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RESEARCH

The Biosemiotic Glossary Project: Habit

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Abstract

In 2014, Morten Tønnessen and the editors of *Biosemiotics* initiated the "Biosemiotic Glossary Project" with the scope to clarify the terminology used in biosemiotics. This initiative was designed to actively involve the biosemiotic community, fostering dialogue that would contribute to the theoretical evolution of the field. In this paper, we explore how the term "habit" is defined and applied within biosemiotics, and how it relates to general semiotics and philosophy. In biosemiotics, "habit" refers to the regular, recurring behaviors or patterns that emerge from an organism's interactions with its environment. This concept, deeply rooted in Charles Sanders Peirce's philosophy, is understood as an adaptive mechanism where repeated actions lead to the stabilization of organisms or systems. Over time, these repeated actions form patterns that guide future behaviors. Peirce extended this concept beyond organisms, suggesting that habits also structure biological and non-biological phenomena by turning random events into predictable regularities. In biosemiotic theory, habits play a central role in semiosis, the process by which living systems generate and interpret meaning, as they regulate interactions and responses in both evolutionary and adaptive contexts. This notion bridges biological development and semiotic processes, offering a deeper understanding of how organisms establish semiotic relationships with their environments. This paper aims to clarify the role of 'habit' in biosemiotic discourse and encourage further discussion within the community to refine its use and implications.

Keywords Biosemiotic glossary · Charles sanders peirce · Environment · Evolution · Habits

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Introduction

A Brief History of a Neglected Concept and the Centrality of Peircean Account

"Habit" has been a significant concept throughout the history of Western thought, impacting various fields of knowledge. Scholars who have studied the relationship between thought and human behavior have addressed the issues posed by habits. However, as Camic's influential account highlights (Camic, 1986), the concept experienced a significant decline during the 20th century. The rise of behaviorism reduced habit to conditioned responses, while cognitive science shifted focus to mental processes like perception and problem-solving, sidelining embodied actions. Similarly, in sociology, structuralist and post-structuralist paradigms marginalized habit in favor of broader analyses of structure and agency. This duality—habit as both historically influential and, at times, neglected—will be clarified in the following discussion. As with almost every concept in our philosophical lexicon, the idea of habit took shape in ancient Greece, first systematically organized by Aristotle through the use of the term ἕξις, a noun derived from the verb ἔχειν (to have). From its inception, the concept was multifaceted: the two values of the verb ἔχειν, transitive and intransitive, lend to ἕξις the idea of "possession" and "being in a certain condition." The core of Aristotle's idea of habit lies in a disposition to act in a certain way in the future, conforming to the formation of the habit itself. From Aristotle's reflections, the concept has evolved through all epochs of thought: a significant development occurred in the Middle Ages, particularly in scholastic philosophy. The term ἕξις was translated into Latin as *habitus*, also a noun form of the verb *habere* (to have), and played a prominent role in the thought of Thomas Aquinas, Duns Scotus, and William of Ockham. In English, the term is translated as habit, which can also mean routine or custom, thus translating the Greek ἔθος and the Latin *habitudo*, *consuetudo*. It is in this second sense that the term habit is commonly understood in much of psychology, thereby excluding the semantic and conceptual depth that dates back to the beginnings of philosophy itself.

Several modern and contemporary authors have recognized the importance of habits to humans, placing this ancient concept at the center of their thought (from Hume, Reid, and classical pragmatists, to Heidegger, Merleau-Ponty and Deleuze. American philosopher Charles Sanders Peirce (1878) was one of these. A creator of key theories and concepts for contemporary thought, from semiotics to the logic of relations, to the first formulation of pragmatism, Peirce demonstrated a constant interest in habits, making them central points of many aspects of his thought.[1] Peirce shows a deep awareness of the history of the concept, referring directly to Aristotle,

[1] A comprehensive examination of how Peirce's concept of habit extends across various disciplines and permeates his entire philosophical system is provided in Bernardi della Rosa (2024). Habit is not merely a psychological or behavioral phenomenon but is coextensive with Peirce's broader ontological framework, deeply intertwined with his categories of being and reflective of the natural laws that govern reality. This expansive view situates habit as a fundamental concept that bridges the human and the natural, illustrating its pervasive role in Peirce's thought, from his semiotics to his metaphysical and epistemological commitment.

scholasticism, empiricism and Scottish psychology. However, Peirce went a step further than most of the preceding tradition of thought: starting from the core of the Aristotelian notion, he significantly expands the theoretical scope of this concept:

> Peirce asserted that, rather than persons having habits, it is habits that have us - that we dwell in and through habits. By extension, culture would be itself little beyond habit and likewise so would be individual personalities. This recursivity and layeredness makes demands on those scholars presumptuous enough to ponder the development of habit, as did Peirce throughout his life, 1839–1914. Reflecting on this observation, habit may be to humans as water is to fish. (Anderson, 2016: 2)

From a semiotic perspective, Peirce's contributions are central not only to his broader philosophical system but also to his formulation of habit theory (Colapietro, 2009; Kilpinen, 2016; Noth, 2010; Santaella, 2016; West, 2016), which extends beyond the boundaries of species and challenges the anthropocentric view (Pickering, 2016). For Peirce, it is not merely humans who acquire habits; rather, the entire organic—and even inorganic—world possesses regularity and conforms to laws. We, in turn, navigate and adapt to this habitual structure of the cosmos.

The context in which Charles Sanders Peirce developed his philosophy was deeply intertwined with the evolving understanding of the concept of habit throughout the 19th century. This era was marked by significant intellectual activity and transformative shifts in scientific and philosophical fields, particularly in physiology, psychology, and biology. The period from the mid to late 1800s saw habit emerge as a key concept in both American and European philosophical discourse, reflecting a growing interest in how biological, psychological, and philosophical perspectives intersected.

One of the key developments during this time was the publication of Charles Darwin's *The Origin of Species* (1859), which introduced a new dimension to the study of behavior by distinguishing between innate instincts and learned habits. This shift in understanding was pivotal in reshaping discussions around habit, particularly within biological and psychological contexts. Darwin's ideas prompted a reevaluation of how habits functioned within evolutionary theory, which influenced the philosophical debates of the time. The ensuing debates within the "Metaphysical Club",[2] were instrumental in developing these ideas further. Peirce, a key member of this club, was influenced by these discussions, which highlighted emerging evolutionary perspectives and contributed to his own revolutionary views on habit.

Integral to this evolving understanding was the Lamarckian perspective on the hereditary nature of habits. While Darwin's theory of evolution focused on natural selection and the gradual adaptation of species, Lamarck's theory of inheritance of acquired characteristics introduced an alternative view, suggesting that habits could be transmitted from one generation to the next. This idea profoundly influenced 19th

[2] The Metaphysical Club, a short-lived discussion group in Cambridge, Massachusetts, in the early 1870s, brought together thinkers like Charles Sanders Peirce, William James, and Chauncey Wright to explore ideas that contributed to the development of pragmatism (Menand, 2001).

