thus we all live and act in many intersecting symbolic Umwelts, each of which is inhabited by a huge number of abstract concepts. One of the most important symbolic worlds is our *ethical Umwelt*.

Our symbolic Umwelts of physics, chemistry, and biology have made the infinity of space and time objects of our scientific research. They have made it possible for us to think systematically about the vastness of space, the past and the origin of the universe, and the evolution and origins of life. However, our abstract, purely symbolic access to these areas of physical actuality does not guarantee that we *understand* the symbolized entities and processes. It was not by chance that German Neo-Kantian philosopher Heinrich Rickert introduced a distinction between *understanding* (*Verstehen*)—a concept, however, that must not be equated with Kant's concept of understanding (*Verstand*)—and *explaining* (*Erklären*). Experience of value and meaning is the *conditio sine qua non* for understanding. Hence, entities and processes that do not have any value or significance for us cannot be understood but merely described or explained.⁷⁰ From the perspective of Edmund Husserl's phenomenology, we may say that we understand only beings and processes, which are part of our *life-world* (*Lebenswelt*) or realm of our sensual and other experiences.⁷¹ From Rickert's and Husserl's point of view we *cannot* say that we understand physical and biological entities and processes, which we can explain by applying our abstract symbolisms, if they do not belong to our life-world. "Understanding" the explanations of scientists is not the same as understanding the beings the explanations are about. "Understanding" abstract symbolic systems, such as mathematical and logical equations and algorithms, is possible only because of internal explanation. Or stated another way, we acquire an understanding of such algorithms and equations by actually explaining them to our selves.

Uexküll divides our visual area into the "visual space" and the "remotest plane."⁷² Within the visual space we are able to see objects stereoscopically and thus to have depth perception of them. In other words, we only perceive our spatial distance from objects if they are within our visual space. The outer limit of our visual space is the remotest plane. If objects are beyond our remotest plane we are not able to estimate which of them is closer to us and which is further. We perceive such objects as though they were placed on the inner side of the same spherical surface, the so-called "celestial sphere." All celestial bodies appear to move on that sphere. In

direct analogy to Uexküll's distinction between visual space and space beyond our remotest plane, we may also separate our symbolic processes into those inhabiting our "area of understanding" and those operating beyond our "remotest plane of understanding," that which marks the beginning of a vast "space" of knowledge and that may be called "space of mere explaining." Of course, the usage of the term "space" here corresponds well with Bergson's understanding of spatialization or spatialized (abstract) knowledge. We can only then be confident that we understand beings and processes if they inhabit our "area of understanding," our life world. With regard to all of the other phenomena outside our life world we can only explain them. Viewed in this light we should not think that we understand the essence of entities, which we denote by scientific symbols, such as "electrons," "quarks," "quantum processes," "gravitational waves," "dark energy," "black holes," "genes," and "proteins" without them being a part of our embodied, experiential world or life-world (Husserl), as are trees, humans, rocks, mountains, oceans, storms, feelings, thoughts, and many of our own organic processes.

The entirely abstract concepts of contemporary physics, life sciences, technology, and biotechnology are clearly outside of what I have called our "area of understanding." The fact that we successfully operate with abstract symbols in our scientific languages proves only that we have learned the abstract rules of their application; it by no means shows that we understand the nature of the represented entities, let alone the complex relations between them. The symbolic systems of contemporary nano- and biotechnology, to most inventors of which the concept of life-world doesn't mean anything, allows manipulating natural beings without having even the faintest idea of the tremendous distance between their nature and our explanations of them, since those entirely abstract concepts are clearly outside of what I have called the "remotest plane of understanding."

Unfortunately, this negative aspect of symbolization, which beside science and technology also haunts politics, Anglo-American analytic philosophy, and neoliberal economics, seems to escape Cassirer's attention in *An Essay on Man*. Of course, in 1944 it was not nearly so obvious as it is today that our ignorance of the distance between our abstract symbolisms and the nature of the symbolized entities and processes—the basis of what Whitehead so accurately described as "fallacy of misplaced concreteness"⁷³—can be so destructive. Today we have to understand that explaining should not be confused with understanding and that the horizon of our life-world grows incomparably slower than our ability to act

outside of our “area of understanding.” Moreover, my impression is that the horizon of our life-world is collapsing at ever increasing speed due to the constantly accelerating spread of all forms of digital “communication” and other technologies, especially those that promise to control the future of our life as well as that of other species, for example, biotechnologies.

Nowadays it is obvious that, as Matthew T. Segall says, “symbolic consciousness also has the power to produce civilizational myths that are entirely detached from the ecological context of the living planet that sustains us” (Chapter Two).

SACRED ENVIRONMENT AND THE RISING OF THE AGE OF INTUITION—A BERGSONIAN-WHITEHEADIAN PERSPECTIVE

The term “Umwelt” cannot have the same meaning that Uexküll gave to it over a hundred years ago. Today, “Umwelt” can no longer simply mean the part of our surroundings that is meaningful to us. In today’s German language “Umwelt” means “environment.” However, in different discourses “environment” has different meanings. From the scientific point of view of theoretical ecology, both the rainforests of Earth and the dunes of Mars are environments. But *what is at stake today is the rescue and preservation of the living Umwelt of the Earth* and not the “terraforming” of Mars that is promoted by some contemporary technocrats. Given the current severe ecological crisis, it is imperative that any understanding of “Umwelt” has an ethical imperative. I suggest the following definition of “Umwelt” or “environment,” to wit: “the *living* world to be saved.” This world has a spatiotemporal extension. Its spatial extension coincides with the terrestrial biosphere. Its temporal extension entails the past and, most notably, the future of the biosphere, which includes the future of humanity. Thus the term “Umwelt” must refer also (but not only) to *future* living beings including humans. We should, however, not forget that the survival of our biosphere will be decided in the next decades and not in a distant future. The term “the living world to be saved” is an intrinsically political concept, laden with strong ethical intentions. *This term refers to something that must be saved and preserved because it is indispensable and, at the same time, it is in severe danger.* From this point of view the concept of Umwelt/environment should not be applied to other planets or space colonies. In our extremely critical present age it is important to outline the concept of “Umwelt” as an *Earth-centered* or *geocentric concept* because what is at stake

