CHAPTER 1

Jakob von Uexküll's Theories of Life

In 1952, Georges Canguilhem, the great historian and philosopher of the sciences, remarked that the concept of the environment (*milieu*) was becoming indispensable in the consideration of living beings. In *La connaisance de la vie*, he writes: "The notion of the milieu is in the process of becoming a universal and obligatory mode to capture the experience and existence of living beings. We can almost even say that it forms a necessary category of contemporary thought" (129). This is quite the claim, particularly since it was not always so. For quite a while, the living being was conceptually displaced from its natural milieu. Though Uexküll figures as only part of Canguilhem's historical account, he was nevertheless a key facilitator in this contemporary focus on animal environments. From as early as 1909 with the publication of *Umwelt und Innenwelt der Tiere*, through to the end of his life in 1944, Uexküll focused his research on attempting to discern and give expression to the "phenomenal worlds" (SAM, 7) and "subjective universes" (TM, 29) of animals. Each of these terms, however, is just a different way of translating Uexküll's new concept of "*Umwelt*," a term that more literally means "surrounding world" or "environment," but that I will retain in the original language.[1] His contention was that conventional biology had run its course by treating animals as objects governed by mechanical laws of nature such that they became accessible to the scientific eye of human objectivity. If biology continued to understand animal life with misguided objectivity, it would eventually succumb to the influence of chemistry and physics by seeking, wrongly in his estimation, to ground its knowledge in the reductionist accounts of chemico-physical factors. Much of his treatise on *Theoretical Biology* (1920) explicitly attends to the differences between biological thought and the seemingly wayward ways of physics and chemistry. Rather than continuing to understand animals as "physico-chemical machines" (TB, xiii), Uexküll contends that animals must be interpreted by virtue of the environments that they inhabit, and, insofar as it is possible, from the perspective of their behavior within such environments. The biologist must do so, moreover, while remaining free from the inclination to anthropomorphize the *Umwelten* of animals and, as Marjorie Grene has noted, retaining the rigorous accuracy expected from science.

These observations lead us to discern a number of key aspects that Uexküll introduces with his *Umwelt* research. In order to give a brief indication of the direction I intend to take in the ensuing pages, the following can be said concerning Uexküll's research. Uexküll firmly believes that nature conforms to a plan (*Planmäßigkeit*) whereby organic and inorganic things cohere together in great compositional harmony. The musical reference is a consistent one in his literature and is crucial to understanding how he interprets organisms as 'tones' that resonate and harmonize with other things, both living and nonliving. Nature's conformity with plan is based partially in Kantian and Baerian terms; I will explore both of these bases. The melodic perspective also leads Uexküll to differentiate himself from Darwin's theory of evolution, which he saw as a 'vertical' model of descent and one that emphasizes far too much a chaotic view of nature's formations. Uexküll was not necessarily anti-evolutionary, but his focus was certainly directed elsewhere, specifically toward a more 'horizontal' model that looks at how organisms behave and relate to things across their respective environments. Instead of interpreting organisms based on natural selection, for instance, Uexküll sought to understand them with respect to the designs that they represented in relation to meaningful signs. This led his research toward positing an ethological study of animal behavioral patterns, anticipating the work of such notable ethologists as Konrad Lorenz and Niko Tinbergen. *Umwelt* research also led him to be an early pioneer of a field that would become known as biosemiotics. In studying the behavioral patterns of different animals, Uexküll noted that animals of all levels, from microorganisms to human animals, are capable of discerning meaning from environmental cues beyond a purely instinctual reaction. Such meaning is attributable to how organisms enter into relationships with other things and thus come to see the environment as laced not just with signs, but with significance itself. The nature of these relations, and more specifically how one interprets them, will have profound consequences when it comes to discerning certain differences between Heidegger's, Merleau-Ponty's, and Deleuze's ontologies.

To better explore these themes, this chapter is divided into the following sections: (1) a brief biography and historical background to Uexküll's biology, (2) nature as conformity with plan, (3) *Umwelt* research, and (4) biosemiotics. Each section is aimed at being faithful to Uexküll's thought while at the same time anticipating the philosophical readings of Heidegger, Merleau-Ponty, and Deleuze and Guattari.

BIOGRAPHY AND HISTORICAL BACKGROUND

Jakob von Uexküll was born in Keblas, Estonia, in 1864, to parents of modest means. His father had interests in politics and became mayor for a short period of the small town of Reval. Uexküll studied zoology from 1884 to 1889 at the University of Dorpat (now the University of Tartu) where he was unquestionably influenced by two strong and contrasting schools of biological thought: the emergence of Charles Darwin's theories (1809–1882) and the legacy of Karl Ernst von Baer (1792–1876). As one commentator explains, one of Uexküll's professors at Dorpat was Georg Seidlitz (1840–1917), a Darwinian scholar who is held to be one of the first to teach Darwin's theory of evolution within continental Europe.[2] It is unclear just how much Seidlitz influenced Uexküll's studies, but as we will see, Uexküll was in the end not very convinced by Darwin's theory of evolution. This may be due to the other and more dominant school of thought at Dorpat, where the influence of Baer, who was himself educated at Dorpat, left a strong presence within the zoology department even after his death.

The schism between the Baerian and the Darwinian influences is fairly representative of a general tension in nineteenth-century German biology. Biology itself, as a formal and unique science, wasn't actually coined until 1802, when both Jean-Baptiste Lamarck and Gottfried Reinhold Treviranus coincidentally first used the term.[3] From its onset, the debate in biology during this period surrounded the issue of how and whether one could understand natural life in a manner equal to Newton's discoveries in physics. In part, biological thought was immediately immersed in the problem of either reconciling or favoring one of two views: the teleological view of nature that found its roots in Aristotelian science and a mechanistic science that found nature obeying unwavering physical laws. Both trends—teleology's necessary goal-directedness and mechanism's lawful accidents—likewise found a philosophical impetus in the works of Immanuel Kant and, following him, in the *Naturphilosophie* of G. W. F. Hegel and Friedrich Schelling. This dichotomy between teleology and mechanism had many voices on either side, but, for our purposes, it suffices to mention that two of the major proponents in biology included Baer's teleological view and Darwin's mechanist theory.