-century discussions around the role of habit beyond individual learning to include hereditary elements. According to Lamarck, habitual behaviors could be ingrained within biological lineages, potentially shaping the evolution of species over time. Lamarck's perspective provided a framework for exploring how habitual traits might evolve and persist across generations, offering a counterpoint to Darwinian views and enriching the ongoing debate about the nature of habits and their role in evolution. During this period, the intellectual landscape was enriched by contributions from various thinkers across different philosophical approaches, both in America and in Europe.[3] This era saw habit being reconceptualized not just as a repetitive action but as an adaptive response to environmental stimuli, crucial for the survival and functionality of organisms. The discussion of habit and its application in broader contexts was further developed through debates on biological and psychophysiological issues.[4] These discussions provided a fertile ground for Peirce's innovative view that habits are fundamental to both organic and inorganic worlds. Peirce posited that the cosmos itself exhibited habitual regularities, extending the concept of habit beyond individual organisms to include broader ecological systems. This comprehensive reevaluation of habit during the late 19th and early 20th centuries was a transformative period that challenged existing philosophical paradigms. It moved the discourse away from anthropocentric frameworks, suggesting that habits are integral to the regulatory and adaptive mechanisms of life itself. The inclusion of Lamarckian perspectives on hereditary habits contributed to this shift, offering insights into how habitual traits might influence evolutionary processes. Overall, the rich intellectual ferment surrounding the concept of habit during this period demonstrated the power of interdisciplinary approaches to deepen our understanding of complex concepts. It highlighted the lasting impact of discussions on evolution from a philosophical perspective intertwined with emerging disciplines like psychology, biology, and physiology on contemporary fields of study such as biosemiotics.

Habit and Biosemiotics

In the field of biosemiotics, the concept of "habits" has been examined as a key semiotic mechanism that governs the interactions between organisms and their environment. The concept of "habit" in Charles Peirce's philosophy is significant to biosemiotics because it explains how organisms interpret and respond to signals in their environment (if we examine Chap. 3, "On Nature's Tendency to Acquire Habits", in Hoffmeyer (1996), the concept is extensively used and analyzed in the context of biosemiotics. It is further developed in later works, including several chapters in Romanini & Fernández, 2014). From a biosemiotic perspective, habit is fundamental to semiosis and to understanding the process by which organisms create meaning and constitute their subjective world. This perspective highlights the continuity between biological processes and interpretive actions, creating a bridge between

[3] See (Bernardi della Rosa, 2020).

[4] See, for example: Murphy, 1869; Lemoine, 1875; Lloyd Morgan, 1896.

nature and cognition, environment and organism, evolution and behavior. Charles Sanders Peirce conceptualized habits as emergent regularities in behavior, which develop through repeated interactions with the environment. In this framework, habits function as signs that organisms employ to navigate their surroundings, thereby facilitating semiosis—the process of sign production and interpretation (Nöth, 2010). This formulation underscores the semiotic nature of habits, suggesting that organisms' behavioral patterns are not merely mechanistic responses but are instead part of a dynamic sign process. Peirce's perspective integrates the development of habits into his broader semiotic theory, where habits reflect the organism's interpretative responses to its environment over time. This understanding is central to biosemiotics, as it links biological processes to semiotic theory by framing life itself as inherently sign-mediated. The adaptation of organisms also involves the selective assumption of those physico-chemical aspects of the organism-environment that are relevant for the persistence of the process. From a biosemiotic perspective, the conditional relations of logic, which Peirce identified with semiotics, reappear in organisms' forms and habits and their components embody this bio-logic.

Semiosis thus facilitates the development of an organism's ability to behave coherently with the environment and implicitly inferentially. "Logic," as used by biosemioticians (Kull et al., 2009: 170), is not something to be considered merely a product of abstract cognition in humans but rather a process that highlights the inferential architecture of biological function, which they believe to be the basis of semiosis in general. One of the aims is to shape a biosemiotic theory of evolution by analyzing how habits and semiotic abilities have evolved in multicellular organisms (Švorcová, 2024). This reinterprets the role of evolutionary theory from a semiotic perspective, showing how habits have enabled organisms to develop complex and adaptive behavior.

Jesper Hoffmeyer, a leading theorist in biosemiotics, has explored how habits influence semiosis, the process through which signs acquire meaning. In his work *Biosemiotics: An Examination into the Signs of Life and the Life of Signs*, Hoffmeyer argues that habits are crucial for understanding the semiotic dynamics that govern the life of organisms. His concept of "semiotic interaction" represents a fundamental aspect of biosemiotic thought.[5] This term describes the interaction between organisms through signs, extending beyond the traditional mechanistic approach to include semiotic and communicative dimensions. According to Hoffmeyer, every organism is engaged in a continuous network of semiotic exchanges with its environment, which are crucial for its survival, adaptation and evolution. These signs can be chemical, visual, acoustic, or of other natures, and are used to send and receive vital information.

> Semiotic interactions refer to interactions in which regularities (habits) developed by one species (or individual, tissue, cell) successively become, for sign-mediated interaction of organisms, used (interpreted) as signs by the individu-

[5] The "semiotic scaffolding" was also a revolutionary concept of Hoffmeyer's, which has much to do with the notion of habit in general terms.

> als of the same or another species, thereby eliciting new habits in this species, eventually to become – sooner or later – signs for other individuals, and so on in a branching and unending web integrating the ecosystems of the planet into a global semiosphere. (Hoffmeyer, 1998: 287)

Other scholars, such as Kalevi Kull, have explored the concept of the "semiosphere",[6] which includes habits as part of the semiotic interactions between organisms and their environment. Kull emphasized that habits not only correspond to the need to respond consistently to environmental cues, contributing to the survival and evolution of organisms, but also emerge as processes of choice, memory and learning, and are also the source of aesthetics in natural coordination and fitting (Kull, 2022). Recent studies have been continuing to develop these concepts, examining how subconscious habits (Alexander & Grimes, 2017) form through biosemiotic mechanisms and influence organismal behavior at the neural level (Favareau, 2010). The flexible semiotic actions dominating subconscious processes and preceding all conscious processes enable learning and the rapid formation of new semiotic habits. This aligns with biosemiotic theory, identifying how the arbitrariness of semiotic habit transitions creates flexibility that can lead to stability in some cases and adaptability in others.