is the rescue of *this* world, in which we live, *now*. We have to get rid of the technocratic temptation to think of possible “terraformed biospheres” on other planets as if this would be just a matter of scientific knowledge, economic power, and time.

The concept of Umwelt/environment, as I understand it, has to be reinterpreted in the light of both Cassirer’s pioneering concept of the “prophetic future” and Bergson’s critique of spatialization. As stated previously, prophecies are not about future events but about *promises, the fulfilling of which is an ethical task*. This, however, I quote again, “implies a new and great act of integration.” What else should this integration be today than the integration of science, technology, economy, ecology, and ethics? Cassirer’s concept of *prophetic future* motivates us to consider how to reconcile the competing interests of science, industry, and the financial sector with what I have called above an “ethical Umwelt.”

This integration requires a view of nature formed by a *new mental closeness or intimacy of understanding* as a counterbalance to the emotional distance of scientific explanations and technological applications. From the perspective of Rickert and Husserl *understanding evolves out of the experience of value*. This raises, of course, the question “for whom do organisms have value?” As Kant says in the *Critique of Judgment*, an organism “can be called a *natural purpose*, and this because it is an *organised and self-organising being*.”⁷⁴ As being purposes for themselves, organisms may also be considered self-values. In the twentieth century, the influential philosopher Hans Jonas based his metaphysics of the organism on the concept of *freedom*.⁷⁵ This is in accordance with Kant’s seminal insight that organisms act and exist for their own purpose. Thus, following Kant and Jonas, in order to understand living nature and not just to explain it, we must be able to experience living beings as manifestations of intrinsic values, which means that they should not be valued for the sake of their contribution to some ends desired by humans, but for their own sake. This is true from Whitehead’s perspective as well. As Segall makes clear “[t]o be actual, to be a fact, for Whitehead, means to experientially enjoy existence as an end in itself, to value oneself as an actuality and to be valued by other actualities” (Chapter Two). Thus, the term “ethical Umwelt” refers to all living beings of the present and the future as being intrinsic values.

Whitehead’s metaphysics provides an excellent philosophical foundation for ethical Umwelt.⁷⁶ Our current mainstream scientific worldview supports the reduction of living beings and natural processes to passive valueless entities devoid of any kind of striving and feeling. The reduction of living

beings to passive entities is, for example, an assumption of neoclassical economics, which understands economy as something that functions in isolation from ecological, social, and ethical issues.⁷⁷ The economy operates based on the abstraction of different forms of capital. For example, natural resources, financial capital, human capital, and know-how are considered quantifiable and therefore convertible and thus interchangeable.⁷⁸ This strategy serves the interests of a particular “moral community” that consists of contemporary mainstream Western economics, industry, and politics, i.e., of an “elite” of Western individuals living in the present. “Moral community” is here understood as the community with the power not only to protect its interests but also to force them upon others because its values are dominant and its knowledge is taken seriously by the majority of Western people. In diametrical opposition to this ideology, Whitehead, Bergson and other process philosophers provide avenues for developing a new economics based on the principles of non-convertability of different forms of capital,⁷⁹ an idea that perfectly corresponds with Bergson’s appeal to do justice to heterogeneity. Process-philosophical economic and scientific theories embed economy and science in the biosphere. In this way such theories expand the moral community to include animals and plants, as well as present and future generations.⁸⁰ Whiteheadian metaphysics suggests that the value of future living beings is not a future value but a present value: *the future has its value now*. Process philosophy considers the extended moral community as being a part of an ethical Umwelt. The idea of a morally significant Umwelt implies its *sacredness*, i.e., that it is a *sacred environment*.

If the concept of ethical Umwelt must embrace all living beings of the future and the present as being intrinsically valuable, the question arises, how can this be attained? This, certainly, cannot be done ad hoc by an autonomous decision of human intelligence. The intrinsic value of nature, and especially of living beings, can only then become the main pillar of a new worldview if it is *empathically experienced*. This brings us back to Bergson’s concept of *intuition*.

The word “intuition” stems from the Latin verb “*intueri*,” which means “to look at.” It denotes an immediate and nondiscursive form of cognition. *It must be noticed that Bergson uses that term in a radically different way than Kant does.* In *Creative Evolution*, Bergson considers life as “consciousness launched into matter”⁸¹—life is duration enveloped by matter. From this perspective, intuition is one of the two cognitive faculties in which the primordial cognitive activity of (ur)consciousness split up. *Intuition is the attention of consciousness on its own movement.*⁸² (It is worth noticing

that we are only then able to experience the nature of our duration as a radically heterogeneous continuum if we direct our attention to our own psychical processuality.)

