Lei Han* and Haoran Sun

Reinterpreting Uexküll's concept of *Umwelt*: bridging science, humanities, and arts with harmony

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Abstract: This paper explores the concept of *Umwelt* as an interdisciplinary framework that bridges biology, philosophy, semiotics, and art. It is presented as an open framework oriented toward future scientific inquiry while adeptly incorporating the realm of human subjectivity and a humanistic perspective. By reinterpreting Uexküll's seminal essay "The new concept of Umwelt," this paper illustrates that in Uexküll's biological universe, life is an active agent where design, practice, and reflection are intertwined. This unity is deeply rooted in the idealistic tradition, with prominent figures such as Plato, Leibniz, and Kant significantly influencing Umwelt theory. Building on this ground, this paper further argues that for the Umwelten and "Umwelten of the swarm" to function as self-organizing systems with intrinsic purposes, it is indispensable to invoke the principle of pre-established harmony (or "soul"), which, according to Uexküll, also governs the concept of Umwelt. This perspective exemplifies the inherent challenges posed by the foundational literature of biosemiotics in the ongoing scholarly discourses surrounding anti-anthropocentrism, encouraging contributions from the humanities and the arts. Consequently, Lotman's insights into the pursuit of unpredictability as a defining characteristic of human Umwelten offer a valuable alternative perspective that aligns with the evolution of both nature and culture. Ultimately, this paper argues that it is necessary, even imperative, to deploy at least two mutually contradictory perspectives to adequately capture the complexity of life research, as no singular viewpoint can encompass the entirety of this field in isolation.

Keywords: Juri Lotman; pre-established harmony; "the new concept of Umwelt"; Umwelt of the swarm; unpredictability

***Corresponding author: Lei Han**, Shanghai Jiao Tong University, Shanghai, China, E-mail: isabelleleihan@sjtu.edu.cn
Haoran Sun, Shanghai Jiao Tong University, Shanghai, China, E-mail: inkfeather@sjtu.edu.cn

1 Introduction

In recent years, a significant trend in biosemiotics research has been the concerted effort to transcend "anthropocentrism." It has become widely accepted in the field that human sign systems cannot serve as a universal model for the semiotic activities of all living organisms. As articulated in the editorial manifesto of *Biosemiotics*, the official journal of the International Society for Biosemiotic Studies (ISBS), it is "naïve to expect that human-centered or brain-centered semiotic theories will work at all levels of biological hierarchy" (Sharov et al. 2015: 3). This development is closely linked to the emergence of biosemiotics from an intersection of methodologies and perspectives spanning disciplines such as biology, semiotics, and philosophy. The interdisciplinary nature of biosemiotics naturally invites academic possibilities for a more comprehensive understanding of the coexistence of universal life and semiotic phenomena.

Currently, the scope of "semiotic agents" considered in biosemiotics research is expanding to include not only nonhuman animals and their components but also "human organizations and technological artifacts" (Sharov et al. 2015: 2). As a growing number of scholars from fields beyond the natural sciences join the biosemiotics community, its interdisciplinary focus continues to broaden. Paul Cobley astutely notes the importance for biosemiotics to "not [to] mistakenly pursue the semiosis of human animals as divorced from that of other organisms," urging the need to "erode, or at the very least, to make more porous, the boundary between living nature and culture, the sciences and the humanities" (Cobley 2016: xi, xii). Cobley's perspective underscores that the primary impetus for the development of biosemiotics today should not merely be to overcome anthropocentrism; rather, it must involve testing the capabilities and limitations of various disciplines in studying the expansive spectrum of living and semiotic phenomena.

The evolution of biosemiotics is characterized by a continual expansion of research subjects and methodologies, alongside a persistent revisiting of foundational biosemiotic literature. A salient example of this is the ongoing systematic study, reinterpretation, and applied renewal of Jacob von Uexküll's concept of *Umwelt*.[1] This concept is intrinsically interdisciplinary, largely due to Uexküll's own integrative academic vision, which accounts for its profound connection to the ongoing evolution of biosemiotics. Tønnessen aptly summarized Uexküll's significance to

1 For instance, the concepts of "Umwelt transition" and "comparative Umwelt mapping" (Tønnessen 2015 [2011]: 16–19) have emerged as significant fields that facilitate the reconfiguration of the semiotic activities of both human and nonhuman life, as well as their interrelations, within modern and postmodern contexts.

biosemiotics, stating, "It is doubtful whether biosemiotics would have emerged at all had it not been for Uexküll's Umwelt theory" (Tønnessen 2015 [2011]: 2). Notably, Uexküll was primarily a biologist, and his affinity with and indebtedness to philosophy – particularly Kant's transcendental idealism as reflected in his Umwelt theory (Bains 2001; Barbieri 2002, 2003; Chien 2005; Esposito 2019; etc.), as well as influences from Leibniz's theory of monads and pre-established harmony (Brentari 2015 [2011]; Buchanan 2008; Marcus 2001; etc.) – is more directly evident in his writings than his ties to semiotics. Moreover, Uexküll's musical background had a notable impact on his Umwelt theory (see, for instance, Stjernfelt 2001; Jämsä 2001; Gipper 2001; Bains 2001; Brentari 2015 [2011]; Buchanan 2008). Despite this multifaceted foundation, both Uexküll's interdisciplinary perspective and the Umwelt concept's own cross-disciplinary nature are frequently treated in the literature as cohesive and self-contained frameworks and taken for granted. Thus, we contend that it is crucial to examine how different disciplines fulfill distinct organizational roles and are organically integrated into this Umwelt theory.

Uexküll's own paper, "Die neue Umweltlehre: Ein Bindeglied zwischen Natur- und Kulturwissenschaften" ("The new concept of Umwelt: A link between science and the humanities"; henceforth: "The new concept of Umwelt") serves as a valuable entry point for such an investigation. Its artful structure presents an outline that reveals the interdisciplinary interactions among biology, physics, philosophy, and music within the Umwelt theory. In interpreting the structure of this article, the present paper particularly emphasizes Uexküll's efforts to incorporate philosophy and music – two significant disciplines within the humanities and art – into the realm of biology. Building on this foundation, this paper aims to explore the role of Uexküll's interdisciplinary perspective in shaping issues such as the construction of Umwelten, "Umwelten of the swarm," and human Umwelten, along with the extensibility and openness that this perspective affords these issues.