> Biosemiotics, for the most part, understands such habit-taking in ways akin to contemporary dynamical systems theory. There, the establishment of higher-order regularities within a complex adaptive (and especially a *living*) system is often the *emergent* product of multiple interacting lower-order regularities, and the systemic resolution of their conflicting effects. Such higher-order regularities may then come to exert formative "downwards" effects upon the system, sustaining the system in ongoing loops of generative self-regulation and normativity. (Favareau & Kull, 2024: 41)

Biosemiotics uses the notion of habit to explore how agency and affective evaluations shape evolution (Švorcová et al., 2023). It challenges the traditional view of organisms as passive entities, emphasizing instead their active role in making choices that guide evolutionary processes, where habit is also a basis for motivations (Kull, 2018). Delafield-Butt (2021) uses the notion of habits to illustrate how these behavior patterns, developed through enacted choices, are fundamental to understanding the evolutionary dynamics of life forms, reinforcing the idea that organisms are proactive participants in their evolutionary journey. These interdisciplinary approaches demonstrate the importance of habits not just

[6] Juri Lotman appears to have introduced the concept of the *semiosphere* for the first time during the *8th Estonian Spring School in Theoretical Biology*, held in May 1982 (Kull, 2006). This concept, originally developed by Lotman (who drew inspiration from Vladimir I. Vernadsky's idea of the biosphere), has been widely applied in biosemiotics by scholars like Hoffmeyer (1998) (independently of Lotman), Deely (2001: 629) (with the term *signosphere*), Maran (2021) (*ecosemiosphere*), and others (Kotov & Kull, 2011). Their work demonstrates how effectively biosemiotics has adapted and utilized this idea across various contexts.

as repetitive behaviors but as meaningful processes emerging from the dynamic interaction between organisms and their environment (Emmeche & Kull, 2011).

While general semiotics deals with the study of signs and meanings in cultural and linguistic contexts, biosemiotics extends this field to natural processes. Charles Sanders Peirce conceives nature as a living organism that, from the stone to the human being, scales life in degrees measured by its capacity of spontaneity and habit changing (Ibri, 2014). In biosemiotics, these habits are seen as signs that organisms use to navigate their environment, facilitating semiosis, the production, and interpretation of signs. The use of the notion of "habit" in biosemiotics has practical and empirical applications in ecosystem management and conservation. Understanding how habits form and are maintained can help develop strategies for biodiversity conservation and sustainable resource management. Although biosemiotics uses main concepts that it has taken over from Peirce such as the triadic model of the sign, the broad concept of final cause, the understanding of habit and habit-taking, indeterminacy, mind and law of mind, and realism (Hoffmeyer, 2008), Peirce has been criticized for not drawing a clear distinction between habit and physical law (Kull, 2014, 2024). From a biosemiotic perspective, *habit* refers to patterns of regularity that emerge from repeated interactions, shaping the semiotic and biological processes that sustain life. *Habit-taking*, by contrast, captures the ability of living systems to form new adaptive patterns in response to environmental challenges, thus driving evolutionary innovation. These processes illustrate the intricate balance between continuity and change, underscoring the pivotal role of semiosis in mediating life's complexity.

The concept of habit in biosemiotics gains depth and coherence when connected to niche construction theory, which emphasizes how organisms actively reshape their environments, creating ecological niches that influence selective pressures over time; this interplay positions habits not merely as individual traits but as emergent semiotic configurations that operate within a multi-level system, integrating the organism's internal dynamics with the external ecological modifications they produce; as highlighted by Atã and Queiroz (2016), habits function as macro-level constraints within hierarchical systems, shaping the processes of semiosis while simultaneously being shaped by the evolving environments these organisms construct, providing a robust framework for understanding the co-evolution of semiotic and ecological systems.

Recently, ecosemiotics has expanded these concepts, integrating cultural and ecological dimensions to provide a holistic view of interactions between organisms and their environment (Maran & Kull, 2014), where the umwelt theory can be seen as the interaction between genetic memory and epigenetics, experience and habits (Maran, 2024; Švorcová et al., 2018). Fernández (2014) emphasizes that Peirce's concept of habits provides a framework for understanding how living organisms develop stable behaviors and adaptation strategies over time. This perspective integrates biological processes with semiotic ones, illustrating how habits bridge the gap between genetic information and environmental interaction. Habits in this perspective highlight the dynamic and evolutionary nature of life, where semiotic processes influence and are influenced by biological functions.

Jablonka (2021) points out how habits emerge through adaptive evolution, development, and learning, emphasizing the benefits of these habits for the agent developing them. Discussing the evolutionary steps leading to the formation of habits, offering a biosemiotic perspective on learning and consciousness. The evolution of nature, as Hoffmeyer and Emmeche (1991) pointed out, is driven by habit, i.e. the tendency to develop new rules through the continuous exchange of information and interactions.

The integration of biosemiotic theories and the notion of habits not only enhances our comprehension of biological processes but also enriches our perspective on the interconnectedness of all living systems. This reflective synthesis underscores the potential of biosemiotics to contribute meaningfully to both scientific knowledge and practical solutions in our ongoing quest to understand and sustain the intricate web of life.

Materials and Methodology

The Biosemiotic Glossary Project, featured in the journal *Biosemiotics*, seeks to clarify key biosemiotic concepts through collective scholarly contributions. Ten years after Tønnessen and the editors of *Biosemiotics* officially launched the project, our aim is to engage with the ongoing debate surrounding this initiative by revisiting the concept of habit—a term of significant historical and philosophical importance, particularly in relation to semiotics and the philosophical developments following the advent of evolutionary theory. Despite its marginalization in many 20th -century discussions, we argue that habit can provide valuable insights for biosemiotics, as demonstrated by our survey. The analysis of responses highlights both interest and theoretical disagreement surrounding this multifaceted concept.

This investigation also stems from a deep interest that arose from our experiences as visiting doctoral scholars at the Department of Semiotics at the University of Tartu, respectively during the academic years 2020-21 and 2023-24, which significantly enriched our doctoral research.[7] The idea for this project emerged from fruitful discussions with Professors Kalevi Kull and Timo Maran, to whom we extend our gratitude. The project took shape two years ago through the collaboration between the two authors, Simone Bernardi della Rosa and Nicola Zengiaro. We launched the survey via the Google Forms platform at the end of 2022, gathering

[7] The mention of the authors' visiting period in Tartu serves two key purposes: first, to illustrate the increasing openness of Italian semiotics towards biosemiotics, as evidenced by Italian researchers actively forging connections with the Tartu school and integrating the influences of their academic experiences into the Italian context (see Zengiaro, 2024a). Second, it underscores the evolution of this project, which began in 2015 with the aim of developing a biosemiotic glossary. After nearly a decade, this initiative has become inseparable from the lived experiences of its expanding community. The project's growth is grounded in the contributions and interactions of its members, reflecting the serendipitous nature of collaborative academic endeavors, where researchers from diverse fields meet and collectively build a shared encyclopedia.

responses from over 20 scholars worldwide, particularly those in the fields of our affiliated disciplines, semiotics, biosemiotics and philosophy.