[A] glance at the evolution of living beings shows us that intuition could not go very far. On the side of intuition, consciousness found itself so restricted by its envelope that *intuition had to shrink into instinct*, that is, to embrace only the very small portion of life that interested it; and this it embraces only in the dark, touching it while hardly seeing it. On this side, the horizon was soon shut out.⁸³

On the other branch of the bifurcation of consciousness, that of intelligence, consciousness succeeded in increasingly freeing itself from the restrictions that matter imposed on it:

On the contrary, consciousness, in shaping itself into intelligence, that is to say in concentrating itself at first on matter, seems to externalise itself in relation to itself; but, just because it adapts itself thereby to objects from without, it succeeds in moving among them and in evading the barriers they oppose to it, thus opening to itself an unlimited field.⁸⁴

In Bergson's view, the evolution of instinct reached its highest level in the insects and especially in the socially organized hymenoptera.⁸⁵ Intelligence emerged on the branch of evolution of the vertebrates in which consciousness focused its attention on the *manipulation of matter* it was passing through.⁸⁶ In other words, the whole evolution of the animal kingdom split up into two divergent branches: one which evolved instinct, the other intelligence.⁸⁷ In contrast to the highly specialized external organs of hymenoptera, such as the mouthparts and the sting of bees and the various mandibles of ants, the external organs of the vertebrates, especially the human hand, have not evolved in order to manipulate specific material structures. Instead of being adapted to the structure of particular material objects, human hands are the most generally usable organs of animal kingdom. The universalistic structure of the human mind, which consists in its unlimited ability to invent, use, and redefine abstract concepts, corresponds directly with the hand's universal abilities. Both human hands and symbolic forms are universal tools which enables us to manipulate an unlimited number of real and potential material structures. Due to the coevolution of the hand and the symbolic mind, the human species

progressed much further than the social insects in freeing itself from the limitations of matter. However, “[o]nce freed, moreover, consciousness can turn inwards on itself, and awaken the potentialities of *intuition which still slumber within it*.”⁸⁸ The primordial interrelation of life and consciousness is not absent in modern humans—it only slumbers within us.

Since intelligence “goes all round life, taking from outside the greatest possible number of views of it, drawing it into itself instead of entering into it,”⁸⁹ “[w]e are at ease only in the discontinuous, in the immobile, in the dead.”⁹⁰ Because of the *modus operandi* of intelligence, our “intellect is characterized by a natural *inability* to comprehend life.”⁹¹ From a Bergsonian perspective, it is the one-sided dominion of intelligence that has caused the enormous alienation of human science, technology, and economy from living nature, creating thus the disastrous contemporary ecological crisis. Before the background of the ethical imperative that obliges us towards what I have called “the living world to be saved,” the following insight of Bergson deserves our whole attention:

[I]t is to the very inwardness of life that intuition leads us,—*by intuition I mean instinct that has become disinterested, selfconscious, capable of reflecting upon its object and of enlarging it indefinitely.*⁹²

Instinct [...] is moulded on the very form of life. While intelligence treats everything mechanically, instinct proceeds, so to speak, organically. If the consciousness that slumbers in it should awake, if it were wound up into knowledge instead of being wound off into action, if we could ask and it could reply, it would give up to us the most intimate secrets of life.⁹³

Intelligence is a cognitive faculty that operates with universal abstract symbolic systems which, because of their universality, cannot be adapted to the specific essence of the particular beings to which the intelligent creators of those abstract systems refer. Therefore, there is always an insurmountable cognitive distance between the intelligent subject and its object. Since “*instinct is sympathy*,”⁹⁴ that distance can only be bridged by the latter which is a cognitive ability that captures the nature of its objects through internal relations between subject and object. Thus, as René Pikarski makes clear in Chapter Four, instinct recognizes its objects empathically through a closeness of being and a sympathy towards life.

From the background of Whitehead’s ontology, Bergson’s understanding of instinct as sympathy (*sym-pathy*) between living beings can

be best approached by the technical term “prehension,” or, more precisely, “physical prehension.”⁹⁵ The concept of prehension corresponds well with what in Western metaphysics has been described as “internal relations,” i.e., as relations through which the related entities constitute themselves, thus being unable to exist without them. One of Whitehead’s most ingenious insights that constitutes the very core of his ontology is that no prehending subject preexists its prehensions. Rather, it comes into existence by prehending other already constituted beings that become its objects. Accordingly, the subject emerges out of a cognitive act that is literally metaphysical (meta-physical), since it does not take place in the physical world. The subject arises as a spatiotemporally localized entity only after the integration of its prehensions into a coherent unity of experience. Of course, one could object that every bee is localized in space and time, and that it preexists its relation to any particular flower that it approaches. By “subject,” however, Whitehead does not understand a living being, such as a bee or an ant, but an actual occasion, i.e., a short-lived process that determines its own constitution through its relations to the Umwelt (see note 18). As already noted, all actual occasions have a mental pole that in almost all cases does not go beyond a proto-mental level (see note 24 of this chapter). Nonetheless, actual occasions that occur in nervous systems, even in those of insects, are coherent complexes of experience. Their mental capacity exceeds by many orders of magnitude the niveau of proto-mentality. Thus, from a Whiteheadian perspective, although the bee is not a subject, its mental life is a series of short-lived subjects. Each subjective act through which the bee recognizes a particular flower emerges as a unification of prehensions that are empathic or sympathetic relations. From that angle the subject is not a bearer of experiences but rather an act of cognition that arises together with its instinctive relations to the Umwelt and cannot be separated from them. It is this nonseparability of the processual subject from its object that constitutes the *closeness of being* or *nondiscursive immediacy* of instinctive cognition. Recently, similar positions have been adopted in the new field of *deep* or *radical neurophenomenology*.⁹⁶