During his academic education, Baer was taught by the biologist Ignaz Döllinger. Döllinger was a close adherent of Schelling's philosophy of nature, and he had also studied under Kant for a short period in Königsberg. This coupling of biology with a philosophy of nature trickled through Döllinger into the works of Baer; however, it was Georges Cuvier and Kant who had the greatest impact on Baer. It is also notable that Baer's first academic posting was in Kant's hometown of Königsberg; even though he didn't teach there until after Kant's death, the connection between Baer and Kant's thought was already secured through his education.

Baer's focus in biology was in the emerging field of embryonic morphology, the study of embryonic forms, and, more specifically, *Entwicklungsgeschichte*, the developmental theory of animal organization. Baer believed that the embryos of all organisms have a purposefulness (*Zielstrebigkeit*) in the unfolding of their development. Each part or organ of the embryo develops according to a plan that demonstrates the overall organization of each organism. Baer outlined four rules over the course of his observations, and all four have come to be summarily known as "Baer's Law," which states that the development of the embryo moves from very general characteristics to more particular and specific ones.[4] Baer's studies are important for many reasons, not the least of which is his strong contribution to the epigenetic theory of embryonic development in contrast to the increasing skepticism surrounding the theory of preformationism, which holds that embryos are already 'preformed' organisms from conception. Baer's argument that observational studies of embryos demonstrate a movement from an indistinct and general form toward an increasingly specific form was quite significant. However, Baer does not jump to the conclusion that all organisms must descend from the same origin, as though all species descended from a primal *Ur*-organism. Rather, all organisms are said to belong to four "types," each of which manifests its own distinctions in morphology, and each therefore has its own general characteristics.

These studies have also ensured Baer a place within the teleological camp. But his teleology is not one that assumes a cosmological aim toward which all of nature is heading, nor does it make a claim for a rational mind or God behind the developmental process. Instead, Baer's teleology is what Timothy Lenoir describes as a "vital materialism," whereby all of nature's entities have "an emergent property dependent upon the specific order and arrangement of the components" (9). Each organism, in other words, develops according to a plan, leading from the general characteristics of its type to the particular traits of that specific organism.

This position will eventually put Baer's teleological view in an irreconcilable position with Darwin's theory of evolution. The difference will be formulated, however, not at the level of morphology, but in the mechanism behind Darwin's theory of evolution. It is well known that when Darwin published *The Origin of Species* in 1859, the most radical idea wasn't evolution itself (the general idea that had been floating around for some time), but the mechanism behind evolution, namely, natural selection. Natural selection, as Daniel Dennett accurately describes, was "Darwin's dangerous idea" because it "unifies the realm of life, meaning, and purpose with the realm of space and time, cause and effect, mechanism and physical law" (21). Darwin, in a word, accounts for the unfolding of species not according to any specific plan or goal, but through a war of attrition where the weak are weeded out, the strong survive, and, more important, pass on their genes to later generations (though Darwin himself could not prove how this last genetic step worked). Natural selection is a dangerous idea for many reasons, perhaps the greatest of which is its ability to offer an observable, testable, and scientific account for evolution, where the repercussions extend into philosophical and religious beliefs. However, what Baer responded to in his manuscript *Über Darwins Lehre* in 1873 was the seemingly accidental and planless nature of Darwin's theory of evolution. As Lenoir claims, Baer was less concerned with denying evolution as such than with offering a "theory of limited evolution" confined to demonstrating a "parallel between the general pattern of ontogenesis and organic evolution" (264–65). This could also explain why Baer entitles his book the way he does: it is a treatise *Über Darwins Lehre* (On Darwin's Theory) rather than *Gegen Darwins Lehre* (Against Darwin's Theory). Evolution, for Baer, is a phenomenon best described in terms of development. Stephen Jay Gould explains this point: "Evolution occurs when ontogeny is altered in one of two ways: when new characters are introduced at any stage of development with varying effects upon subsequent stages, or when characters already present undergo changes in developmental timing" (4). What threatened Baer was the unaccountable phenomenon of natural selection that seemed to overrule the orderly and directed development of organisms. Baer's dispute with Darwinian evolution was therefore oriented toward saving a teleological view of morphology against the overly mechanical and seemingly accidental view of development offered by Darwin.

Such was the intellectual situation in biology when Uexküll studied at Dorpat. The debate between teleological and mechanistic interpretations of natural life was far from over, and even continues to this day, so it is no surprise that it had a decisive influence on the young Uexküll. As will be seen, Uexküll was particularly averse toward the Darwinian theory of evolution, and he was so in a manner peculiar to the formulation of his own developing thought. However, even though Uexküll continued to find himself siding with the historically less popular Baerian interpretation of biology, we cannot forget or dismiss as merely coincidental that he studied biology at Dorpat, Baer's alma mater, just eight years after Baer's death.

After his undergraduate education, Uexküll went on to complete his studies at the University of Heidelberg, where he worked in the field of muscular physiology, particularly of marine invertebrates. He studied under the directorship of Wilhelm Kühne (1837–1900), whom he had met in Dorpat on the occasion of a memorial for Baer's death in 1886. After receiving an honorary doctorate at Heidelberg in 1907, Uexküll worked at the Zoological Center in Naples before eventually founding the Institute for Umwelt-Research in 1926 at the University of Hamburg. While he finished his career in Germany, Italy proved to be his true love and final residence. As Giorgio Agamben suggests, Uexküll had to leave the southern sun of Italy due to the dwindling finances of his familial inheritance, but he still kept a villa in Capri, to which he would occasionally return and eventually spend the last four years of his life. It is also suggested that Walter Benjamin, the German Jewish critical theorist, stayed for several months at Uexküll's villa in 1924. While this encounter probably had little effect on either's work, it is nevertheless interesting in situating Uexküll within the parameters of this intellectual history. The final years of his life were spent with his wife—who would write his biography a decade after his death—in Capri.