This work aims to examine the convergences and divergences found in the participants' responses, highlighting key points of contact and potential implications for future research. Data were collected through 2 parts: the first one consisting of 5 "open-ended questions" posed to experts in the fields. The responses were analyzed using a qualitative approach to identify recurring themes, points of convergence and differences in perspective. In the second part, the section "Responses regarding the relative suitability of different understandings of the concept in the literature" evaluates the different interpretations of habit discussed in the literature. The structure is to offer the authors quotes to know from 1 to 10 how much they agree and then briefly justify their evaluation with comments. At the end of the two sections in which we describe, analyze, and discuss the results of the survey, the final section discusses the main theoretical conclusions emerging from this project and suggests directions for future research within the biosemiotic field.

Results and Analysis of the Survey

Part 1

Responses to the Open-Ended Questions

The first question involved a loose definition. The outline was as follows: **How would you define the term 'habit' from a semiotic and biosemiotic perspective?**

This question was designed to analyze different perspectives on the notion of habit from both semiotic and biosemiotic perspectives, based on the responses of sixteen participants. Through a comparative analysis, the responses explore how the actions of an organism or semiotic agent can construct learning habits. There is a clear convergence in identifying habit as an evolutionary adaptation or learning process leading to the repetition of established behaviors. Additionally, habit is interpreted as a crystallization of established sign relations or the repetition of established communicative patterns. Different authors agree that habit implies a tendency to respond automatically, based on internal or external signs. While habit involves repetition and routine, it is seen as a dynamic process open to change over time.

In order to make one understand the differences in some of the answers, below are a few quotes: "habit is based on learning", "is a repetition of established sign relations", "the crystallization of seemingly random and/or unique feature of nature", "habit as a disposition to act", "a goal-directed action of an organism", "a tendency to respond", "pattern of activity of an agent in response to a sign", "a routinization of a behavior", "an ultimate final interpretant". Divergences within the responses reveal a division between participants emphasizing the biological origins of habit and those focusing on cultural and symbolic dimensions. There is also a divergence regarding the level of organization related to the emergence of habit. Interpretations vary widely concerning the levels of organization at which habit manifests, from

intracellular to behavioral. Finally, while some prefer a broader definition of habit, others focus on its specific semiotic or biosemiotic implications.

The second question aimed to explore the intersection of evolutionary theory and semiotics in understanding the concept of habit. Specifically, it asked participants: "**How do you see the relation between habits from the evolutionary perspective (i.e., as a concept at the core of many biological and philosophical issues since the early debates on evolution) and at the very roots of semiotics (especially in the work of C. S. Peirce)?**" This question sought to understand the relationship between habit as an evolutionary concept emerging from late 19th-century cosmological and biological debates, notably the differing but equally influential proposals of Darwin and Lamarck, and habit as a fundamental concept in semiotics. Many respondents agreed that Peirce's structuring of the concept complicates the picture, as the semiotic perspective develops its unique path. In fact, the relationship between habits from an evolutionary perspective and their roots in semiotics, especially in C.S. Peirce's work, is multifaceted, bridging biological and philosophical realms. According to some respondents, Peirce was influenced by Lamarckian ideas (also neo-lamarckian theorists of organic memory had certain influence), and he thus challenges the traditional divide between inherited instincts and learned habits, suggesting habits as adaptive processes applicable across organic matter. In biosemiotics, habits are seen as communicational patterns for understanding societal and evolutionary dynamics, encompassing both genetic heritage and socialization. While some scholars find alignment between evolutionary and semiotic perspectives on habit, others critique Peirce's "idealistic" notions, particularly concerning the normativity of physical laws. Therefore, despite shared conceptual roots, biosemiotics has developed partly independently from Peirce's ideas. In particular, a key question we want to explore through our survey is whether there is convergence or divergence between the evolutionary and semiotic aspects of the concept of habit, since these are the two aspects at the roots of biosemiotics. Some scholars present a continuous and interrelated view, suggesting no distinction between the two aspects. For Peirce, habit as an evolutionary and semiotic concept are inseparable, as his doctrine of signs and cosmology are closely intertwined. He proposes that habits evolve, and the development of symbols indicates changes in underlying habits. This process reflects how beliefs can shift, with new habits replacing old ones through the natural selection of hypotheses, illustrating evolution as integral to habituation. In addition to the continuous view, the survey responses also revealed a discontinuous perspective on the concept of habit. Some participants drew a distinction between Lamarckian and Darwinian evolutionary theories, highlighting that emphasizing the role of habit in biological and semiotic framework, often involves critical stance towards Darwin's evolutionism. Furthermore, the discussion included a focus on the transmissibility of habits within the framework of biosemiotics. Participants questioned how and which habits are passed down through generations, emphasizing both cultural and biological transmission. One respondent pointed out that biosemiotics should explore the socialization of habits across generations, recognizing that habits, even in animals, can be conceived as semiotic behaviors transmitted from one generation to the next. The debate also touched on whether habits can spread in inorganic nature, with at least three responses emphasizing the distinction between habits and

natural laws. It also underscored the importance of distinguishing between narrow and broad conceptions of habit, recognizing that habits can be analyzed at multiple levels. This differentiation suggests a clear distinction between biological and semiotic approaches. Biologically, habits are seen as adaptive processes emerging through evolution, development, and learning, contrasting with static structures (*habitus*). In semiotics, however, habits are viewed as sign processes (semiosis) involving interpretation, production, and manipulation of signs. This semiotic perspective emphasizes the centrality of evolution even in the cultural transmission of habits, acknowledging that habits in animals also involve semiotic behaviors.

In the third question we aimed at understanding what the introduction of a semiotic perspective, particularly influenced by Charles Sanders Peirce, offers in the history of the notion of habit: "**Since the idea of habit has been present since the dawn of Western thought**, **from Aristotle onwards**, **what do you think the semiotic-oriented notion may have added to the previous interpretation by the philosophical tradition?**" According to most of the answers, the discourse surrounding the concept of habit, from its Aristotelian roots through various Western philosophical traditions, has evolved significantly with the incorporation of semiotic perspectives, particularly within biosemiotics. One notable contribution of biosemiotics is its broadening of the traditional understanding of habit, extending beyond individual upbringing to include environmental and social influences. This expansion challenges deterministic views by introducing flexibility into the process of habit formation, aligning with certain Eastern philosophical traditions, such as Confucianism and Taoism, which emphasize intuitive responses refined through practice. Peirce's semiotic framework offers a unique perspective on habit, proposing a metaphysical unity where habits are generalized as psychic processes, extending even to the laws of nature. This viewpoint implies a deep connection between the investigator's mind and a universal mind, suggesting the potential for accurately representing natural phenomena. However, some scholars argue that the term 'habit' may be redundant within semiotic theory, suggesting more specific terms like 'semiotic process' or 'interpretation' could be more appropriate. Nonetheless, 'habit' retains value within biosemiotics due to its broad applicability across all organisms. The complexity of habit formation is acknowledged, suggesting that the concept may not function as a straightforward explanatory tool but rather as a lens for examining the interplay of various elements. Peirce's logical semiotics provides insights into how rational inquiry influences adaptive habit formation, presenting a mechanism for understanding this process. Overall, the integration of semiotics into the study of habit enriches the understanding by incorporating environmental, social, and meaning-making dimensions, while also raising questions about terminology and the intrinsic nature of habit itself. Additionally, there is an emphasis on the intrinsic potentiality within the regularity of perceptual systems, suggesting a deeper layer to habitual processes. The importance of signs becoming habitual is highlighted, underscoring the role of semiosis in shaping habitual behaviors. Furthermore, the concept of a meta-habit, as contributed by semiotics, may indicate a higher-order understanding or reflection on habitual processes. In conclusion, according to participants' answers, we can argue that the integration of semiotic perspectives has significantly broadened the traditional understanding of habit beyond moral upbringing to include environmental and