While instinct provides an immediate knowledge of living objects, it by no means imparts any understanding of them in the specific meaning that Rickert gave to this term. Understanding cannot be provided by a cognitive faculty that restricts itself to conveying a mere practical and thus limited knowledge of its objects. While real understanding demands that the subject embraces the essence of its objects and thus experiences them as intrinsic values and purposes for their own sake, instinct captures only

those aspects of its objects that are useful to the subject. Only “instinct that has become disinterested, self-conscious,” because the consciousness of that which that slumbered in it has awakened, is, as already said, “capable of reflecting upon its object and of enlarging it indefinitely,”⁹⁷ so that the subject can embrace the essence and intrinsic value of its objects. Instinct that is “wound up into knowledge instead of being wound off into action” has become intuition. As Alex Gomez-Marin so aptly states in Chapter Four, “[i]n instinct and intelligence are bound to survival, whereas intuition is self-transcendent in the sense that it becomes an understanding not restricted by (nor opposed to, perhaps just indifferent to) utility.” In other words: *Real understanding, especially of living beings, can only be acquired by intuition.* Because it is “instinct that has become disinterested, self-conscious, capable of reflecting upon its object,” it can “give up to us the most intimate secrets of life.”⁹⁸

From this perspective intuition is a cognitive capacity that can serve theoretical interests as well. It proceeds, of course, in a radically different way than intelligence. Bergson tries to provide an understanding of human intuition by referring to the relation between the artist and its object:

Our eye perceives the features of the living being, merely as assembled, not as mutually organized. The intention of life, the simple movement that runs through the lines, that binds them together and gives them significance, escapes it. This intention is just what the artist tries to regain, in *placing himself back within the object by a kind of sympathy*, in breaking down, by an effort of *intuition*, the barrier that space puts up between him and his model.⁹⁹

Another good example for intuitive sympathy is the relation between psychotherapist and patient if deep trust has been established between them. It is not rare that therapists in a single instant immediately comprehend the whole psychological complex from which the patient suffers or even guess important events of his life. There are also reports about highly experienced physicians who sometimes feel immediately the cause of a patient's suffering as soon as she enters the office. The same can be said about the empathic relation of some highly committed teachers to their students. Despite these remarkable examples, at the present stage of human evolution, intuition is a poorly developed mental capability.

Although from Bergson's perspective intuition and intelligence are two essentially different cognitive faculties, he makes clear that the former can advance only through the support of the later; without the work of

intelligence intuition remains instinct.¹⁰⁰ The often-made charge of anti-intellectualism against Bergson is ungrounded as the following quote shows:

Intelligence remains the luminous nucleus around which instinct, even enlarged and punned into intuition, forms only a vague nebulosity.¹⁰¹

The role that Bergson assigns to intellect corresponds well with his conviction that, by using language, consciousness liberates itself from the bonds of matter “holding the attention captive.”¹⁰² Nonetheless, if the meaning of “language” is extended to include formal symbolic systems of science and high-tech, Bergson’s optimism becomes questionable. The formal languages of computer sciences gave rise to digital technology and communication technologies. One hundred and ten years after the first edition of *Creative Evolution*, that kind of technology holds the attention of almost all of us, and especially of the youth.

Bergson argues that the concepts of empty homogeneous space, and all the other kinds of spatialization that are fundamental to intelligence, are according to human nature. In my opinion it is more accurate to say that the abstract understanding of space and time are products of the Western mind perfected by occidental philosophy and science. The conception of empty space by ancient atomists, and empty uniformly flowing time by seventeenth-century physicists, are typical products of Western civilization. It is well known that Indigenous peoples experience space and time in a radically different way. Australian Aborigines experience natural landscapes as manifestations of heterogeneous qualities in a way that the idea of empty Euclidean space makes no sense at all. Navigators of Micronesia experience the ocean as a highly heterogeneous structure: swells, currents, the shape of waves, and ripple patterns are crucial guides in sailing.¹⁰³ These examples show that the idea of a homogeneous continuous medium is not necessarily immanent to the human mind. Rather, it is a characteristic product of the Western intellect, to which intuition is probably more foreign than all other forms of human intellect that have been cultivated in non-Western cultures.

Presently, one of the most excessive manifestations of one-sided Western intellect is the several forms of technocratic-scientistic transhumanism described by Linda Groff in Chapter Six. The same kind of scientism can be seen in all plans to manipulate the evolution of the terrestrial biosphere and to create biospheres on other planets, e.g., “terraforming” Mars.

These examples present a highly exaggerated trust in Western intellect. However, our one-sided overreliance and overstrain of abstract intelligence reveals itself most clearly when transhumanists proclaim the control over human evolution through biotechnology and other kinds of high-tech.¹⁰⁴ Technocratic transhumanism demonstrates very clearly that due to its enormous distance to its objects, unbalanced intelligence ignores and even condemns everything that escapes the grasp of its comprehension. The risk of this one-sided development of human intelligence through the interweaving of bioscience, biotechnology, digital technology, and globalized economy is that human “evolution” degenerates into an “autistic” species that recognizes and estimates only the manifestations of technological-scientific intellect. The search for signals from other “intelligent” species in the endless vastness of the universe corresponds well to the increasing global “autism” that alienates us from the “less intelligent” inhabitants of our planet.