Over the course of his life, Uexküll wrote well over a dozen books, as well as many more scientific articles, covering a wide range of topics from the physiological musculature of marine invertebrates to the subjective lives of animals, from God and the meaning of life to biological readings of Plato and Kant. Among the most influential of his works are the aforementioned *Umwelt und Innenwelt der Tiere* (1909), *Theoretische Biologie* (1920), *Die Lebenslehre* (1930), *Streifzüge durch die Umwelten von Tieren und Menschen* (1934), *Niegeschaute Welten* (1936), and *Bedeutungslehre* (1940).

NATURE'S CONFORMITY WITH PLAN

If biology, as Uexküll understands it, is the "theory of life," then one might best begin by asking what life is in order to arrive at his biology. Toward the end of his life, Uexküll will place more and more emphasis on "meaning" and "significance," stating in *The Theory of Meaning* "that life can only be understood when one has acknowledged the importance of meaning" (26). But before addressing the theme of meaning in the section on biosemiotics, we can observe how Uexküll eventually comes to focus on meaning and signification via his early theory on nature's conformity with plan (*Planmäßigkeit*). In fact, one can read the development of his thought as leading from theoretical biology to a general concept of life as inherently meaningful, as I will propose here. Nature's conformity, as he states in *Theoretical Biology*, "is the basis of life" (xi), so we turn first to this before turning our attention to how life might be thought of as meaningful.

Uexküll opens his largest and most comprehensive text, *Theoretical Biology*, with an acknowledgment to an unlikely source: the German philosopher Immanuel Kant (1724–1804). In his introduction, Uexküll writes: "The task of biology consists in expanding in two directions the results of Kant's investigations:—(1) by considering the part played by our body, and especially by our sense-organs and central nervous system, and (2) by studying the relations of other subjects (animals) to objects" (xv). Before examining these two points in further detail, we need to know what exactly Uexküll means by "the results of Kant's investigations," such that we understand his biology as expanding on it. To do so, one need only look prior to this enumeration, where he offers a rather succinct, though largely undeveloped, interpretation of Kant's philosophy, when he states that "*all reality is subjective appearance* [Alle Wirklichkeit ist subjective Erscheinung]" (xv).

Uexküll takes as his guiding philosophy a thesis that will provide the foundation for the entirety of his thought: that the reality we know and experience is ultimately what we subjectively perceive in the world. There is no objective reality in the form of objects, things, or the world; there is nothing outside of the individually subjective experiences that create a world as meaningful. If Uexküll has a biological ontology, it is here. He will add layers and depth to this position, but the foundation is already set. Reality is created through the experiences of each and every subject, and this, as we shall see, holds for all animals just as much as it does for humans. Uexküll is clearly inspired by Kant's self-proclaimed second Copernican revolution; this is Kant in his most familiar form. In the preface to the second edition of *Critique of Pure Reason*, Kant writes of the "altered method of our way of thinking, namely that we can cognize of things a priori only what we have put into them" (Bxviii; Bxxii). By likening his thought to Copernicus, Kant sought to reevaluate the role that the perceiver plays in knowing the surrounding world of things. Instead of assuming an objective world that exists independent of the subjective perceiver, Kant reformulated the question by asking whether it may not be we who are subjectively, albeit a priori, forming our knowledge of the world. It is no longer thought that our ideas and thoughts mirror the world outside us, but that the world conforms to our cognitive faculties. If this is the case, then it remains the task of the philosopher to ascertain the categories of the mind that allow for our sensibility and understanding to construct such a world in which we live. Alas, this remains the critique of pure reason and not the task of theoretical biology. For our purposes, let it suffice to note that Uexküll more or less takes Kant at his word by glossing over his position, and thus concludes that "Kant had already shaken the complacent position of the universe by exposing it as being merely a human form of perception" (IU, 109). Uexküll expands this thought, however, by attributing subjective perception to not just human forms of perception but to the *Umwelten* of all animal perceptions.

What is further noteworthy in Uexküll's adoption of the subjective position is that he repudiates the notion that we will ever get to a reality outside of subjective perceptions. On this point he differs from Hermann von Helmholtz, whose work he often cites as informative to his own observations, and it could be for this reason that he makes an appeal to Kant's philosophy. Still within the introduction to *Theoretical Biology*, it is admitted that "Helmholtz indeed acknowledged that all objects must appear different to each subject; but he was seeking the reality behind appearances" (xv). It is possible then that Uexküll took Helmholtz as his starting point for observing the subjective appearance of reality, but that he found Helmholtz overextending himself into an area that he ought to have left well alone. Like Kant, Uexküll did not believe that we could get to a noumenal "thing in itself"; all that we have are phenomenal appearances. Helmholtz believed this reality behind appearances to be "the physical laws of the universe," but, for Uexküll, such a reality can only be tenable as an article of faith, not of science.

This prepares the way for Uexküll's rejection of certain physical principles on the basis that he finds biology to be largely nonmechanistic. A significant theme of his theoretical biology is to underscore, in a decisive manner, how and why biology is different from the other natural sciences, specifically physics and chemistry. This includes, among other things, claiming how organisms are different from machines, which he answers in a twofold fashion: by referring to living things as both self-developmental and autonomous. With the first, Uexküll contrasts the "centripetal architecture" of purely physical things with the "centrifugal architecture" of organisms; the former accounts for how material things are formed by outside forces acting inwardly, whereas with the latter we are led to see how organisms develop from the inside out (TB, 190). This highlights the role that Uexküll gives to morphology. Living things develop, from the blastula phase on, in a coherent, self-regulated way directed by inner principles. This importantly does not preclude outside agents acting on the genesis of the living thing. It will be quite the contrary, as we will see in his descriptions of the *Umwelt*. So while the contrast with machines is perhaps simplistic, the point he makes is clear: material, nonliving things are created from the outside by parts being put together or taken apart, whereas living, organic beings develop from an inner force that unfolds according to a morphological plan. Living things are always already a completed unity, no matter what stage of development, in a way that objects and machines cannot be. The vital materialism of Baer's morphological studies is evident here in Uexküll's account, though I'm not sure we can go so far as to call him, as Lorenz lovingly does, a "dyed-in-the-wool vitalist."[5] The inner force, as we shall see, is offset by environmental factors.