social factors, emphasizing flexibility while breaking from rigid, mechanical interpretations of the concept. Peirce's framework suggests a metaphysical connection between the human mind and a universal mind, viewing habits as part of a cosmic process. This approach underlines the universality of habit across all life forms, moving away from anthropocentric views. Additionally, it highlights the interaction between habit, consciousness, and rationality, focusing on the meaningful processes of sign interpretation and habit formation.

In the fourth question, we asked the authors to give us a precise indication of the current debate on habit, trying to orientate our gaze in both general semiotics and biosemiotics. The question is as follows: **How would you evaluate the current debate on habits in a semiotic and biosemiotic perspective in the light of the most recent discoveries in evolutionary biology and epigenetics? What do you think could be the most interesting outcomes?**

Fourteen authors provided a variety of opinions and approaches on the semiotic and biosemiotic debate concerning new discoveries in evolutionary biology and epigenetics related to habits. Some emphasized the central role of habits in biosemiotics, viewing them as key elements to analyze rather than attributing these phenomena to evolutionary randomness. They highlighted that habits are not limited to humans and animals but can be found in all organisms, including organs, cells, and proteins, reflecting a systemic and complex view in contemporary science. Moreover, it was suggested that habits are not always conscious and reflective but can be supported by various levels of memory systems. These levels accumulate over time, forming behavioral patterns that are not coordinated at an intentional level, extending this phenomenon to all organic life. Half of the authors stressed the link between habits and evolution, suggesting that habits are similar to genetic traits but more flexible. They noted that habits are a natural phenomenon shaped by evolution in the organism-environment relationship. New discoveries in epigenetics blur the lines between habits and genetics, indicating that habits can influence gene expression and thus evolution. One respondent highlighted that environmental factors affecting gene expression can be seen as signs in a semiotic framework, suggesting a reciprocal relationship where biological processes and semiotic interpretations are deeply interconnected.

In these answers, habits can be viewed as driving forces in evolutionary change, shaping the directions that evolutionary processes take. Some scholars argue that the concept of habit should be incorporated into scientific discussions on evolution, integrating biosemiotic insights to unlock new perspectives and discoveries. The existing debates provide a comprehensive overview of how habits are understood within semiotics and biosemiotics, highlighting their critical role in biological and evolutionary contexts. This suggests that further exploration of habits may offer valuable insights for future research on ecological and evolutionary dynamics.

In the last section of the first part, the authors were asked to provide a quote or comment from contemporary debates that could offer a fresh perspective on the concept of habit. The question was: **If you wish**, **please provide a quote (or a comment) from contemporary debate's topics**, **either your own or another authors**, **that you feel adds a new or particular perspective on the concept of habit in literature**, **as emerged from the above responses. For instance**, **about the growing**

debate concerning the possibility of non-human animals contracting habits, which is still regarded as one of the main distinctions with human beings, or the renewed discussion, after the discoveries of epigenetics, about the inheritance of habits (which Peirce and other pragmatists were convinced of).

The authors provided 12 responses sourced from various notable figures in semiotics, pragmatism and biosemiotics, including Charles S. Peirce, Thomas A. Sebeok, Kalevi Kull, John Dewey, Marcel Danesi, Terrence Deacon, and John Deely. Other contributors came from fields like biosemiotics, evolutionary psychology, and anthropology, such as Yogi Hendlin, Sigmund Ongstad, Jana Švorcová, Anton Markoš, Michael Tomasello, and Phillip Guddemi.

One notable quote from Deely (1992) discusses Peircean semiotics and emphasizes habits' relationship with the scientific laws of the universe. Peirce suggested that nature's habits are founded on semiotic principles that establish conditions for semiosis. This stands apart from other quotes, which typically focus on biological contexts. The accompanying comment points out that the universe itself is not a semiotic agent and cannot develop habits. It highlights our limited understanding of the universe and the impossibility of experimenting with it as a whole. Critically, it argues against Deely's view, noting there is no evidence the universe creates other universes, likening Deely's argument to the anthropic principle, which does not prove the universe acts adaptively.

Part Two

Responses Regarding the Relative Suitability of Different Understandings of the Concept in the Literature

As mentioned earlier, this session presented quotes for the authors to either agree (rating 10) or disagree (rating 1). The authors shared their perspectives with reported comments on classical and new ideas related to "habit" in the fields of semiotics, philosophy and biosemiotics. Their responses reveal how they engaged with these foundational concepts, reflecting agreement or disagreement based on their understanding of how habit functions in cultural and biological contexts. The 1-to-10 scale was selected for its simplicity and versatility, allowing participants to express nuanced preferences or evaluations. Even with a smaller sample, the scale provides a finer granularity than binary or categorical scales, which can help identify trends and variances in responses. In analyzing the responses, we considered scores above 6 as indicating a positive alignment with the quote, as previously indicated to the respondents in the survey we had sent to them. Additionally, the use of this scale is consistent with previous studies on other entries in the *Glossary of Biosemiotics*, ensuring consistency and facilitating comparability across different contributions to the project.

"The most plastic of all things is the human mind, and next after that comes the organic world, the world of protoplasm. Now the generalizing tendency is the great law of mind, the law of association, the law of habit taking.

We also find in all active protoplasm a tendency to take habits. Hence I was led to the hypothesis that the laws of the universe have been formed under a universal tendency of all things toward generalization and habit-taking". (Peirce, C.S., *Cambridge Lectures* - "Habit" [1898], C.P. 7.515)

"I will begin the work with this guess. Uniformities in the modes of action of things have come about by their taking habits. At present, the course of events is approximately determined by law. In the past that approximation was less perfect; in the future it will be more perfect. […] Moreover, all things have a tendency to take habits. For atoms and their parts, molecules and groups of molecules, and in short every conceivable real object, there is a greater probability of acting as on a former like occasion than otherwise. This tendency itself constitutes a regularity, and is continually on the increase. […] We have therefore only to suppose the smallest spur of it in the past, and that germ would have been bound to develope into a mighty and over-ruling principle, until it supersedes itself by strengthening habits into absolute laws regulating the action of all things in every respect in the indefinite future. According to this, three elements are active in the world, first, chance; second, law; and third, habit-taking. Such is our guess at the secret of the sphynx". (Peirce, C. S. 2000 "A guess at the riddle" [1887-88], W6: 208,)

The responses to the two quotes by C.S. Peirce reveal a divided opinion among participants regarding their alignment with biosemiotic perspectives. Half of the respondents rated Quote 1 above 6, with 40% of these giving it a score above 8. However, the other half rated it below 6, suggesting some disagreement or uncertainty about the concept's relevance or application within biosemiotics. This division is similarly reflected in the responses to the related Question 1.1, where 52% rated the relevance above 6, including three responses with the highest rating, while 48% rated it below 6.