Bergson thinks of intuition as a cognitive faculty that only intelligent species can evolve, allowing them to empathize potentially with all manifestations of life. Most probably they must evolve if they are to survive and not to collapse under the enormous weight of their increasing technological and intellectual abilities. In this century, above all, a specific form of intuition, that at the present is in an embryonic state, must undergo a significant evolution: ecological intuition. Ecological intuition is the faculty of humans to empathize with the ethical Umwelt, “the living world to be saved.” As Theo Badashi says in his chapter, we humans must “fall back in love with life, with nature, and with the beauty and mystery that resides in the heart and consciousness of every living thing.”¹⁰⁵ The concept of ecological intuition is also similar to Jason Kelly’s concept of “cosmic consciousness.” Kelly argues that Walt Whitman, Richard M. Bucke, and Edward Carpenter each share the understanding that the evolution of life has a spiritual purpose, “the desire to love and be loved.”¹⁰⁶ Whitman, Bucke, and Carpenter’s valuation of experience—which corresponds with James’s and Whitehead’s “radical empiricism”¹⁰⁷—appreciates evolution as something sacred. As such, the purpose of evolution not only decisively transcends the reasoning of reductionist biosciences but also a particular form of teleological thought that Bergson characterizes as “radical finalism.”¹⁰⁸ As a typical product of human intellect, radical finalism ties purpose to plan. Whitehead’s ontology, however, transcends the limits of pure intellectualistic philosophy and introduces a new form of teleological reasoning, which requires a leap of intuition. This reconsideration of teleology is in perfect

accordance with Badashi's understanding of "Participatory-Teleology," which is "a central aspect of the process of Cosmogeneration."¹⁰⁹ For those of us to whom intuition reveals the universe as "a great Cosmic Subject," humans—like all beings—are aspects of this subject.¹¹⁰ If this is true, our intuitions, abstractions, symbolic systems, artworks, and technologies are fundamental manifestations of the Earth's own actualization process.

Paradoxically, whereas the evolution of cosmic consciousness through human intuition will further divide humans and animals, it will open human beings to unprecedented and unforeseeable ways of empathizing with other living beings. When this happens, humanity will be able to feel the *sacredness* of the living world again. We will rediscover the fundamental truth about the whole of life that we began to lose almost three thousand years ago, when monotheism compressed the divine creative forces into one personal creator.¹¹¹ At the present stage in history, that truth, so familiar to our distant ancestors, is being preserved in age-old indigenous cultures, such as the Aborigines of Australia and Native Americans who have not forgotten how to intuitively experience the unique sacredness of the landscape. The Western conception of the sacred always implicitly contains a distinction of essence that divides reality into two metaphysically distinct realms. It implies the separation between physical beings and processes that constitute the world on the one hand and God as the divine being or act that transcends them on the other. In 1915, taking this line of thought further, Emile Durkheim introduced the "sacred-profane" distinction.¹¹² From a process philosophical perspective, this initially religious-sociological distinction can be metaphysically extended by connecting it to Bergson's concept of spatialization. This connection is legitimate because, other than in *Time and Free Will*, where Bergson conceives of spatialization primarily as an epistemological term that can be applied only to human intelligence, in *Creative Evolution* he upgrades that concept to a metaphysical category. I think, however, that from a broadly process philosophical perspective it makes more sense to integrate the sacred-profane dichotomy with Bergson's epistemology.¹¹³ The distinction between the sacred and the profane should be connected with the distinction between the heterogeneity of duration on the one hand and the abstract spatializations of pure intellect that operates without any faculty of intuition on the other. In other words, it is our scientifically, technologically, and economically shaped Western system of abstractions that desecralizes our understanding of the physical world, including the biosphere and ourselves. A particularly good example of profanization or secularization, one that corresponds well with

the meaning of “profane” as it has been introduced here, is the bioscientific project of “naturalizing” faith and morality. While so-called “neurotheology” attempts to reduce religious experience to an internal product of brain activity, reducing the feeling of divine presence to a mere illusion, neo-Darwinist oriented biologists try to explain the emergence of altruism and moral experience by means of natural selection.

After many centuries of obedience to our increasingly one-sided development of abstract intelligence, we find ourselves caught deep in the net of highly abstract symbolic systems that we have diligently woven together. If we are not willing to abandon intelligence and degenerate to animals, only the rising of intuition can help us to free ourselves from the trap into which we have maneuvered our species. We can only then establish a corrective to the exaggerations of abstract intelligence and thereby protect planetary life by creating *a new evolutionary dimension*.

Although it is premature to judge whether we will succeed in entering a new stage of our unprecedented evolution, there are already signs of hope that this will be the case. In Ecuador and Bolivia, nature, known in the indigenous languages as *Pachamama* (Earth Mother), has been recognized as *a subject with its own rights*. This happened in 2008 in Ecuador, on a constitutional level, and in 2009 in Bolivia, on a legal level. It is the first time in history that nature has been established as a *legal entity*.¹¹⁴ Chapter 7 of Ecuador’s constitution has the title “Rights of Nature” and consists of articles 71–74. Article 71 stipulates that

Nature, or Pacha Mama, where life is reproduced and occurs, has the right to integral respect for its existence and for the maintenance and regeneration of its life cycles, structure, functions and evolutionary processes.¹¹⁵

Article 72 states:

Nature has the right to be restored. This restoration shall be *apart* from the obligation of the State and natural persons or legal entities to compensate individuals and communities that depend on affected natural systems. (italics added)¹¹⁶

This is certainly a serious step towards resacralisation of our Umwelt. That from the point of view of scientific materialism the Earth Mother must be dismissed as a myth cannot avert the onset of a new era in which spirituality and ecology will be unified. For, as Segall writes in Chapter

Two, starting from Joseph Campbell's thoughts, "myths generated by ritually induced emotional upwelling need not be dismissed as childish fairy tales, but can be understood to be the archetypal energies of the cosmos itself erupting into human symbolic consciousness."