The late works of cultural semiotician Juri Lotman, particularly his book *Culture and explosion*, offer significant insights into this line of inquiry for reading Uexküll's theory, despite their fundamentally divergent perspectives and methodologies. In this book, Lotman proposes a set of systematic terms for understanding the dual models of human semiotic activity: one rooted in science, the other in art. His exploration of unpredictability and predictability enriches our understanding of the distinctions between the semiotic activities of human and nonhuman animals. By juxtaposing these two thinkers, this paper does not seek a Hegelian synthesis of their contradictions; rather, it acknowledges that the concept of Umwelt has a quality akin to the wave–particle duality phenomenon in physics, necessitating two opposing viewpoints to describe it – neither of which can fully encompass its essence in isolation.

2 Unveiling the interdisciplinary nature and governing principle of harmony in the concept of Umwelt

In "The new concept of Umwelt," Uexküll presents an ambitious vision for understanding the world as a coherent whole through his examination of artifacts, the (pre-)material world, and the living world, despite the article's relatively brief length. The article opens with a reflection on the diversity of the world and the subjectivity of human perception. The first topic addressed is the Umwelt of the human subject, where Uexküll discusses the effectual and perceptual dimensions of artifacts embodied in the example of a bell. He then transitions to a discussion of the astronomical macrocosm, scrutinizing the cosmological theories of Kepler and Newton. Uexküll critiques the prevailing scientific view shift toward a strict mechanistic causality, which he believes has abandoned teleological and purposive perspectives. This is followed by his discussion of the newly discovered wave–particle duality phenomenon in physics, which not only introduces a microcosmic viewpoint but also re-emphasizes the importance of the observer in scientific theories. It is only toward the closing section of this article that Uexküll delves into the living cosmos – the universe of various life forms and the interactions between Umwelten. It is important to note that the concept of "purpose" permeates Uexküll's discussions of these three universes and is closely aligned with the notion of "harmony." Musical metaphors consistently serve as vehicles for the concept of harmony throughout the article. This emphasis on purpose and harmony underscores Uexküll's interdisciplinary approach, blending scientific inquiry with philosophical and artistic reflections.

Uexküll argues that artifacts must conform to the principle of existing as purposive entities, with this purpose dependent upon the perceiver or observing subject. The basis for an artifact's ability to fulfill its function or purpose lies in the harmonious relationship between its parts and the whole, operating in both individual and collective aspects. Uexküll employs the metaphor of a symphony to illustrate this harmony: just as a melody is the product of prearranged harmonious coordination among different instruments, so too can artifacts only perform their functions or fulfill their purposes when guided by the pre-designed harmony imparted by human intention. This view aligns with Kantian teleology, highlighting the role of human will. Within this framework, an object, a mental state, or an action is deemed purposive because it is regarded as arranged by the will according to a certain rule.

This transcendental philosophy forms the underlying structure of Uexküll's discussion of artifacts and is equally evident in his exploration of the astronomical

cosmos, where humanity is elevated to a divine will. For Uexküll, the astronomical cosmos of Kepler and Newton operates according to different principles. Kepler sought to uncover the hidden design and order within the cosmos, while Newton focused on causal relationships and physical laws (such as universal gravitation).[2] However, Uexküll's critique of Newton does not imply a full endorsement of Kepler, as reflected in their differing employments of musical metaphors. Kepler endeavored to explain celestial motion through the harmony of the spheres, which he believed to originate from a divine designer. In contrast, Uexküll likened God to a perceiver and observer of the celestial harmony of the spheres. Although both metaphors reinforce the idea that the universe's inherent order and harmony are the results of design and are thus purposive, it is important to note the shift in focus from the designer to the perceiver between Kepler and Uexküll. This shift reflects one of the insights Uexküll gained from the then-recent discovery of the wave–particle duality in physics.

Uexküll's discussion of wave–particle duality serves multiple purposes. Firstly, he employs this duality phenomenon to emphasize that even in the natural sciences, represented by modern physics with its emphasis on mechanistic laws and causality, the role of the observer in influencing phenomena must be acknowledged.[3] Secondly, this discussion marks a significant shift in the concept of meaning: meaning is no longer assigned by a designer (a metaphysical or originating intention) but arises from the observer or perceiver – the cognitive, embodied subject. Here, Uexküll returns to his musical metaphor, underscoring that, just as harmony and design imbue a melody with significance only in the presence of an attentive ear, so too do forms filled with harmony and design lose meaning without an observing perspective. This idea is later reinforced in his biological discussions.

In the biological discussion, Uexküll compares nature to a theater as well as to the designer of life itself, where the processes of design, performance, and reflection converge. This convergence is vital, as it highlights an essential feature of Uexküll's view of the living cosmos: within this realm, the living subject simultaneously acts as designer, performer, and potentially observer. Therefore, the act of performing life's "music" and listening to it represents active engagement, with each living being functioning as an instrument or musician in nature's orchestra. In this analogy, the

2 Although Newton was predominantly concerned with causal relationships and physical laws, he also believed that the perfect order of the universe pointed to an initial designer – God.

3 This notion subtly suggests the possibility of the observer as a designer. However, this perspective does not imply a return to Aristotle's view, which posited that everything exists for the sake of humanity, but rather encourages us to reconsider the concept of "design" from the standpoint of living entities themselves. In other words, purpose must be intrinsic to the entities in question. This aligns with Kant's concept of "natural purposiveness," which he employed to elucidate the distinction between life and nonlife.

design of life forms is determined by the natural melody, just as the harmony of a musical sequence dictates the design of an instrument – not the other way around. Each individual's harmonious performance within this orchestra also sustains the cohesion of the ensemble as a whole. In this way, living organisms are able to actively construct and expand their own meaning-worlds, both vertically (in terms of understanding design) and horizontally (in terms of perceiving and interacting with other organisms).

Thirdly, Uexküll attributes the principle of harmony to a pre-material rather than a material world. He interprets the discovery of wave–particle duality as a revelation of a pre-material realm, whose laws resemble those of harmonics. In this realm, it is the principle of harmony that organizes particles to form various substances, analogous to how "a melody governs its tones" (von Uexküll 2001: 116). The laws of mechanistic causality apply only within the material world and are inapplicable to this pre-material domain. The reference to particles and their harmonic laws in the pre-material world serves as a conceptual bridge in Uexküll's argument, not only presenting a microcosmic perspective on the previously discussed astronomical bodies, but also resonating with his later exploration of the living cosmos and its governing principles. It even suggests that life phenomena emerge from the union of the material and pre-material worlds. In this sense, the foundational and governing principle of harmony, for Uexküll, not only unites particles in the pre-material world but also aligns celestial bodies in the material cosmos and, crucially, orchestrates living organisms in the living world.