The comments reveal a range of perspectives on Peirce's ideas. One view questions Peirce's characterization of "law," suggesting that his use of the term aligns more with human-developed mathematical models than with inherent universal regularities. This skepticism challenges the notion that regularities naturally increase over time, critiquing Peirce's failure to clearly distinguish between physical laws and acquired habits. Some scholars argue that labeling natural phenomena as "laws" can be misleading, proposing alternative terms like regularities or control, highlighting the importance of precise terminology in biosemiotic discourse. Additionally, there is skepticism towards the metaphysical or transcendental arguments in Peirce's quotes, cautioning against accepting such premises without empirical support. This reflects a desire for an evidence-based foundation within the biosemiotic paradigm. Despite the criticisms, some recognize Peirce's dynamic view of habit, acknowledging its partial alignment with a semiotic perspective. While Peirce's notion of law may seem overly strong, his acknowledgment of the role of "chance" and the process of "habit-taking" resonates with the biosemiotic understanding of dynamic processes in living organisms and other

semiotic agents. However, there are divergences regarding the extension of habit beyond living organisms. Some restrict the notion of habit to living organisms and other semiotic agents, while others remain hesitant, questioning whether habits can extend to the inorganic realm. This divergence reflects differing interpretations of habit within the same biosemiotic different theories.

"If we now revert to the psychological assumption originally made, we shall see that it is already largely eliminated by the consideration that habit is by no means exclusively a mental fact. Empirically, we find that some plants take habits. The stream of water that wears a bed for itself is forming a habit. Every ditcher so thinks of it. Turning to the rational side of the question, the excellent current definition of habit, due, I suppose, to some physiologist says not one word about the mind. Why should it, when habits in themselves are entirely unconscious, though feelings may be symptoms of them, and when consciousness alone, —i.e., feeling, —is the only distinctive attribute of mind?". (Peirce, C. S., 1998 "Pragmatism" [1907], EP2: 418)

The responses to the quote reveal a majority agreement with Peirce's view, with 67% of participants rating the alignment above 6, including 20% who gave it the highest rating. However, a notable minority of 33% rated it below 6, indicating some disagreement or reservations. This mixed response highlights differing perspectives on the concept of habit being extended beyond mental phenomena to include unconscious processes in nature, as suggested by Peirce. The higher ratings reflect an appreciation for this broader, non-anthropocentric view, while the lower ratings suggest some skepticism or discomfort with this expansive definition.

Some comments challenge Peirce's perspective, suggesting that habit equates to reproducibility, questioning the necessity of semiotics in understanding deterministic processes. This view raises questions about the distinction of habit from other phenomena like sign relations and the role of semiotics in clarifying deterministic processes. Other commentators find Peirce's characterization too abstract, questioning its suitability as a definition of habit. This criticism implies that Peirce's conceptualization may be too enigmatic to serve as a practical framework for understanding habit formation and behavior. There is also an emphasis on the non-mental aspects of habit formation, suggesting that habits often arise from experience, history, or trauma rather than conscious choice. This perspective underscores the role of unconscious processes in shaping behavior, indicating that habit formation is not always a deliberate or voluntary process. Regarding the applicability of habit to non-human entities like plants, some participants question whether phenomena lacking purpose can truly be considered habits. This raises broader questions about the nature of habit and its relation to intentional or "goal-oriented" behavior in both human and non-human organisms.

"Man is born with a tendency to do more things than he has ready-made arrangements for in his nerve-centers. Most of the performances of other animals are automatic. […] The great thing, then, in all education, is to make our nervous system our ally instead of our enemy. […] For this we must make

automatic and habitual, as early as possible, as many useful actions as we can, and guard against the growing into ways that are likely to be disadvantageous to us, as we should guard against the plague. The more of the details of our daily life we can hand over to the effortless custody of automatism, the more our higher powers of mind will be set free for their own proper work. There is no more miserable human being than one in whom nothing is habitual but indecision, and for whom the lighting of every cigar, the drinking of every cup, the time of rising and going to bed every day, and the beginning of every bit of work, are subjects of express volitional deliberation. Full half the time of such a man goes to the deciding, or regretting, of matters which ought to be so ingrained in him as practically not to exist for his consciousness at all". (James, 1890, *Principle of Psychology*: 75)

The responses to William James' quote reflect a stronger alignment with biosemiotic perspectives, with 74% of participants rating it above 6. Of these, 60% gave it a score of 8 or higher. However, there remains a minority (25%) that rated the alignment below 6. The comments on William James' quote reflect a range of perspectives. Some participants appreciated James' practical approach to habit formation, noting its positive and necessary aspects, particularly in freeing cognitive resources for more complex tasks. However, concerns were raised about the term "automatism," suggesting it might lead to a Cartesian view of animals as mere automata, which could misrepresent how instincts and habits function in both human and non-human animals. There was also a recognition of the potential benefits of automating stable aspects of life, allowing consciousness to focus on irregular or complex issues. Some responses emphasized the need to balance habitual actions with mindfulness, to avoid the dangers of excessive automation. Additionally, one commenter highlighted the flexibility of habits, challenging the notion that they are purely mechanical or inflexible. However, as one of the participants suggested, William James' advice to hand over the details of life to the "effortless custody" of habit was generally seen as sound, particularly in managing the stable details of life, which "frees consciousness to deal with those aspects that are not regular enough to be relegated to the background."

"We must suppose the continuity of life and sameness between living beings, whether plants or animals, and their descendants, to be far closer than we have hitherto believed, so that the experience of one person is not enjoyed by his successor, so much as that the successor is bona fide but a part of the life of his progenitor, imbued with all his memories, profiting by all his experiences –which are, in fact, his own – and only unconscious of the extent of his own memories and experiences owing to their vastness and already infinite repetitions". (Butler, S. (1878), *Life and Habit*: 50)

With a 50% rating at 7 or above, there is a clear agreement among some participants on the continuity and collective aspect of experiences proposed by Butler. However, the remaining responses, ranging from 3 to 6, suggest a divided opinion

or skepticism about the concept. This suggests a debate on whether the concept fully aligns with a biosemiotic perspective or if it leans too heavily on metaphysical or idealistic notions not entirely accepted in contemporary biosemiotic discourse. Some commentators view this perspective as reflecting a semiotic line of thought, though it is considered somewhat exaggerated by others. The notion is also recognized as aligning with common sense. However, another viewpoint compares this vision to Lamarckism, suggesting that while modern science acknowledges some incorporation of learned experience into DNA through epigenetics, it does not fully support the idea of inheriting memories as Butler proposes. This viewpoint highlights cultural beliefs resembling this idea but notes the lack of scientific consensus (e.g., Jung's collective unconscious). Additionally, Butler's influence as a theorist of organic memory is acknowledged, but there is hesitation regarding his attribution of "feelings" to cells, possibly stemming from his panpsychist tendencies, complicating the full acceptance of his views.