The centrifugal theory of development coincides nicely with his second point, notably the claim that living things are autonomous beings not dictated by physical laws alone. One of the central features that distinguishes the living from the nonliving is that living things are subject to their own self-governing laws. According to Uexküll, "to be a subject means, namely, the continuous control of a framework by an autonomous rule" (TB, 223). His use of autonomy is fairly literal. It is not an issue of an organism's freedom to do what it wants, but its natural inclination to self-rule. It abides by its own principles, no matter how fixed these may be, and not the rules of another. Organisms, therefore, are not mere machines because of their inner morphological development and of their autonomy. They are understood as a whole, not by divisible parts.

The point here is that Uexküll does not believe biology ought to inquire into the domain of physics and chemistry, for to do so leads toward positing absolute laws, such as Helmholtz's "physical laws of the universe." Nor should physics and chemistry intrude on biology. To do so would require formulating problems and answers irrespective of the uniqueness of the living being in question. This marks a significant departure in theoretical biology, for Uexküll believes that biological thought has been under the influence of the chemical and physical sciences for too long. His claim is all the more provocative due to its parallel with the contemporaneous critique of metaphysics present during his time. It is interesting to read that the belief in an objective reality underlying the apparent world has not only been a thorn in the side of postmetaphysical thought, as found with Nietzsche for instance, but that this belief has also undermined the advancement of biology because of physics' proximity with such a metaphysics. In fact, Uexküll makes the startling claim that "present-day physics is, next to theology, the purest metaphysics" (TM, 42) precisely because of its faith in an idealized objective world that presumably lies beyond the temporary fleetingness of subjective appearances. Biology is simply not in the same company as (meta)physics: "Biology does not claim to be such extensive metaphysics. It only seeks to point to those factors present in the living subject that allow him to perceive a world around him, and serve to make this world of the senses coherent" (TM, 43). To this end, "it seems," Uexküll notes, "that we must abandon our fond belief in an absolute, material world, with its eternal natural laws, and admit that it is the laws of our subject" that constitute the world as meaningful (TB, 89).

The path that Uexküll is navigating is a difficult one. On the one hand, he finds impetus for the future of biological thought in the guidance of Kant's philosophy. Here we find, in Uexküll's reading, that there is no truly objective world other than what we subjectively perceive. That which is known cannot exceed an irreducible world of experience; there can be no absolute world from a biological position. He maintains this to be true of the entire natural world, from the simplest to the most complex of organisms. In making this claim, he likewise shies away from a world of pure causality where everything can be explained by mechanical and physical laws. On this point, Uexküll is clear that we must distance biology from physics if we want to address nature's plan. As he explains, "[p]hysics maintains that the things of Nature around us obey causality alone. We have called such causally ordered things 'objects.' In contrast to this, biology declares that, in addition to causality, there is a second, subjective rule whereby we systematize objects: this is conformity with plan, and it is necessary if the world-picture is to be complete" (TB, 103). For him, "*all reality is subjective appearance*" because reality is constituted by living things that are subjects themselves, even if they together constitute a greater plan. On the other hand, however, Uexküll does not want biology to devolve into an entirely relativist science, where the world can be interpreted any which way and where nature is subject to a variety of accidental, random, and chaotic events. For better or worse, this is his impression of Darwinism and the theory of evolution more specifically. In order to further clarify this thought, his "conformity with plan" must therefore be situated between the too-strict objectivity of physical mechanism and the too-random planlessness of Darwinism.

Uexküll most clearly distances his theory from Darwinism by offering a brief narrative of the history of science from Kepler to Darwin. In both his *Theoretical Biology* and, in greater detail, "The new concept of Umwelt" (1937), Uexküll describes how science passed, between the time of Kepler and Newton, from a "*perceptual*" orientation to a "*functional*" view of the universe. The description is as literal as it sounds: modern science originally arose through the observation of natural things, from plants and animals to the distant stars in the sky above. Such perceptual observations, however, gave way to a more rigorous study of how things in the universe function independent of the observer. For example, he suggests that modern astronomy originated as a perceptual study of heavenly bodies by wondering about the likelihood of a design behind their observable movements. The harmony of these movements was attributed to God who alone was thought capable of ordaining such a perfect cosmic balance. However, with the emergence of Newton's natural laws, Uexküll finds that perceptual study succumbed to a study of function to such an extent that "causation" came to overrule "design" as the guiding principle of science. Newton's discoveries had such an impact that the physical and chemical sciences "busied themselves with the functional side of things and shoved the perceptual side away with scorn. Both acknowledged only the law of cause and effect and denied the existence of design in nature" (NCU, 114). Together with this shift, "something fundamentally shattering had happened—God had left the universe."

The absence of God is important here not only because Uexküll finds the death of God in Newtonian science (though this is certainly interesting), but because his argument against causation and function hinges on the relation to God, more so than on perceptual science. Studying the world as if it were a mechanical machine seems to imply that design is no longer possible and that God is no longer necessary. Without God as the designer, the world becomes a machine simply going through mechanical and ultimately meaningless motions. Unfortunately Uexküll never really offers sufficient reason to substantiate this claim. It is unclear, for instance, why Newton's science must imply the departure of God. It was a common argument in the eighteenth century to maintain that a perfectly causal world must have been created by God, rather than necessitate his absence. The argument was so well known that David Hume chose to embody it in the character of Cleanthes in his *Dialogues Concerning Natural Religion*. Cleanthes offers the hypothesis that the world is analogous to a great machine precisely to prove God's existence. Most of the dialogue is an entertaining and insightful confrontation between Cleanthes and Philo about this very proof and its ability and inability to explain both God and the world. Uexküll, it seems safe to say, believes that a causal, mechanical world only proves God's unimportance, not his existence. Nevertheless, it is his belief that with the rise of scientific reason in the eighteenth century there was a proportionate decline in finding meaning in a designed universe. One could still argue that God may have created the world and set it in motion, but with the increasingly pervasive belief in a perfectly rational and causal system, God was no longer necessary to keep it going. Like a machine, the earth and universe function perfectly well on their own without the creator. Thus, Uexküll concludes, "[t]he design of the world had broken down. Looking for it had become meaningless" (NCU, 114).