The recognition of nature as a legal entity by two contemporary existing states clearly demonstrates that the time is ripe for the intuitive understanding of the idea of sacred environment. We are passing the threshold of our next evolutionary phase.

73. “La conscience met dans la matière continue une discontinuité: l’être raisonnable cherchera à rétablir la continuité, en vertu du sentiment profond qu’il a de la continuité originelle” (Bergson, *Mélanges*, 441).
74. Bergson, *Creative Evolution*, 21.
75. Spyridon A. Koutroufinis, chap. 5 in this volume.
76. “We claim, on the contrary, that the spontaneity of life is manifested by a continual creation of new forms succeeding others” (Bergson, *Creative Evolution*, 78).
77. “Now, a mystic society, embracing all humanity and moving, animated by a common will, towards the continually renewed creation of a more complete humanity, is no more possible of realization in the future than was the existence in the past of human societies functioning automatically and similar to animal societies” (Bergson, *The Two Sources of Morality and Religion*, 70).
78. Bergson, *Creative Evolution*, 29.

CHAPTER FIVE: KOUTROUFINIS

1. I would like to warmly thank Jason James Kelly and Matthew T. Segall for useful remarks on the early drafts of this paper and for carefully reading the final version.
2. Jakob von Uexküll, *Umwelt und Innenwelt der Tiere* (Berlin: Springer, 1909), 117, 196, 249, 252; Uexküll, *Theoretische Biologie* (Frankfurt/Main: Suhrkamp, 1973 reprint), *Theoretische Biologie*, 2nd ed. (Berlin: Springer, 1928), 320.
3. Jakob von Uexküll, *Theoretical Biology* (New York: Harcourt, Brace, 1926), translation of *Theoretische Biologie*, 1st ed. (Berlin: Gebrüder Paetel, 1920), 127; Thure von Uexküll, “A teoria da *Umwelt* de Jakob von Uexküll,” *Revista Galáxia* 7 (2004): 19–48.
4. Jakob von Uexküll, *A Foray into the Worlds of Animals and Humans* (Minneapolis: University of Minnesota Press, 2010), 150.
5. Uexküll, *Theoretical Biology*, 78, 97–99.
6. Uexküll, *Theoretical Biology*, 93.
7. Uexküll, *Theoretical Biology*, 98.
8. Uexküll, *Theoretical Biology*, 103.
9. Uexküll, *Theoretical Biology*, 78.

10. Uexküll, *Theoretical Biology*, 15, 16.
11. Uexküll, *Theoretical Biology*, 126–77.
12. Uexküll, *Theoretische Biologie*, 62.
13. Uexküll, *Theoretische Biologie*, 50, 63, 95, 96, 115, 127, 156.
14. Immanuel Kant, *Critique of Pure Reason* (Cambridge: Cambridge University Press, 1998), B 129–32.
15. Kant, *Critique of Pure Reason*, B 134–35.
16. Kant, *Critique of Pure Reason*, B 130.
17. Kant, *Critique of Pure Reason*, B 137.
18. A core idea of Whitehead’s metaphysics is that actual occasions are processes that constitute themselves through internal relations to their environment. Whitehead calls these relations “prehensions.”
19. Another core idea of Whitehead is that the self-creation of a process or actual occasion is the growing together of its prehensions (see note 18) to a new unity. Actual occasions are short-lived flashes of existence. After the completion of their self-creation, they exist in space for only a short time during which they can be prehended. Whitehead describes the process, i.e., the new actual occasion that arises from the integration of the prehensions as *concrecence*, from the Latin verb “concreco” meaning “growing together.” Thus, the actual occasions are *synthetic* acts of self-constitution.
20. *Vernunft* is *Verstand* guided by principles. *Vernunft* also has a moral component.
21. Kant, *Critique of Pure Reason*, B 76.
22. Kant, *Critique of Pure Reason*, B 132.
23. Spyridon A. Koutroufinis, and Arthur Araujo, “Uexküll, Whitehead, Peirce: Rethinking the Concept of ‘Umwelt’ from a Process Philosophical Perspective” (forthcoming).
24. A basic premise of Whitehead’s metaphysics is the assumption that actual occasions are inseparable *physical-mental bipolar unities*. He conceives of the actual occasions as “processes of experience,” (Alfred North Whitehead, *Adventures of Ideas* [New York: Free Press, 1967], 197), which he calls subjects of their own experienced immediacy (Alfred North Whitehead, *Process and Reality, An Essay in Cosmology*, corrected edition, ed. David Ray Griffin and Donald W. Sherburne [New York: Free Press, 1979], 25). Actual occasions are physical-mental

unities. They are processes endowed with subjectivity that are always related to and can also generate things that exist physically in space-time. Whitehead explains that the term “mental” is much more comprehensive than “conscious,” as only very few mental phenomena can be classified as possessing consciousness. Nearly all actual occasions are merely *proto-mental* events and as such they are not conscious. Different processes are configurations of widely variable types and may exhibit any number of grades of consciousness, including a complete lack thereof, depending on their complexity. But all processes are complexes of experience. Thus, the idea of experience plays a much greater role in Whitehead’s concept of a subject than does the idea of consciousness.