In discussing the harmonious order of the living world, Uexküll is not referring to any specific organism or individual life form but rather to the interactions within Umwelten of various life forms. Here, harmony pertains to the manner in which the Umwelten of various living beings interact "according to a plan as the notes of an oratorio are harmonically connected" (von Uexküll 2001b: 117). The musical metaphor resurfaces, and more specifically, the laws of harmony are concretized as the principles guiding the interactions between organisms. Uexküll illustrates this idea using a triple-tiered structure: the vertical progressions from monophony to two-part counterpoint to three-part harmony, alongside the horizontal progressions of themes, melodies, single movements, and symphonic works, each of which can contain vertical progressions within its own layers. This approach highlights the complexity of life, from individual behaviors to collective actions, from simple stimulus–response reactions to the intricate processes of development and growth. These dynamics represent the interaction between different life forms and underpin his musical theory of nature and life.

In Uexküll's musical theory of life, every level, part, and the relationship between parts and the whole is grounded in "harmony" (musical consonance). Although Uexküll does not explicitly state this in his article, it is evident that within

an individual organism's Umwelt, the relationships between each of its meaning-carriers should also be harmonious and purposeful, much like the chords of a melody. Consequently, the relationships within and between individual organisms, groups, species, and even across different species, all align with an inherent, interactive harmony and purposiveness. Each part of the biological universe contributes to a larger, harmonious movement, and the entire living universe can be viewed as a graceful concerto or a choir. As Cassirer noted, Uexküll's biological universe complements the astronomical universe. Uexküll aims to reintroduce a grand design into the study of the world, enriching our perspective of observation, and the principle of harmony is what enables the biological universe to complement the astronomical universe. In this sense, Uexküll's vision of life in the universe transcends more than biological or physical phenomenon; it presents an ongoing, purposive symphony that integrates both the natural world and the universe of living beings into a single, harmonious whole.

In summary, the structure of Uexküll's paper "The new concept of Umwelt" suggests that harmony is a fundamental principle that permeates the artificial world, the biological world, and the entire natural universe. Moreover, as its subtitle "A link between science and the humanities" indicates, his Umwelt theory embodies a harmonious relationship between the sciences and the humanities. In this way, Uexküll establishes a conceptual framework wherein the Umwelt, as an interdisciplinary – indeed, even transdisciplinary – concept, built upon the principle of harmony, serves as both a methodological model and a metalanguage. The object world it addresses is one that is structured around harmony, purpose, and plan. From this perspective, Uexküll's thought occupies an ambiguous space between mechanism and vitalism, not as a flaw in disciplinary awareness, but as an endeavor to reflect on and transcend the absolute binary opposition between these two perspectives. His approach seeks to establish a third position or a "fourth conception" (von Uexküll 1938: 23; qtd. in Brentari 2015 [2011]: 166), transforming the seemingly idealistic "principle of harmony" into one of the core principles for future open, interdisciplinary, or even transdisciplinary academic research. Uexküll's work thus paves the way for a more integrated, flexible approach to studying life, one that bridges the divides between the natural sciences, the humanities, and the arts.

3 From Umwelt to Umwelten: insights from the idealistic philosophical tradition

Uexküll's Umwelt theory, underpinned by the principle of harmony, aligns him in certain respects with classical idealistic philosophers. Even if it is described as

embodying a form of "religious vitalism" (Stjernfelt 2001: 88),[4] it remains essential not to overshadow the significance of the principle of harmony or the broader idealistic philosophy that forms the methodological basis for his exploration of biological universe.

In Uexküll's biological universe, the living subject serves simultaneously as designer, actor, and potentially observer. This crucial point, conveyed through Uexküll's use of musical metaphors, is rooted in a deeper philosophical foundation. It is informed not only by the well-known Kantian transcendental idealism but also by Plato's philosophy. This connection is not without basis. Uexküll's work "Die ewige Frage: Biologische Variationen über einen platonischen Dialog" ("The eternal question: biological variations through a Platonic dialogue"; henceforth: "The eternal question") serves as a derivative writing of Plato's *Meno*, evidencing this intellectual kinship. Similar to Plato's pursuit of the idea, Uexküll's reliance on harmony in his Umwelt theory is expressed through his attempt to extract universal knowledge from the varying lives of organisms in order to design an ideal form or model of the biological world, essentially, creating a "Republic" of the biological world.[5]

Plato, through the voice of Socrates in the *Republic*, posits that the judgment of whether an animal is suitable, beautiful, and perfect depends on the purposiveness that *φνσις* (physis) has designated for it. In contrast, the judgment of an artificial object hinges on the use designated by *τέχνη* (techne). Plato employs a musical analogy to illustrate that the most reliable knowledge comes from practitioner: the flute player possesses the best understanding of the flute's quality, and this knowledge should inform the flute maker's design of this instrument (*Republic*, Book X, 601d–e). Uexküll appropriates this musical metaphor in his "The new concept of Umwelt," pointing out that just as musical harmony defines the design of instruments, so too does the agent of life impart knowledge of how life should be perfected to the designer of life. It is here that the idealistic philosophies of Plato and Kant converge within the implicit logic of Uexküll's Umwelt theory: if life is driven by an internal purpose, then the designer of life is equivalent to the actor of life – it is both its cause and its result (Kant 2007: 385).

4 Cf. Stjernfelt's theory of "categorical perceptions": The possibility of "harmonies" between the Umwelten of different species relies precisely on the reciprocal fitting of categorical perceptions, where the categories of perception act as the "tones" enabling these species to share a Goethean likeness-relationship (Stjernfelt 2001: 92).

5 Uexküll's biological "Republic," in its radical form, may risk conceptualizing the biological activities in nature as following a cyclical rhythm. Modern critiques argue that it is precisely the concept of "pre-established harmony" that complicates Uexküll's ability to account for phenomena such as species extinction or the contingency of environmental evolution (Brentari 2015 [2011]: 10, 147). This is echoed in Stjernfelt's use of a musical metaphor, where he suggests that while evolution can be viewed as a symphony as a whole, it is always in a state of constant improvisation (Stjernfelt 2001: 88).