It is with the departure of God, then, that meaning unravels. But just as important, it is because of God's absence that Uexküll discovers the move from a mechanical and functional universe to one that is random and without plan. His narrative thus moves as follows: from a harmoniously designed universe (Kepler), to a meaningless mechanical system (Newton), to an accidental, planless world (Darwin). What is perplexing about each shift—what Thomas Kuhn would call "scientific revolutions"[6] of paradigms—is that God's absence underlies each one. How can God's departure be responsible for the movement from a designed universe, to a mechanical one, and to a planless one? The answer is not altogether clear and unfortunately one that Uexküll does not even begin to address. The theme of God reveals a religious current that runs through Uexküll's writings on nature and life. But for the purpose of understanding his position on nature's conformity with plan, it is not entirely necessary that his reasoning be complete in this story. What *is* important is how he finds Darwinian science as pervaded by a potentially harmful planlessness. With no God to oversee an inherently meaningful design in the world, nature might not be teleological after all.

As modern science cracks open the mysteries of nature, living things are gradually stripped of an inherent purpose. As Uexküll writes, "This way it became possible that not only the inorganic world, but also the living things were declared products of accidental happenings. . . . Finally man himself became an accidental product with purely mechanical, aimlessly functioning physical processes" (NCU, 115).

What Darwinian evolution promotes, according to Uexküll, is a "causal chain" that unfolds from "random displacements" and accidental occurrences, rather than an overarching design at work within nature. Uexküll echoes these reservations in his earlier work, *Theoretical Biology*, where he accuses Darwin of propagating "hopeless confusion" (264) with his theory of evolution. One of the problems is the purported misuse of the term "evolution." Uexküll explains that evolution derives from the Latin term *evolutio*, meaning an "unrolling" or "unfolding" (263). What he finds confusing is that rather than asserting a theory that details fewer folds (evolution as an unfolding of folds), Darwin's theory seems to advocate greater complexity by introducing more and more folds into the process. A paradox is seen between the etymology of evolution and its actual application; according to Uexküll, evolution ought to be a theory of increasingly fewer folds but instead becomes one of even greater complexity under Darwin. While this may be a false problem that Uexküll introduces—for he unconvincingly interprets 'unfolding' as being synonymous with less complication—it demonstrates the degree of his dislike for Darwinian evolution.

This said, the issue at hand has less to do with Uexküll's critique of Darwinism than with his promoting a different direction for biological theory. Kalevi Kull writes that "despite his opposition to Darwinism, Uexküll was not anti-evolutionist" so much as he was a firm proponent of epigenesis (Uexküll, 5). It is perhaps fair to say that he directed his attention more to the issue of physiological development than to evolution itself, even if, and particularly because, his remarks against evolutionary theory never appear convincing. His principal objection to this point is that "evolution means that within the germ the finished animal already lies concealed, just as the folded bud contains the perfect flower, and in addition to growing, has merely to unfold and evolve in order to produce it" (TB, 264). Aside from being reductive and misattributing the theory of preformationism to evolution, his interpretations often seem to be wrong and could be the result of having misunderstood Darwin's ideas.[7]

The focus on epigenesis offers a more informative look at how Uexküll distances himself from Darwinism. Whether correctly or not, Uexküll believes that Darwinian evolution offers a constantly changing horizon in which accidents occur and random pairings coincide to produce strange and potentially monstrous offspring. The accidents of natural history, together with the notion that once paired, only the parental ancestors contribute to an organism's development, lead Uexküll to believe that, on the one hand, Darwinism is too haphazard in accounting for natural events and, on the other, too concerned with purely material interactions between specific ancestors. In other words, he finds Darwinism too complacent in attributing nature's growth to random, historical chance and too materialistic in claiming that only the inheritance of 'genes' lead to the future of the species. This reading reinforces the "hopeless confusion" that he perceived in Darwin's ideas: both a chaotic freedom and a materialist determinism, both chance coincidences of a long history and the particular determinism of parental 'genes.' The result of such an interpretation is something akin to a planless, chaotic physicalism:

> Since Darwin's day, we see not only the inorganic objects, but also the living things in the sensed-worlds of our fellow-men, fall to pieces. In the majority of sensed-worlds, animals and plants have become nothing but assemblages of atoms without plan. The same process has also seized on the human being in the sensed-worlds, where even the subject's own body is just an assemblage of matter, and all its manifestations have become reduced to physical atomic processes. (TB, 335)[8]

The repercussions for Uexküll's own theory is that nature has more of a regulative plan than Darwin suggests, and that more than just the material genes of the two parents contribute to the development of organisms. His confrontations with Darwinism point toward his notion that nature has a conformity with plan.

To repeat, Uexküll's conformity with plan attempts to steer a path between the mechanical laws of chemistry and physics and the apparently random variations in nature suggested by Darwinism. For Uexküll, nature is neither entirely causal, nor is it just random; it is neither simply physical, nor is it spiritual. Rather, nature accords with an overarching plan that has set parameters in which life forms can interact (thus not entirely random) as well as inclusive of agents and forces other than the parental genes as developmentally constitutive for the organism (thus not exclusively materialistic or organic). To be fair, Uexküll paints an overly simplistic and one-sided picture of physics, chemistry, and Darwinism, as distinct ideologies as extreme in their views as they are wrong for biological science. I have drawn this comparison in order to better illustrate what Uexküll is working against in the formation of his own theoretical biology.