25. Uexküll, *Theoretical Biology*, 53.
26. Ernst Cassirer, *An Essay on Man: An Introduction to a Philosophy of Human Culture* (New Haven: Yale University Press, 1944), 41.
27. Uexküll, *Theoretical Biology*, 126.
28. Cassirer, *An Essay on Man*, 42.
29. Cassirer, *An Essay on Man*, 43.
30. Cassirer, *An Essay on Man*, 43.
31. Cassirer, *An Essay on Man*, 43.
32. Cassirer, *An Essay on Man*, 44.
33. Cassirer, *An Essay on Man*, 48.
34. Cassirer, *An Essay on Man*, 48.
35. Terrence W. Deacon, *The Symbolic Species: The Co-Evolution of Language and the Brain* (New York, London: Norton, 1997).
36. Cassirer, *An Essay on Man*, 52.
37. Cassirer, *An Essay on Man*, 54.
38. Cassirer, *An Essay on Man*, 56.
39. Cassirer, *An Essay on Man*, 59.
40. See Deacon, *The Symbolic Species*, and his chapter in this book.
41. For the role of sexual selection in human evolution see chaps. 19 and 20 of *The Descent of Man* (Charles Darwin, *The Descent of Man, and Selection in Relation to Sex* [Princeton, NJ: Princeton University Press, 1981]).

42. Cassirer, *An Essay on Man*, 64–65.
43. Cassirer, *An Essay on Man*, 66.
44. Henri Bergson, *Time and Free Will* (London: George Allen & Unwin, 1950), 95.
45. Bergson, *Time and Free Will*, 78–79; italics added.
46. Bergson, *Time and Free Will*, 84.
47. We are allowed to add apples with apples but not apples with oranges unless we add fruits.
48. Bergson, *Time and Free Will*, 76.
49. Bergson, *Time and Free Will*, 89.
50. Bergson, *Time and Free Will*, 96.
51. Cassirer, *An Essay on Man*, 72.
52. Cassirer, *An Essay on Man*, 74.
53. Cassirer, *An Essay on Man*, 75.
54. Henri Bergson, *Matter and Memory* (London: George Allen & Unwin, New York: Macmillan, 1929), 22.
55. See Chapter II of Bergson, *Time and Free Will*.
56. Bergson, *Time and Free Will*, 98.
57. Bergson, *Time and Free Will*, 100–101, italics added.
58. Bergson, *Time and Free Will*, 99.
59. Bergson, *Time and Free Will*, 98.
60. Bergson, *Time and Free Will*, 97.
61. Bergson, *Time and Free Will*, 97 [addition by Koutroufinis].
62. Bergson, *Time and Free Will*, 98.
63. Bergson, *Time and Free Will*, 97.
64. Bergson, *Time and Free Will*, 96, italics added.
65. Henri Bergson, *Creative Evolution* (London: Macmillan, 1922), 142–95.
66. Bergson, *Creative Evolution*, 141, 149–50.
67. Cassirer, *An Essay on Man*, 78.
68. Cassirer, *An Essay on Man*, 78–79.
69. I owe this idea to René Pikarski. See his chapter in this volume.

70. Heinrich Rickert, *Die Grenzen der naturwissenschaftlichen Begriffsbildung* (Tübingen: Mohr, 1929).
71. Edmund Husserl, *The Crisis of European Sciences and Transcendental Phenomenology* (Evanston IL: Northwestern University Press, 1970), 123–35.
72. Uexküll, *Theoretische Biologie*, 21.
73. Whitehead, *Process and Reality*, 7.
74. Immanuel Kant, *Critique of Judgment* (Indianapolis: Hackett Publishing Company, 1987), § 65.
75. Hans Jonas, *The Phenomenon of Life. Toward a Philosophical Biology*, (Evanston, IL: Northwestern University Press, 2001) and “Evolution und Freiheit,” in *Philosophische Untersuchungen und metaphysische Vermutungen* (Frankfurt am Main: Suhrkamp, 1994), 11–33.
76. Whitehead, *Process and Reality*.
77. Barbara Muraca, *Denken im Grenzgebiet: Prozessphilosophische Grundlagen einer Theorie starker Nachhaltigkeit* (Freiburg, Munich: Alber, 2010), 42.
78. Muraca, *Denken im Grenzgebiet*, 37–39, 46.
79. Herman Daly, *Beyond Growth: The Economics of Sustainable Development* (Boston: Beacon Press, 1996), 51; Muraca, *Denken im Grenzgebiet*, 45–52.
80. Muraca, *Denken im Grenzgebiet*, 173–81, 243–47.
81. Bergson, *Creative Evolution*, 191.
82. Bergson, *Creative Evolution*, 191.
83. Bergson, *Creative Evolution*, 192, italics added.
84. Bergson, *Creative Evolution*, 192.
85. Bergson, *Creative Evolution*, 141.
86. Bergson, *Creative Evolution*, 191.
87. In Bergson’s words: “Now, since instinct is nowhere so developed as in the insect world, and in no group of insects so marvellously as in the Hymenoptera, it may be said that the whole evolution of the animal kingdom, apart from retrogressions towards vegetative life, has taken place on two divergent paths, one of which led to instinct and the other to intelligence” (*Creative Evolution*, 141).