Indeed, in Uexküll's framework, the harmony of the living world primarily refers to the interaction between the Umwelten of different organisms. This carries with it an underlying logic: the Umwelten that constitute the universe of Umwelt, much like life itself, should be driven by natural purpose, fulfilling the dual causal relationship necessary for life as a natural or intrinsic purpose. This dual relationship can be articulated as follows: "Parts are causally related to each other, meaning that each part exists as the purpose of the others through the interaction with other parts, and each part generates other parts as means to this end. This reciprocal causal relationship between parts generates the whole, and conversely, the whole defines the parts" (Zhou 2021: 14; Lei Han's translation). In this implicit logic, both the Umwelt and the Umwelten mirror what Kant described as a self-organizing system.

However, this logic appears to conflict with a common critique of Uexküll's Umwelt theory, namely the accusation that it leads to solipsism. As Brentari notes, "The dependency of environments on the *a priori* structures of the subjects, one of the anchors of Uexküll's Umweltlehre, in fact seems to lead to those subjects' isolation within a closed species-specific 'world'" (2015 [2011]: 166). He also references Plessner, who argues that Uexküll's assertion that the *a priori* material (environment, as a reflection within objects) forms part of the animal subject's internal structure, rather than a component of its relation to reality, is flawed (Brentari 2015 [2011]: 185). The concern, then, becomes the gulf between the *a priori* subject and the empirical subject, and how this divide between species/individuals can be reconstructed into a self-organizing collective through some organizing principle. Simply reinterpreting this organizing principle as "pre-established harmony" seems not to fully address this paradox in modern academic terms. However, since these issues arise from the interdisciplinary nature of Uexküll's Umwelt theory, we may be directed toward those aspects of this integrated framework that have yet to be fully elucidated, seeking potential solutions to these challenges. In this regard, the author turns to Uexküll's frequently employed metaphor of the "bubble."

Whether in *Theoretische Biologie* (Theoretical biology [1926]); *A stroll through the environments of animals and humans* (1975 [1934]), or many other works, the soap bubble (*Seifenblase*) is a metaphor that Uexküll favors to express the concept of Umwelt:

> So 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 soap-bubble of the extended constitutes for the animal the limit of what for it is finite, and therewith the limit of its world; what lies behind is hidden in infinity. (von Uexküll 1926: 42)

> To do so, we must first blow, in fancy, a soap bubble around each creature to present its own world, filled with the perceptions which it alone knows […] the world as it appears to the animals themselves, not as it appears to us. (von Uexküll 1975 [1934]: 5)

In these two metaphors, the concept of boundary or limitation is implicitly present. The spherical imagination – the self-enclosed space – forms the shape of the bubble, with the biological subject at its center. Each Umwelt bubble is described as independent, as the Umwelt of different subjects varies due to differences in their perceptual capacities and behaviors. A subject, constrained by these limitations, is unable to perceive or comprehend the Umwelt of another subject, making the interior of the bubble filled with the finite and accessible, while the exterior remains inaccessible and infinite. In this sense, the concept of Umwelt points to the highly individualized experience of an organism. The subject becomes the sole constructor and originator of meaning, with everything within its bubble that can be perceived and understood serving as the object and carrier of meaning. Consequently, the Umwelt forms "a self-enclosed unit, which is governed in all its parts by its meaning for the subject" (von Uexküll 2010: 144; also cf. Han 2021: 111–112).

Although the second bubble metaphor clearly draws upon Kant's transcendental idealism and his distinction between *appearance* (object) and *thing-in-itself* (thing), the more direct and profoundly influential source of Uexküll's use of the bubble metaphor is Leibniz, rather than Kant. In Leibniz's work *New physics*, the bubble emerges as one of the core concepts, referring to certain physiological structures and models in nature that can be observed under a microscope, displaying innumerable variations in shape and size, and playing crucial roles in complexes, structures, and energy functions (Escribano-Cabeza 2021: 141). A similar metaphor also appears in his later work *The monadology*, where the notion of the bubble is reframed as a particle system: "Each portion of matter may be conceived as like a garden full of plants and like a pond full of fishes. But each branch of every plant, each member of every animal, each drop of its liquid parts is also some such garden or pond" (Leibniz 1965 [1898]: 256).

Therefore, when Uexküll adopts a dewdrop metaphor that reflects the entire world in defense of his Umwelt theory, it should not come as a surprise:

> Each of these myriads of drops mirrors all the world with the sun, the mountains, the forests and the shrubs, a magical world within itself. Imagine for a moment, in his mind, that each one of these innumerable drops does not only shine in the diversity of the shimmering colors, but also possesses its own subjective tone, the one that distinguishes all living beings, then you will understand that the theory of the environment has nothing to do with the silly solipsism. (von Uexküll 1938: 47–48; qtd. in Brentari 2015 [2011]: 167)

Uexküll concretizes the myriad Umwelten existing in an instant as the myriads of drops in a field, all coexisting at the same moment.[6] It is in the display effect created

6 Through this strategic momentarization, the movement rate of a biological subject's internal world is reduced to a near-static state, allowing an external observer to engage with this dynamically

by this instantaneous view that we perceive these drops, each representing the unique environment of a particular organism within nature. Their existence interacts with larger ecologies and broader environments; furthermore, they are reflections of the world as a whole, or more precisely, they represent specific perspectives on the world, all consistent with each other. To seek some form of consistency, or harmony, between different Umwelten (whether among individuals of the same species, between human animals and nonhuman animals, or across all living beings) within the philosophical traditions of Kant and Leibniz necessitates the assumption of a commonality among different subjects and their respective sensory and effectual mechanisms. This suggests the need for "a supersensible factor that Uexküll declares unknowable, but whose influence is well-visible" (Brentari 2011: 167), which co-ordinates between different Umwelten. When confronted with this issue from a metaphysical standpoint, the recourse to the "soul" or the ultimate harmony becomes inevitable.