If nature's conformity with plan has little in common with either physics and chemistry or Darwinism, then how are we to understand it? Might this parting of ways signal a return to Kant's influence on Uexküll? It might be tempting to turn to Kant, particularly to his *Critique of Judgment* and the later writings on history where he expresses a teleological theory of nature. But despite his occasional appeals to Kant's philosophy, Uexküll does not follow his teleology. In fact, he explicitly renounces a teleological force behind nature: "Instead of seeing in it merely a rule stretching across time and space, men have spoken of 'purpose' and 'purposefulness' in Nature. . . . It is advisable therefore to dismiss from biology, for all time, expressions such as 'purpose' and 'purposefulness' " (TB, 270). What Uexküll finds problematic in teleology is its deceptive tendency to anthropomorphize nature; that is, to see nature as guided toward ends that only we humans can objectively perceive. This may account for why Uexküll allows for a "rule" to stretch across time and space, but not one that considers purposive ends. To see a purpose is to presume insight into the full working of nature and thus to also perhaps see where it is heading. If this were the case, we would not only have insight into nature as a whole, which presumes the absolute standpoint of physics that he has already dismissed, but also the ability to interfere and control nature's future. This would further suppose that nature's rules may be altered or changed. In contrast, the rules of nature's plan appear to be unalterable: "This force of Nature we have called conformity with 'plan' because we are able to follow it with our apperception only when it combines the manifold details into one whole by means of rules. Higher rules, which unite things separated even by time, are in general called plans, without any reference to whether they depend on human purposes or not" (TB, 175–76). One can see that Uexküll, despite his reservations with teleology, nevertheless remains Kantian in his language.

With this point, we begin to move away from his critical appraisal of other positions toward the establishing of his own theoretical contributions. It has already been mentioned that he favors a 'horizontal' view of nature as opposed to a 'vertical' one. The idea that nature conforms to a plan acquires its greatest support from Uexküll's observations of rules that extend horizontally across time and space, rather than as lineages descending historically through time. While demonstrating a reluctance to embrace Newtonian physics and Darwinian evolution to explain biological phenomena, his own position becomes increasingly interesting in how he extends his observations across the horizon of nature. Nature becomes akin to a "web of life" that extends in all directions uniting both living and nonliving things into a cohesive design. Uexküll expresses this idea in the following manner:

> These mutual restrictions give us proof that we have before us a coarse-meshed tissue, which can be comprehended only from a standpoint higher than those afforded us by individual, com-

> munity, or species. This all-embracing interweaving cannot be referred to any particular formative impetus. Here at last we see the action of life as such, working in conformity with plan. (TB, 258)

It is with this "all-embracing interweaving" view of nature that Uexküll makes his greatest impact in the fields of ecology and ethology. Nature conforms to a plan, a "super-mechanical principle" (TB, 350), that has no "formative impetus," but that extends across all things, both organic and inorganic. To better understand nature's plan, or at least derive a better indication of its design, we now turn to Uexküll's groundbreaking studies of animal *Umwelten*. With his *Umwelt* research, we return to the Kantian notion from which we began—namely, that "all reality is subjective appearance"—as well as to an elucidation of the web-like forms of life that constitute animal environments.

UMWELTFORSCHUNG

Uexküll is probably best known for the advances he made in the study of animal behavior. His innovation was to approach the environments of animals as not only a feature of ethology but as absolutely necessary to understanding animal life. The animal, together with its environment, are observed to form a whole system that Uexküll called an *Umwelt*, a term that he popularized as early as 1909 in his book *The Environment and Inner World of Animals*. His studies eventually led him to establish the field of *Umweltforschung*, the research and study of animal environments, as a way for biology to become a science more true to the animal *as* a subject with its own experiences.

How the *Umwelt* became important to Uexküll's studies can be traced once again back to Kant. The degree to which Uexküll leans on his interpretation of Kant demonstrates just how informative Kant's philosophy was to his biology, even if Uexküll does not always appeal to him or even fully elucidate the finer details of Kant's system.[9] Nevertheless, the idea that "all reality is subjective appearance" informs all of Uexküll's thought, and it reappears as central to his discussions of *Umwelten*. As one indication, he notes that "Kant had already shaken the complacent position of the universe by exposing it as being merely a human form of perception. From there on it was a short step to reinstall the *Umwelt* space of the individual human being in its proper position" (IU, 109). It is not difficult to see why the concept of *Umwelt* became so important once reality is acknowledged as subjective appearance. If it is agreed that the world is constituted through each individual subject, then it becomes necessary to ask how the world appears to each organism as a subjective appearance. What quickly becomes clear is that it is no longer easy to speak of "the world" as an objective fact, as a reality independent of our subjective experiences. In a remarkable passage, we are informed that things in the world have no existence independent of our individual perceptions:

> Objects, equipped with all the possible sensory characteristics, always remain products of the human subject; they are not things that have an existence independent of the subject. They become 'things' in front of us only when they have become covered by all the sensory envelopes that the island of the senses can give them. What they were before that, before they became covered, is something we will never find out. (TB, 107)

If this is so—namely, that objects do not exist independent of subjects who sense them—then not only the things in the world but the world as such becomes a concept in need of clarification. This is precisely what Uexküll intends when he introduces the concept of the *Umwelt*—to differentiate it from the objective world—and in its application to all animal subjects and not just humans alone. As we shall see, these distinctions between Umwelt and world, on the one hand, and human and animal, on the other, hold particular significance.