"**But important as is this difference for many purposes it should not conceal the fact that habits are like functions in many respects, and especially in requiring the cooperation of organism and environment. […] Habits are ways of using and incorporating the environment in which the latter has its say as surely as the former**". (Dewey, 1922, *Human Nature and Conduct*: 15)

The high ratings, with 86.7% of participants scoring between 8 and 10, indicate strong agreement on the functional expression of habits, especially concerning the cooperation of organisms within their environment. This homogeneity in responses suggests a shared understanding of habits as key functional elements within biosemiotic and ecosemiotic frameworks. One participant highlighted the close resemblance between John Dewey's notion of habit and Jakob von Uexküll's Umwelt, emphasizing the functional regularity of an organism in sustaining itself within a specific environment.

Even though only 26% of the authors interviewed provided answers, this highlights the strong consensus among them, showing the importance of considering habit as a crucial aspect of an organism's adaptation strategies. This perspective aligns with the contemporary view in biosemiotics that habits are not merely behavioral repetitions but are dynamic processes that emerge from the interactions between organisms and their environments.

Adaptation, therefore, is seen as a manifestation of these regularities, illustrating how habits play a critical role in the organism-environment relationship. This understanding reinforces the idea that habits contribute significantly to the functional and cooperative dynamics of organisms, supporting their survival and evolutionary success.

"Habit has its abode neither in thought nor in the objective body, but in the body as mediator of a world […] The acquisition of a habit is indeed the grasping of a significance, but it is the motor grasping of a motor significance". (Merleau-Ponty, 2012 [1962], *Phenomenology of Perception*: 165 – 67)

Approximately 80% of participants rated the quote above 6, with 60% of these giving 8 or higher, indicating a strong alignment with the idea within the biosemiotic framework, which values the interplay between physical embodiment and semiotic processes. However, the remaining 20% rated the alignment lower than 6, suggesting some divergence in opinion or possible reservations about the exclusive focus on the motor aspects of habit, which may not fully capture the complexity of semiotic processes. The comments reflect a general acknowledgment of the significance of Merleau-Ponty's emphasis on the body as a mediator of the world and his portrayal of habit formation as a motor understanding of meaning. Some responses suggest that while the quote is acceptable, similar concepts like "life-world" and "habitus" may serve analogous roles in understanding the relationship between habit and the body's mediation in the world. Additionally, it is highlighted the relevance of the quote in the context of habituation and sensitization, noting that it captures the motor aspect of habit formation but also points out that habit formation involves various semiotic processes beyond motor understanding. A critical perspective is also raised, suggesting that Merleau-Ponty's dichotomy between mind and body might be overly Cartesian, implying that Peirce's approach, which connects belief to habit without strictly confining it to bodily processes, could offer a more nuanced perspective.

"Habits are basic and foundational aspects of our mental lives. Without habit, there is no calculation, no speech, no thought, no recognition, no game playing. Only a creature with habits like ours could have anything like a mind like ours. But habits, at least many of them, are situational or environmental. A habit is like a trail laid down by our own repetitive action. A habit is not merely a disposition to act or an automatic or unthinking tendency; it is a responsiveness to the environment in which we find our selves. If the trail is paved over or if familiar landmarks are removed, our habits can frequently be extinguished. In the previous chapter we discussed the way in which skillful use of tools and technology (including language) enables us to transform not only what we can do but also our own sense of ourselves. Likewise, to remove those external tools and structures would be to eliminate the mastery on which our manner of activity depends". (Noë, 2009, *Out of Our Heads: Why You Are Not Your Brain, and Other Lessons from the Biology of Consciousness*: 125)

The responses to Alva Noë's quote demonstrate a strong agreement among participants, more than any other, with 87% rating the quote above sufficiency, including a significant portion of them giving it a score of 8 or higher. This suggests a general consensus on the idea that habits are closely tied to environmental and situational contexts. The high approval rating may reflect an alignment between biosemiotics scholars with more contemporary philosophical perspectives like Noë's, which emphasizing the role of external tools and structures in shaping not only our actions but also our self-conception.

The comments reflect an appreciation for the resonance between Noë's statement and Charles Peirce's idea (and Aristotelian) that "knowledge is habit", highlighting

the alignment between Noë's conceptualization of habit and Peirce's philosophical framework. The challenge of conceptualizing habit within a theoretical framework is acknowledged, noting the tension between treating habit as a concrete object or as an integral concept in semiotic theory. Despite this challenge, the situational or environmental aspects of habit are recognized, aligning with Noë's emphasis on habits as responses to the surrounding environment.

Another response appreciates the metaphor of habit as a "trail laid down by our own repetitive action," noting its compatibility with Peirce's idea of habit-taking. However, there is a question about whether the concept of environmental reactivity, applicable to organisms, extends to entities like atoms. The emphasis on the environment is contextualized within the broader philosophical discourse, allowing to draw parallels with thinkers like Dewey, Merleau-Ponty, Aristotle, Schelling, and Lamarck. From a biosemiotic perspective, these comments underline Noë's recognition of habits as dynamic responses to environmental stimuli.

"**The idea of nature's tendency to take habits however is central to biosemiotics. As Peirce himself observed**, **a habit is the most general form of an interpretant**, **since the formation of a habit implies that an event will (nearly) always provoke the same response**, **so that therefore the response is not just accidental but must be related to the event. Habit formation thus is the core of semiosis (sign-process). Biosemiotics holds**, **that semiosis is a fundamental aspect of our universe**, **a principle which however only manifests itself in its genuine triadic form through the birth of life**". (Hoffmeyer, 2006, "Genes, Development, and Semiosis": 158)

The responses reveal a significant level of agreement with Hoffmeyer's definition, with 80% judging it to be completely accurate (scoring from 8 to 10) and the remaining 20% expressing more than satisfactory approval. This consensus highlights the relevance and acceptance of Hoffmeyer's conceptualization within the biosemiotic discourse.

Among the comments, one stands out by critically assessing the suitability of the term "habits." This comment argues that, although well-argued, "habits" may not be the most fitting term. The critique points to the historical context, indicating that the biosemiotic community has "revered" the notion of habit since Peirce. The commenter suggests that biosemiotics would benefit from a meso-concept that could effectively replace the frequently used notion of habit.