In the framework of Leibniz's theory of "substantial form," the unity of matter arises from the "pre-established harmony" of the substantial form. Leibniz's theory of "substantial form" is a reflection upon and transcendence of Aristotle's theory of substance, integrating Aristotle's concept of form as primitive motive force. Leibniz critiques that, according to Aristotle's concept, which posits that everything in matter is an aggregation of infinitely divisible parts, arguing that since all infinitely divisible matter lacks unity, finding unity within matter is impossible. Instead, the true principle of unity, according to Leibniz, stems from the giving of form to substances (Leibniz 1999: 26–27).

changing bubble. Roland Barthes once invoked the Greek etymology of the term "figure" to describe the fragmentary, meta-writing that encapsulates the dynamic discursive praxis of lovers and the beloved. "Figures" originally referred to bodily postures captured at a specific moment in time, static representations of a body in motion. They exist both in a diachronic dynamic and in a synchronic modality, or more precisely, at the intersection of these two states (Han 2019: 207–208). When Uexküll uses the dewdrop metaphor, he undertakes a task similar to Barthes. Dewdrops or Umwelt bubbles, as dynamically individual systems captured in a moment by an observer, resemble the "figures" of Barthes, positioned at the confluence of evolutionary and synchronic existence. According to Gudrun and Thure von Uexküll, there is an interaction between the subjective environments of different species, marking a temporal dimension in Umwelt theory; this interaction reveals the "co-belonging moments" of different biological subjects (Brentari 2015 [2011]: 166). We argue that Uexküll, building his Umwelt theory with great recourse to Kantian philosophy, necessarily views the framework of time and space as the *a priori* conditions for the subject's understanding of the external world. However, the "marking-out" of these "co-belonging moments" of different biological subjects implies that without such momentarization as a provisional operation, the Umwelt theory could not advance toward practical application.

In "On nature itself," the substantial form is introduced as the concept of "monad," which links to other concepts such as entelechy,[7] primitive motive force, and soul, among others: "[A] first entelechy must be found in corporeal substance, a first subject of activity, namely a primitive motive force […]. And this substantial principle itself is what is called the *soul* in living things and the *substantial form* in other things […] it makes up what I call a monad" (Leibniz 1989: 162; emphasis in the original). In Leibniz's philosophy, concepts such as bubble, monad, soul, and the first entelechy are synonymous, all referring to form (Duan and Li 2002: 24; Li 2023: 30). Monads, while not capable of interacting with one another, are interconnected through the arrangement of the God monad. This interconnection, according to Leibniz, is what he calls "pre-established harmony." This solves the problem of continuity from one monad to another, as well as the issues of the order and movement among entities.

We must approach the concept of the "soul" with caution. For Leibniz, "perceptions" and "appetitions"[8] constitute the two fundamental activities of the monad, or soul, together forming its inner world and its relationship with the external world. Perception is a property common to all souls, a genus concept, with natural perception, animal sensation, and rational knowledge representing its species – the latter being more specific to humans (Chang 2018: 84) – responding to Aristotle's doctrine of the soul.[9] From this perspective, Leibniz's distinction between animal sensation and rational knowledge can be understood as differentiation between nonhuman animals and humans in terms of perception; and Uexküll's use of the terms "sense organs" and "motor organs" reflects not only Leibniz's philosophical legacy but also the influence of Aristotle.

When Uexküll adopts Leibniz's concept of the bubble to illustrate his Umwelt, he inevitably reintegrates the notion of a shared essence or the God monad, which Leibniz associates with the "soul." Within each monad resides the entire world, and within each subject is the soul. The soul is both the distinguishing feature between

7 "Entelechy" is a concept in Aristotle's philosophy referring to the intrinsic purpose or the complete actualization of a thing's potential. It simultaneously signifies both the potential that can be realized and its actualization, representing the internal primitive motive force of an entity.

8 In the 1714 work "Principles of nature and of grace, founded on reason," Leibniz asserts that "one monad, it itself and at a particular moment, can only be distinguished from another by internal qualities and activities, which can be nothing else but its *perceptions* […] and its *appetitions*" (Leibniz 1990 [1973]: 195). In this statement, Leibniz underscores that the "monad" is distinguished solely by its internal qualities and activities, with a temporal boundary – referred to as "a particular moment" – also being delineated.

9 Aristotle argued that the *differentia specifia* of animals resides in their souls, and the *differentia specifia* of the soul is characterized by the interaction between soul and body. The soul represents form, the body represents matter, and their interaction generates perceptions and movements, or "appetitions" in Leibniz's terminology.

life and nonlife and the source of a shared essence among different living forms. It represents the origin of harmony and vitality, as noted by Brentari:

> Whether we consider the individual organism, all living beings, or even things on a cosmic level, according to Leibniz, the harmony of relations between parts can only be explained by allocating vital spontaneity and procedural autonomy to matter. These features come from it being animate matter, i.e. matter in which spiritual realities or monads occur in an immediate and invigorating way. (2015 [2011]: 51)

The soul or monad can simultaneously serve as the disintegrated, determinate substratum of a part and as the principle of continuity that unifies the whole. In this sense, Umwelt, much like the monadic bubble, is endowed with vitality through the soul, functioning both as the substrate and the principle of unity. Therefore, both Umwelten (the various environments of different creatures) and Umwelt (an individual's environment), in this context, are envisioned as a (life-like) system with a natural or intrinsic purpose. Also, as Uexküll himself argues, this conception does not imply solipsism.

Nonetheless, it is essential to note that such an interpretation of Umwelt theory is likely to be met with criticism or even anger from the scientific community, for it could seem to strip Uexküll, the biologist, of his scientific orientation, casting him solely as a proponent of idealistic philosophy. However, this is not the intention of this paper. The analysis in this section aims to highlight that we cannot fully comprehend the vitalistic aspect of Uexküll's Umwelt theory without engaging with its idealistic philosophical roots. Nor should we overlook the profound challenge this philosophical tradition poses to the mechanistic view in biology, which treats life as an object. Life, as Uexküll presents it, is an active agent where design, practice, and reflection are intertwined. This is precisely the insight that Umwelt must be conceived as an interdisciplinary concept, bridging the humanities and sciences. This view grants all living subjects a semiotic ethics originally considered exclusive to humans – an ethics of self-reflective observation.

4 Umwelten of the swarm

It is essential to construct a bridge between an individual Umwelt and all the various Umwelten, a connection which may take the form of the *Umwelten of the swarm*. The subjective environment can transcend the individual organism, determined by a "pre-established harmony," or, put differently, by the soul that endows matter with vitality. For Uexküll, this "soul" is referred to by various terms: it may be termed "vital energy" (*Lebensenergie*), "natural factor" (*Naturfaktor*), or "natural force" (*Naturkraft*). Uexküll stresses the unknowability of this force, which stands as a

fundamental postulate and "is ultimately responsible for the harmony and accordance in effect on every level of nature (in the single organism, among different organisms, in ecosystems, etc.)" (Brentari 2015 [2011]: 122–123).