In order to better appreciate the lives of animals, the environments in which they live require illustration. But what is an environment if not the subjective appearance of the animal in question? Does the environment just bring us back to the animal? In a passage that shows a certain affinity with Heidegger's notion of being-in-the-world, Uexküll suggests that the animal and *Umwelt* are not two distinct beings, but a unitary structure that must be considered holistically: "all things within [the plan] must react on one another. So we may begin either by studying subjects, or by investigating their appearance-worlds. The one could not exist without the other" (TB, 71).[10] If it is the case that each organism in effect creates its own environment, then it is plausible that there are just as many environments as there are organisms. Uexküll concludes as much when, in reference to the question of whether the world can only be known through human cognition, he writes that "this fallacy is fed by a belief in the existence of a single world, into which all living creatures are pigeonholed" (SAM, 14). There no more exists a single world than there exists a single organism that inhabits it. He argues just the opposite. In contrast to the physicists' world, which he claims to be but "one real world," Uexküll proudly claims that "the biologist, on the other hand, maintains that there are as many worlds as there are subjects"

(TB, 70). To substantiate this claim, he frequently appeals to examples drawn from his empirical research, such as a seemingly "objective" description of a meadow or a tree, only to break down the landscape into a multitude of different *Umwelten* according to each individual organism. In one example, Uexküll notes how even something as simple as a single flower, can be a sign of adornment for a human, a pipe full of liquid for an insect, a path to cross for the ant, or a source of nourishment for a cow (IU, 108; TM, 29). From the case of a single flower, it is easy to see how a tree, coral reef, underground soil, or, larger still, a meadow, forest, or ocean may prove to be composed of a wide diversity of *Umwelten*, rather than just one real world. In the case of each organism, a new world comes into being, and, with each new world, one finds a further demonstration of one of Uexküll's favorite metaphors for the *Umwelt*: the soap bubble.

The image of a soap bubble surrounding every living being may well be one of the most endearing aspects of Uexküll's thought. This metaphor describes how the spherical *Umwelt* circles around and contains the limits of each specific organism's life, cutting the organism off in two respects: it provides a limit to the bounds of the organism's environment, but also acts as a layer that shields the organism from our observation. This motif appears consistently in his literature, and it is one that plays a central role in later interpretations of him, specifically by Heidegger and Merleau-Ponty. Appealing to a self-enclosed sphere is itself not new to philosophical discourses, and it could be the case that Uexküll may even be drawing from Leibniz's theory of monads when describing the spherical *Umwelt* as a soap bubble, as has been suggested in an early commentary.[11] More generally, the notion of a spherical *Umwelt* may simply derive from a tradition that likens the natural world to such things as atoms, planets, orbs, and the solar system. The *Umwelt* might be considered as akin to a microcosm in this respect. Nevertheless, Uexküll was fond of the soap bubble image:

> the space peculiar to each animal, wherever that animal may be, can be compared to a soap bubble which completely surrounds the creature at a greater or less distance. The extended soap bubble constitutes the limit of what is finite for the animal, and therewith the limit of its world; what lies behind that is hidden in infinity. (TB, 42)

Perhaps most decisive in this description is not so much that we are meant to think of the organism as being encased within something akin to a literal bubble (though he does suggest as much), but that each organism is limited as to what is accessible to it. The *Umwelt* forms a figurative perimeter around the organism, 'inside' of which certain things are significant and meaningful, and 'outside' of which other things are as good as nonexistent insofar as they are "hidden in infinity."

A good example of this, and one that is frequently cited in literature on Uexküll, is his description of the tick (*Ixodes rhitinis*). The life of the tick, and the female tick more specifically, provides a useful illustration of an organism's *Umwelt* because of its relative simplicity and the ease with which it can be variously interpreted. "Out of the vast world which surrounds the tick," Uexküll claims, "three stimuli shine forth from the dark like beacons, and serve as guides to lead her unerringly to her goal" (SAM, 12). Nearly everything in the external world that surrounds the tick has no significance to it. The moon, weather, birds, noises, leaves, shadows, and so forth do not matter to the tick. They may belong to the *Umwelt* of other organisms that live in the midst of the tick, but they do not carry any meaning for the tick itself. The external world (*Welt*) is as good as nonexistent, as are the general surroundings (*Umgebung*) of the organism. Both are theoretical references to contrast with the meaningful world of the *Umwelt*. What does matter to the tick, however, is the sensory perception of heat and sweat from a warm-blooded animal, on which the female tick feeds, lays its eggs, and dies.

Uexküll recounts how ticks will position themselves in a hanging position on the tip of a tree branch in the anticipation of a mammal passing beneath the branch (SAM, 6–13). After mating, the blind and deaf tick is first drawn upward by the photoreceptivity of her skin. While the tick hangs on a branch, very little affects it. The tick does not feed itself, shelter itself, or engage in any other activities. It simply waits.[12] And, remarkably, ticks have been noted to hang motionless for up to eighteen years at a time until a precise environmental cue eventually triggers it from its rest. This span of time encompasses nearly the entire life span of the tick, and it does so until the tick senses a specific odor emanating from the butyric acid (sweat) of a mammal. This sensation triggers a second response: the tick releases itself from the branch in order to fall onto the hair of the moving mammal. At this point, the tick's third response is to turn toward the source of the heat and bore itself into the mammal's skin. The taste of the blood matters little; experiments have shown that the liquid has to be the right temperature in order for the tick to drink. These three cues (what Deleuze will call "affects") constitute the *Umwelt* of the tick: (1) drawn by the sun, it climbs to the tip of a branch, (2) sensing the heat of the mammal, the tick drops onto it, and (3) finding a hairless spot, the tick feeds on the mammal's blood. Once the tick has bored itself in, it sucks the mammal's blood until the warm blood reaches the tick's stomach, at which time a biological response is activated, and the sperm cells that a male has already deposited and are waiting in the female are released to fertilize the awaiting eggs. This reproductive action will not occur if the foregoing sequence of events first takes place.