88. Bergson, *Creative Evolution*, 192.
89. Bergson, *Creative Evolution*, 186.
90. Bergson, *Creative Evolution*, 174.
91. Bergson, *Creative Evolution*, 174, italics added.
92. Bergson, *Creative Evolution*, 186, italics added.
93. Bergson, *Creative Evolution*, 174.
94. Bergson, *Creative Evolution*, 186.
95. Whitehead, *Process and Reality*, 23.
96. Claire Petitmengin, “Enaction as a Lived Experience: Towards a Radical Neurophenomenology,” *Constructivist Foundations* 12, no. 2 (2017): 143–45.
97. Bergson, *Creative Evolution*, 186.
98. Bergson, *Creative Evolution*, 174.
99. Bergson, *Creative Evolution*, 186, italics added.
100. Bergson, *Creative Evolution*, 187–88.
101. Bergson, *Creative Evolution*, 188.
102. Bergson, *Creative Evolution*, 195.
103. Ward Goodenough, “Navigation in the Western Carolines: A Traditional Science,” in *Naked Science: Anthropological Inquiry into Boundaries, Power, and Knowledge*, ed. Laura Nader, 29–42 (New York: Routledge, 1996), 37–38.
104. Linda Groff, chap. 6 in this volume.
105. Theo Badashi, chap. 9 on this volume.
106. Jason James Kelly, chap. 8 in this volume.
107. Jason James Kelly, chap. 8 in this volume.
108. Bergson, *Creative Evolution*, 41–53, 133.
109. Theo Badashi, chap. 9 on this volume.
110. Theo Badashi, chap. 9 on this volume.
111. As Segall aptly says, “[o]nly very recently in the history of our species have these ritualized symbolic enactments become detached from their encompassing cosmic and biotic rhythms. Our modern myths have become too anthropocentric. We have immersed ourselves in a symbolic system that is radically out of tune with our ecological context”

(chap 2 in this volume).

112. Emile Durkheim, *The Elementary Forms of the Religious Life*, trans. Joseph Swain (New York: The Free Press, 1965).
113. In *Creative Evolution* spatialization is considered a real process that connects God and the world. Matter is conceived of as the final outcome of a divine act of emanation: the heterogeneous duration of creative energy that emanates from God gradually loses its tension and becomes increasingly homogeneous and thus determinate. The physical universe emerges out of a universal process of spatialization of divine energy into inorganic matter. Due to its homogeneous order, inorganic matter is ruled by laws that can be described mathematically without any reference to divine creativity. In this sense, the whole of inorganic material reality may be characterized as profane. Accordingly, in Bergson's processual cosmology the sacred-profane dichotomy may be given a metaphysical meaning by being read in parallel with the distinction God-inorganic matter (or divine duration-homogeneous order). Though not an emanationist thinker, Whitehead also claims that matter is continuously generated by physical acts of spatialization that depend on God. Each actual occasion manifests itself in time and space: it spatializes itself in the literal sense of that word. In Whitehead's metaphysics, however, the causal interpenetration of God and temporal actual occasions is conceived of in a more subtle way than in Bergson's *Creative Evolution*. God not only creates the so-called 'initial aim' of each temporal process (Whitehead, *Process and Reality*, 244), God also participates in all processes that compose the world (*Process and Reality*, 31, 88), being thus *influenced* by them. Therefore, from a Whiteheadian perspective the sacred-profane dichotomy cannot be paralleled with the distinction God-matter. Hence, from a broadly process metaphysical perspective that attempts to balance between Whitehead's and Bergson's philosophies, it is better to interpret the sacred-profane-dichotomy epistemologically rather than metaphysically. In other words, it is advisable to apply it only to a human conception of reality.
114. María Valeria Berros, "The Constitution of the Republic of Ecuador: Pachamama Has Rights," Environment & Society Portal, Arcadia 11 (2015); see Rachel Carson Center for Environment and Society: <http://www.environmentandsociety.org/node/7131>.
115. Republic of Ecuador, *Constitution of 2008*, Chapter 7, Article 71, accessed February 24, 2018: <https://www.constituteproject.org>

/constitution/Ecuador_2008.pdf.

116. Republic of Ecuador, *Constitution of 2008*, Chapter 7, Article 72.

CHAPTER SIX: GROFF

1. Part II of this article is an updated, expanded version of Linda Groff, “Future Human Evolution and Views of the Future Human: Technological Perspectives and Challenges,” in *World Future Review*, Second Special Issue on “Future Human Evolution,” Vol. 7 no. 2–3 (Summer/Fall 2015).
2. Linda Groff, “Models of Change: A Foresight Tool to Aid Policy-Makers,” in *World Affairs: The Journal of International Studies*, Third Special Futures Issue 15, no. 4 (2011): 4, 12–38.
3. Christian Schwagerl, *The Anthropocene: The Human Era and How It Shapes Our Planet* (Sante Fe, NM: Synergetic Press, 2014).
4. Elizabeth Kolbert, *The Sixth Extinction: An Unnatural History* (New York: Picador, Henry Holt, 2014).
5. Alvin Toffler, *The Third Wave* (New York: Bantam Books, 1980); Linda Groff, “Social and Political Evolution” in *Encyclopedia of the Future* (New York: Macmillan, 1996).
6. Ray Kurzweil, *The Age of Spiritual Machines: When Computers Exceed Human Intelligence* (New York: Penguin Press, 1999); *The Singularity Is Near: When Humans Transcend Biology* (New York: Viking Press, 2005, and Penguin Press, 2006); *How to Create a Mind: The Secret of Human Thought Revealed* (New York: Penguin Books, 2012); *The Singularity Is Nearer* (forthcoming); Bart Koslo, *Heaven in a Chip: Fuzzy Visions of Society and Science in the Digital Age* (New York: Three Rivers Press, 1999).
7. Ray Kurzweil, *The Age of Spiritual Machines; The Singularity Is Near; How to Create a Mind; The Singularity Is Nearer*; “The Ubiquity and Predictability of the Exponential Growth of Information Technology—Talk at the Singularity Summit 2009” (October 6, 2009), accessed February 23, 2015, <https://vimeo.com/7322310>; Koslo, *Heaven in a Chip*.
8. See n.7.
9. Personal communication with the author.
10. Gregory Stock, *Metaman: The Merging of Humans and Machines into*