While this force remains an eternal mystery for Uexküll, he endeavors in *Theoretical biology* to discuss the ways in which this force manifests within the boundaries set by the species. This is where his concept of functional cycles becomes relevant. Thus, functional cycles can serve as the basis for discussing the Umwelten of the swarm. In *Theoretical biology*, Uexküll proposes that the Umwelt of a species could be envisioned as the collective result of the functional cycles of all individuals within that species, while still allowing for individual differences within these cycles. Ultimately, this would create an Umwelt that is broader and more comprehensive than that of any single individual (Sutrop 2001: 451). Following a similar logic, Sutrop and Kull extended this idea, posing the question of whether a collective Umwelt for both human and nonhuman life forms could be conceptualized. Could we also imagine that any individual cell within a living organism has its own Umwelt (Sutrop 451; Kull 1998)? More radically, within human societies, beyond individual persons and species, can we discuss a specific collective form of people through the concept of the "public," thereby extending the discussion to the Umwelt of a population (Han and Peng 2023)?

Kull argues that only by considering the role of functional cycles as centralized systems can we begin to talk about a collective Umwelt. Sutrop, however, questions this perspective, asserting that such reasoning must be grounded in the resolution of two foundational issues: 1) How do we define the subjectivity of a collective subject? 2) What are the basic structural elements of the functional cycle within a collective Umwelt? These two questions strike at the heart of the issue. With regard to the first question, a collective Umwelt formed from individual Umwelten must involve some form of continuity and harmony among individual subjects to constitute a collective subject; namely, the subjectivity of the collective is contingent upon this very continuity. As for the second question, it raises the inevitable inquiry: What is the relationship between the functional cycle of a collective Umwelt and that of an individual Umwelt? Do the individual cycles simultaneously constitute part of and align with the operational principles of the collective Umwelt? Furthermore, this discussion may give rise to additional concerns: How does a collective subject, formed through the aggregation of different life forms, maintain its self-identity in a dynamic sense? In other words, how do we distinguish between the self and the non-self, the internal and the external? Might the merging of different aggregations provoke a new round of discussions on continuity, unity, or harmony? Such questions could indeed proliferate *ad infinitum*.

Kull and Sutrop, both active semioticians from the Tartu school, are part of a semiotic tradition that engages deeply with the questions of individual and collective

subjects, as well as the structural dynamics of cultural systems. These concerns are central to the work of Juri Lotman, the intellectual leader of the Tartu school, particularly in his treatment of culture as a collective intellect and the broader implications for systems of communication. For example, in his essay "Culture as collective intellect and the problems of artificial intelligence," Lotman addresses issues related to collective subjectivity (1979). However, we do not intend to expand the scope of this paper into cultural semiotics; rather, our point here is to underscore that when we attempt to discuss a complex collective subject, the question of human Umwelten becomes one of the most crucial topics, particularly because the most nuanced manifestations of differences between individual subjects remain, within the present scope of human cognition, one of the most evident aspects of human experience. This will be further elaborated in the next section.

It is also important to note that in their treatment of the Umwelten of the swarm, Kull and others place significant emphasis on functional cycles, which, in certain respects, may not entirely align with Uexküll's original conception. Although Uexküll did indeed conceive of a species' Umwelt in *Theoretical biology* based on the concept of functional cycles (Sutrop 2001: 451), this also indirectly suggests that Uexküll was constrained by the materialist, biological categorization of species, which ultimately limited his ability to center functional cycles within this framework. An alternative perspective might be offered by Cassirer, who notes that there was no necessity to probe into any purposive forces, for Uexküll, "it was enough to prove that the living world, in its totality and in its detail, has a stable *teleological* structure" (Cassirer 1950: 202; emphasis in the original). This structure is not a materialistic one, but rather an "idealistic morphology" (Cassirer 1950: 200). When the teleological inquiries concerning organisms are to be grounded in the issue of functional autonomy, Uexküll begins with the concept of "the autonomy of *form*" rather than corporeality. According to Cassirer, "[t]he real analogue to the concept of biological form is not to be found in the world of material things or processes with which physics is concerned, but must be sought elsewhere, in the pure relationship of *geometry and stereometry*" (1950: 200; emphasis in the original). He refers to Uexküll's seminal work *Die Lebenslehre*:

> The structure is not a material thing: it is the unity of immaterial relationship among the parts of an animal body. Just as plane geometry is the science not of the material triangles drawn on a chalkboard with chalk but of the immaterial relationships between the three angles of three sides of a closed figure […] so biology treats of the immaterial relationships of material parts united in a body so as to reconstitute the structure in imagination. (von Uexküll 1930: 9; translation by Cassirer; qtd. in Cassirer 1950: 200)

It is precisely due to the nonmaterial nature of this structure that it could serve as a model capable of extending from the level of the individual organism to the broader

inter-organismal level, thus facilitating the transformation of Leibniz's concept of pre-established harmony within biology.

Uexküll was likely able to narrow down the implementation of "pre-established harmony" to a collection of functional cycles (or a universal model[10]) due to an age-old recognition within the field of natural research: the quest to understand the origins of all things, including the birth, death, and existence of life, ultimately lacks definitive answers. This resonates with Socrates' admission in Plato's *Phaedo* (96a–c). In his work "The eternal question," Uexküll describes his motivation for creating this piece by indicating that he would pose to Socrates the question of how to interpret nature, highlighting that the problem of vital force remained a mystery for himself as well. However, with this vital force as an activating,[11] primitive motive force, at least some aspects of how organisms maintain life through perception, behaviors, and interaction with their environment are knowable. Therefore, the Umwelt theory serves as a bridge between the scientifically knowable world and the world that science cannot fully grasp.

The Umwelt of any organism includes important parameters that can be quantitatively analyzed by science, such as food, mates, shelter, predators. However, how these parameters are perceived and interpreted by the organism, and how they are organized into a unified system, entirely depends on an internal self. A living organism possesses an internal world within its physical form, and this internal world determines what kind of meaning-carriers are present in its Umwelt, as well as how they are organized. Therefore, the internal world holds crucial significance, as it supplements, confirms, and explains elements that science cannot exhaustively analyze. Conversely, the very fact that science cannot fully analyze all aspects of life demonstrates that it is futile and impossible to completely sever the objective world from the subjective one (Sharov 2001: 211).

Now, it's possible to reconsider the fact that Uexküll's Umwelt theory occupies an ambiguous space between mechanistic and vitalistic thought. He grounds his approach in idealist philosophy as a methodological foundation, while employing functionalism as a concrete operational framework. His work cannot be said to treat the mind and body, or matter and thought, in the same manner as continuity theory,

10 In Sebeok's terminology, he uses "model" in place of "Umwelt": "All organisms communicate by use of models (Umwelts, or self-worlds, each according to its species-specific sense organs), from the simplest representations of maneuvers of approach and withdrawal to the most sophisticated cosmic theories of Newton and Einstein" (Sebeok 2001: 21–22).