At this point, the tick has accomplished its plan, and dies soon after. To be sure, many, if not most, ticks do not make it through this full cycle, but this does not diminish the significance of the tick's *Umwelt*. Above all else, these few environmental signs interest Uexküll the most. These signs alone constitute the *Umwelt* of a tick, such that everything else does not factor as meaningful in any way; indeed, there *is* nothing else for the tick, even if there may be for another organism. It is on this point that we can see a parallel with other organisms. In the way that a tick can sense the precise odor of mammalian sweat, the same odor may have no significance for other living beings. This sign does not figure into my *Umwelt*; it has no significance for me. However, I may perceive and be affected by the same mammal in another way. Perhaps the mammal is a dog out for a walk in the woods. Just as the mammal belongs within the *Umwelt* of the tick, the mammal may equally belong to my own *Umwelt*, albeit with a different significance. And while the dog may not notice the tick, it may notice a squirrel to chase or a twig to play with. With this understanding, it becomes clear how it can be said that these signs form the "soap bubble" in which this tick lives, in effect limiting the significance available to it. As Uexküll notes, "[e]ach *Umwelt* forms a closed unit in itself, which is governed, in all its parts, by the meaning it has for the subject" (TM, 30). But this example further demonstrates how the *Umwelten* of different organisms may overlap with one another. The relations between things expand and mesh with one another in the intricate web of life.

Before further addressing the role of significance and meaning—which become more central in Uexküll's later writings—one last important theme must be mentioned in relation to the *Umwelt*. Along with the metaphor of the soap bubble, Uexküll also frequently employs a musical reference to describe the *Umwelt*. However, whereas the soap bubble captures an organism's *Umwelt* by circling it within a defined parameter, the musical analogy extends outward by demonstrating how each organism enters into relationship with particular aspects of its surroundings. The two are not mutually exclusive, but rather offer complementary perspectives on the *Umwelt*. On the one hand, the soap bubble emphasizes how Uexküll sees the *Umwelt* as finite and spherical by encircling the organism within certain limits, and, just as important, precluding us from ever penetrating into another organism's soap bubble to fully understand the significance of its *Umwelt*. On the other hand, Uexküll characterizes nature as a harmony composed of different melodic and symphonic parts (TB, 29), such that the emphasis in this analogy is placed not on the limitations that capture the organism within a confined sphere, but with how organisms express themselves outwardly in the form of interlacing and contrapuntal relationships.

To better understand the workings of nature, it is therefore a matter of composing "a theory of the music of life" (NCU, 120). The music of life is roughly composed of five interconnected parts or segments. Although Uexküll is never completely explicit or consistent in his use of terminology, I believe we can nevertheless interpret his musical terminology with the following biological equivalents:

1. *Chime and/or rhythm of cells:* The basic form of music, a simple bell chime or rhythm, is found at the level of cellular movements. Since cells can be "subjects" in their own right, they too are capable and even necessary in forming a part of nature's music. For example, Uexküll writes: "The ego-qualities of these living bells made of nerve cells communicate with each other by means of rhythms and melodies: It is these melodies and rhythms that are made to resound in the Umwelt" (TM, 48).

2. *Melody of organs:* A melody is slightly more intricate than a rhythm, and thus belongs to the functioning of organs. For example, Uexküll writes: "The chime of the single-cell stage, which consisted of a disorderly ringing of single-cell bells, suddenly rings according to a uniform melody" (TM, 51). The melody of organs is best demonstrated in relation with the next stage:

3. *Symphony of the organism:* The organism as a whole works as a symphonic production of the different organ-melodies and cellular-rhythms that make it up. By adding the different chimes, rhythms, and melodies together, you get the symphony of an individual organism. For example, Uexküll writes: "the subject is progressively differentiated from cell-quality, through the melody of an organ to the symphony of the organism" (TM, 51).

4. *Harmony of organisms:* Harmony begins with at least two different living organisms acting in relation with one another, but harmony can also extend to a collective whole, such as a colony, swarm, herd, or pack. For example, Uexküll often notes the contrapuntal duet that forms a harmony between two organisms: "We see here [in pairs] the first comprehensive musical laws of nature. All living beings have their origin in a duet" (NCU, 118). Or: "two living organisms enter a harmonious, meaningful relationship with each other" (TM, 52). And further: "The harmony of performances is most clearly visible in the colonies of ants and honeybees. Here we have completely independent individuals that

keep up the life of the colony through the harmony of the individual performances [with each other]" (NCU, 118).

5. *Composition of nature:* When all of the parts of nature come together, it may be said that nature itself forms a musical composition. Although Uexküll is slightly hesitant in naming a precise composition of nature, he is no less certain that nature does form one: "Nature offers us no theories, so the expression 'a theory of the composition of nature' may be misleading. By such a theory is only meant a generalization of the rules that we believe we have discovered in the study of the composition of nature" (TM, 52).

While it is true that there can be many parts of nature that do not 'make music' with one another, Uexküll is nevertheless clear that despite any discordance, "disorderly ringing" among cells, or disharmony between organisms and things, nature as a whole exhibits an overall harmonic composition.

This theory of the harmonic composition of nature brings us back to the earlier expression of nature's "conformity with plan." If we recall Uexküll's antagonism toward the physicists' mechanical view of natural laws and their belief in the existence of one real world, we can now see how his theory of nature's musical composition is a response to it as well as a more unified formulation of his belief in nature's conformity with plan. "Instead of laws of mechanics," Uexküll explains, "the laws are here closer to the laws of musical harmonics. Thus the system of the elements starts with a dyad, followed by a triad, etc" (NCU, 116). Later in this same essay, he concludes this point when he notes how "we find all properties of living creatures connected to units according to a plan, and these units are contrapuntally matched to the properties of other units" (122). The plan that nature abides by is a musical score. Yet, Uexküll never to my knowledge confirms what type of musical score this might be. After all, to say that nature's plan is similar to a musical composition can conjure up many images of nature: is it a Vivaldian plan, with plenty of baroque orchestration? Or is nature more comparable to Schönberg's minimalist twelve-tone pieces? Or the off-tempered plays of a John Coltrane score? I would be curious to know what Uexküll might think of the experimental and chaotic score by Sylvano Bussoti that Deleuze and Guattari represent on the first page of their chapter "Introduction: Rhizome" in *A Thousand Plateaus*. Could such chaos be found within the overall ordered design of nature? Presumably a universal depiction of nature will always accommodate slices of chaos, just as we are left with the possibility of infinite subjective *Umwelten*. More than likely, Uexküll would respond that nature's compositional plan includes all of these scores, and many more.