11 In his interpretation of Aristotle's definition of the doctrine of poesis, Han-liang Chang notes that Aristotle's concept of *mimesis* can be understood as "potential dynamis": "Mimesis functions as a potential dynamis that, once activated, manifests in various aspects of creation, ultimately taking form as different types of arts. This entire process represents a semiotic progression from potentiality and probability to actuality" (Chang 2018: 22).

which blurs the distinction between these elements (Cobley 2016: 12). Rather, it can be said that he pursues pioneering discussions around a core issue: "The strong continuity between life and mind suggests that life and mind share a common abstract pattern or organizational form, and the functional properties of the mind being intensifications of those basic functional properties inherent to life itself" (Zhou 2021: 13; Lei Han's translation). In the wake of Uexküll's Umwelt theory, contemporary fields such as autopoietic enactivism and phenomenology of life have emerged, vigorously engaging with this core thesis. From this perspective, we can argue that Uexküll's Umwelt theory has indeed opened up extraordinary avenues for research in today's life sciences, philosophy, and semiotics.

5 Human Umwelten through the lens of Lotman's concepts of disharmony and unpredictability

In the essay "The new concept of Umwelt," Uexküll outlines a cosmic view of life wherein humans possess a unique ability to create artifacts compared to other life forms. However, when examined through the perspective of species specificity, this human uniqueness loses its mystique. In another essay, "An introduction to Umwelt," Uexküll further divides the human subject's life universe into two distinct realms: the perceptible universe and the cognitive universe. The former is a world of meaning shaped by the capacities and activities of human sensory organs and motor organs, while the latter exceeds the perceptual phenomena, belonging instead to the realm of thought and understanding. This cognitive universe can also be referred to as the symbolic universe. The extent, vastness, and complexity of this second universe are beyond what any other life form's universe can encompass.

Human sign systems interact with other systems in a holistic manner; yet within this whole, each individual element accentuates its independence and uniqueness. This idea resonated profoundly with Lei Han during her translation of Lotman's *Culture and explosion* (forthcoming) into Chinese, where Lotman argues that "[p]erhaps the sharpest manifestation of human nature is in the use of proper names and, linked to this, the isolation of individuality, the uniqueness of the individual personality as fundamental values for 'other' and 'others'" (Lotman 2009 [1992]: 31). No other species, he asserts, strives as much as humans do for individualized meaning in life. Lotman inspires us to consider the diversified variants of intrinsic purposiveness in human life as core indicators of its meaningful world.

Criticism against this view might still arise from an anti-humanistic standpoint. Indeed, Lotman's argument draws from Rousseau's emphasis on human individuality

in the latter's *Confessions*, as well as from Kant's notion of "self-consciousness" – both foundational to the Enlightenment's anthropocentric framework. However, as mentioned in the introduction, the contemporary direction of biosemiotics and its vitality should extend beyond merely overcoming "anthropocentrism." The transcendental practices of interdisciplinary life research must also be a central focus. In this sense, we contend that it is both necessary and justifiable to treat the meaningful worlds of human life and other life forms with equal importance, and we should develop a renewed understanding of the relationship between human sign activity and the broader biological semiotic system.

Over the past few years, we have consciously focused on the issue of the human Umwelten, not from an anthropocentrist perspective, but rather from an ethical sensitivity to human semiotic activity. The unique self-descriptive mechanisms of human culture, coupled with the binary division between object language and metalanguage, enable humans to engage in a meta-reflection of their own semiotic praxis. From this perspective, reconsidering the concept of Umwelt – the subjective meaning-world established between a living organism and its environment through perceptive cognition – we might argue that the perception, understanding, and reflection of this meaningful world should involve at least two pathways: the relationship between the subject and the environment constituted by others and the relationship between the subject and the environment as constituted through its relation to itself. The relationship between the subject and its environment is not a binary one, but rather a dynamic interaction characterized by permeable boundaries. Considering the self as part of the environment and recognizing its relationship with itself as an essential component in constructing the meaning relationships between subject and environment should fall within the scope of biosemiotic research.

In *Culture and explosion*, drawing on the lines of the Russian poet Fyodor Tyutchev, Lotman summarizes the relationship between human sign activity, other life forms' sign activities, and nature through the pair of terms, *disharmony* and *harmony* (Lotman 2009 [1992]: 25–27):

> A song is born with billows' speed,
> And harmony in nature's rages;
> The rustling music of the ages
> Streams through the straight but supple reed.
>
> The world is like a perfect score,
> With not a single note discordant;
> Man, free to mock and self-important,
> Alone is with this world at war.

> Whence is the flaw in the design?
> Is there a force that will restore us
> To nature's undivided chorus?
> Why does the thinking rush repine?
> (Tyutchev 1993: 124–125)

Uexküll uses the term "harmony" indiscriminately across artificial objects, the astronomical cosmos, and the universe of living beings. However, Lotman contrasts the "harmony" of nature with the "disharmony" of humanity, highlighting the opposition between nature and culture, especially underscoring the disruptive presence of humans within nature.[12] In Tyutchev's concept of "harmony," there is an implicit pursuit of the eternal and the unchanging. Yet, for Lotman, one of the distinctive characteristics of humans is their drive to invent new things and their embrace of unpredictability. Thus, in the grand chorus of nature, the disharmonious aspect of human presence, according to Lotman, represents a disruption of repetition or linear, closed movement. For example, while animals engage in ritualistic, repetitive behaviors aimed at correctness, human behaviors gravitate toward the invention of something new and unpredicted by their enemies, behaviors that do not always adhere to established rules (Lotman 2009 [1992]: 27–29). This distinction becomes particularly evident in the comparison between the innate abilities of animal offspring and those of human children. As Lotman puts it, "If we define 'talent' as a special ability to undertake any form of activity, then a 'talented' animal with special success accomplishes preexistent actions (we are not considering here the kind of training introduced by man); the behaviour of a child whether 'good' or 'poor' is, by its very nature, experimental" (Lotman 2009 [1992]: 31). From this perspective, the "disharmony" of humans in nature can be seen as a structural manifestation of the experimental expansion of individuality.

The ability to predict, especially the capacity to seize opportunities that range from the predictable[13] to the unpredictable, serves as a significant indicator of the behavioral differences between nonhuman and human animals. It also represents the process by which all living systems translate natural history into cultural history through semiotic activity. This is precisely the essential conclusion drawn in Hoffmeyer's seminal works on semiotic freedom, where he argues that the proliferation of life systems partially arises from organisms' ability to recognize patterns and predict the acquisition of nutrients (Cobley 2016: 2). This predictive ability enables organisms to capitalize on occasional opportunities for improvement, thereby driving the ongoing evolution of systems such as cells, organisms, and species, engendering structures with greater semiotic freedom or *interpretance*. The increase

12 Lotman also references E. L. Radlov's discussion on harmony of the spheres (Lotman 2009 [1992]: 27).
13 In Hoffmeyer's terminology, this is articulated as "anticipatory activities."

in semiotic freedom encourages the growth of semiotic capabilities, yielding correspondingly meaningful interpretations that assist organisms in adapting more effectively to their environments (Hoffmeyer 2010a: 34; Hoffmeyer 2010b: 194–196). However, Barbieri, in *The organic codes: An introduction to semantic biology*, notes that while the origin and evolution of life occur through natural selection and habits, significant evolutionary events are often associated with the emergence of new organic codes (2003). While it would be premature to attribute great evolutionary advances solely to life's pursuit of the unpredictable, these observations sufficiently support the idea that incorporating notions of unpredictability, incidental variation, and individual differences into the *a priori* claims about the harmonious relationship between life and its environment can promote a more comprehensive understanding of life and its relationship with the environment. Life, in different dimensions and degrees, enacts the significance of both predictability and unpredictability, prompting the dual evolution of nature and culture. Furthermore, the study of unpredictability should become a crucial aspect of researching humans as semiotic beings, and it may play an important role in future artificial intelligence studies.

6 Concluding remarks

Uexküll's foundational role in the field of biosemiotics is indisputable, and his influence on the ongoing development of biosemiotics remains profound and enduring. In the paper "The new concept of Umwelt," which the current article delves into, Uexküll shapes the concept of Umwelt within an interdisciplinary context, positioning it as both an object of scientific inquiry and an integral part of cultural and philosophical discourse. This has laid the groundwork for Umwelt to become a foundational and open-ended concept in the history of modern academia.

The philosophical underpinnings of Uexküll's Umwelt theory merit continual discussion; as a meta-philosophical method for exploring the life world, it transcends the original transcendental or idealistic stance. Uexküll's recourse to a classical interpretation of nature is one of the key aspects of this meta-philosophical approach. This approach is not only the starting point of the Umwelt theory but also its central mechanism of self-defense. As demonstrated in "The eternal question," Uexküll does not merely aim to let Socrates master contemporary biological knowledge, but also seeks to resurrect Socrates as the very incarnation of truth in the defense of Jacob von Uexküll, evoking a "martyr-like" fervor, as Chang observes (Chang 2018: 75–78).

The classical philosophical disputes between idealism and materialism, which were later transformed into debates between vitalism and mechanism in modern times – debates that Leibniz and Kant both grappled with, and which Uexküll

encountered in the academic disputes of his time – biology was reduced to a mere subsidiary of physics and vitalism dismissed as pseudoscience. Just as classical texts and arguments afforded theoretical and ethical legitimacy to Uexküll's self-defense, the methods of meta-philosophy and music (embodiment of the arts) also granted such legitimacy; yet their influence extends beyond this. The introduction of philosophical methods, though placing Umwelt theory in the ambiguous space between mechanism and vitalism, simultaneously endows the theory with the potential to establish continuity between life and mind, thereby opening up extraordinary avenues for future research in contemporary life sciences, philosophy, and semiotics.

The recurrent invocation of musical metaphors not only reflects the inclusion of artistic models within Umwelt theory but also highlights the characteristic feature of the living universe, where the designer, actor, and reflective observer are integrated into one. Furthermore, the existence and role of the human observer and their perspective are emphasized. According to Thure von Uexküll, the concept of Umwelt implies a synthesis of the object and the observer: "postulates that the laws of the natural sciences are not laws of nature, but rules which we derive for our own objectives from our confrontation with natural phenomena" (T. von Uexküll 1987: 151). To this day, all biosemiotics research, even when grounded in scientific models and supported by rigorously articulated scientific theory, cannot escape the intervention of the human observer's perspective. To some extent, when Uexküll states in "The new concept of Umwelt" that "Lady Nature is no schoolmistress, boring us with rules and calculations. She offers us ever novel spectacles, from which we ourselves have to deduce the rules" (von Uexküll 2001b: 118), he reveals a scene later mirrored by Roland Barthes for readers of literature and art. The text of life does not maintain a singular meaning; rather, the act of perception, observation, and inference opens the significance of the life text to unfold toward an infinite world.

In "The new concept of Umwelt," Uexküll establishes a tripartite universe. In a dialogue with his disciple Peeter Torop, Lotman posits that humans inhabit a world defined by the dialectical unity of scientific and artistic models (Torop 2009). The world models proposed by these two scholars are not merely cognitive structures but also interactive and reflective frameworks. Divergent discoveries from science, the humanities, and the arts collectively prompt us to recognize that, whether considering the human domain, the micro- or macro-cosmic astronomical universe, or the vast expanse of the entire life universe, it is necessary to employ at least two mutually contradictory perspectives to adequately describe them, as no single viewpoint can fully accomplish this task. In this sense, Uexküll's Umwelt theory is genuinely an open theory directed toward the future, and it has never neglected the realm of human subjectivity and the humanistic perspective.

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Bionotes

Lei Han
Shanghai Jiao Tong University, Shanghai, China
isabelleleihan@sjtu.edu.cn

Lei Han (b. 1987) is a tenured associate professor at the Shanghai Jiao Tong University, Shanghai, China. Her current research interests include semiotics and contemporary French theory. Her publications are *On Roland Barthes: An exploration of semiology of discourse* (2019, in Chinese), "The idealistic elements in modern semiotic studies: With particular recourse to the *Umwelt* theory" (2021), and "The untranslatability of *Literaturnost* revisited in the era of artificial intelligence" (2023).

Haoran Sun
Shanghai Jiao Tong University, Shanghai, China
inkfeather@sjtu.edu.cn

Haoran Sun (b. 2001) is a graduate student at Shanghai Jiao Tong University. His main research interests include semiotics, French literary theory, philosophy of language, and psychoanalysis.