The reasoning provided is that the term habit tends to privilege the individual and the body, whereas genres are shared not by providing the same habit to different participants, but by assigning roles. The commenter highlights that their position on the citation is that the habit of animals, for example, creates "life-genres" and vice versa, through the process of semiosis. This perspective suggests that habits and life-genres are co-constructed through semiotic interactions, reflecting a dynamic interplay between behavior and environmental context. This insight calls for a nuanced understanding of habits within biosemiotics, advocating for conceptual evolution to better capture the complexity of semiotic processes.

"**Von Uexküll viewed organisms as subjects competent to interpret their sensorial inputs and choose appropriate actions. Meaningful activities (habits) are thus organized via choice-dependent regulatory feedback that connect sensors and effectors into a closed functional circle**". (Sharov & Tønnessen (2021), *Semiotic Agency. Science beyond Mechanism*: 48).

In the evaluation of this citation, the second most recent as a publication, there was a strong consensus, with 92.4% agreeing wholeheartedly. A particularly noteworthy response highlights the distinction between "habitual activities" and "habits," in relation to the terms "semiotic" and "communicational." This comment suggests that statements can act as triggers for habitual reactions. Additionally, another commentator agrees completely with the explanation of how organismic habits function or are feasible. This second comment supports the notion that the citation accurately describes the internal mechanisms of organisms, particularly how habits incorporate regulatory feedback loops.

However, within the same commentary, the author raises questions about the use of the functional circle concept, expressing doubts about its closure. These concerns are rooted in the desire to emphasize the organism's free reactivity within a specific environment. The commentator appears to argue that while habits may involve regulatory feedback, the concept of a closed functional circle might not adequately capture the dynamic and responsive nature of organism-environment interactions. This highlights an ongoing debate within biosemiotics about the balance between structured mechanisms and the inherent flexibility and adaptability of living organisms.

"**Habit is a regular pattern of behaviour. It is more or less automatic**, **while not absolutely automatic**, **as different from many completely mechanical processes in an organism's body. For example**, **each step an animal makes when walking is very similar to its steps made earlier. However**, **there is still some narrow room for free choice to make the next step differently. Thus**, **habit is the semiosis that repeats in almost the same way**, **since the choice it makes is heavily biased**". (Kull, 2022. "The Biosemiotic Fundamentals of Aesthetics: Beauty is the Perfect Semiotic Fitting": 10)

The most recent citation included in the questionnaire appears to have garnered significant approval, with 86% of respondents rating it with full marks. This high level of agreement suggests that the citation provides a clear and effective explanation of the concept of habit in biosemiotics framework. The accompanying comments reflect a consensus, affirming the insights from Kull's, 2022 article on the regularity of behavioral patterns.

The notion of automatism in habits, as highlighted in the citation, is core to contemporary biosemiotics. Respondents acknowledged that the citation accurately captures the essence of habit as a regular and automatic behavioral response. This emphasis on automatism underscores the importance of understanding habits as fundamental components of organismal behavior, integral to the study of biosemiotics.

Moreover, the alignment of the comments with Kull's article indicates a broader acceptance and validation of his perspective within the biosemiotic community. This convergence of views not only strengthens the theoretical framework surrounding habits but also highlights the ongoing relevance of Kull's contributions to the field. The concept of habit, particularly its automatic and regular nature, remains a key area of focus in understanding the semiotic processes that underpin organismal interactions and adaptations.

Discussions/Conclusion

Throughout our analysis, we have observed that, while biosemiotics often presents the notion of habit as a key element of semiosis and meaning-making in evolution (Lacková, 2021), there is still much to debate. This diversity is reflected in the various theoretical perspectives offered by different scholars, which sometimes diverge from Peircean approaches and occasionally present challenges to integrating these views coherently within both general semiotics and biosemiotics. Specifically, Peirce's broader conception of habits—extending beyond biology to encompass universal laws—has not been fully embraced as a semiotic framework within biosemiotics. This raises two critical points: first, biosemiotics may need to clarify whether Peirce's semiotic theory is indeed the appropriate methodology to apply; second, it is important to differentiate and harmonize the terminologies between biosemiotics, general semiotics, and cultural semiotics.

The study highlights the different interpretations and applications of habit in biosemiotics. Interpreted scholars emphasize the dual role of habit as a mechanism of stability, which forms regular behavioral patterns, and of adaptability, which allows organisms to adapt through habit-taking. These findings are in line with Peircean semiotics and suggest further exploration of the evolutionary and ecological dimensions of habit.

Habit seems to serve as a bridge between biological processes and semiotic theory, providing a valuable perspective on the interactions between organisms and environment. Although the application of these ideas to broader ecological and social challenges remains speculative, the results provide a basis for future directions. Grounding the concept of habit in empirical and theoretical discussions strengthens the potential of biosemiotics in addressing issues such as ecosystem resilience and adaptation in changing environments. This study highlights the unifying potential of habit within biosemiotics, balancing diverse perspectives with fundamental theoretical insights. Future research should deepen this understanding by linking theoretical advances on habit with practical applications in biology, ecology, and beyond.

This highlights a need for further refinement in understanding how biosemiotics positions itself within the broader field of semiotic theories and how it should address the methodological divergences and terminological nuances that arise. Regarding the first point, the assumption that Peircean semiotics is a necessary foundation for biosemiotics—taken for granted since Sebeok identified Jakob von Uexküll and Charles Peirce as the founding fathers of modern biosemiotics—has

already been challenged by other authors (Jappy, 2023; Olteanu & Campbell, 2023). What emerges on the horizon is an effort to employ multiple semiotic models and theories to advance the biosemiotic discourse (Barreto et al., 2022). However, this approach raises further issues that, while beyond the scope of this discussion, the biosemiotic community will need to address: What semiotic methodologies should biosemiotics employ? What is its primary object of analysis, and which approach proves most fruitful for engaging with it? How can the community reconcile the application of diverse semiotic frameworks to living systems under a unified discourse?

In clarifying its positions, as we have attempted to initiate in this paper, an investigation into the threshold of habit in nature is needed. The central question is whether habit in nature is a pervasive regulatory phenomenon that guides and coordinates environmental relationships, or if it operates within individual organic elements that collectively form habits for coordination. This subtle distinction has significant implications: if habit is considered a pervasive phenomenon in nature, we align with Peirce's view, arguing that habit is tied to the concept of nature as a whole, rather than just biology. On the other hand, if we assert that only living beings are subject to habit, then habits function as individual constraints that, on a larger ecological scale, allow coordination only among individual habits. In Peirce continuity these views are not problematic, but out of his framework they need a strong theoretical claim.

This exploration is important because it influences how we understand the role of habit in both biological and ecological systems. It also determines whether we interpret habit as a universal principle of nature, consistent with Peircean metaphysics, or as a more localized, biological phenomenon limited to living organisms. These differing perspectives could reshape how biosemiotics positions itself within broader debates about life, semiosis, and environmental interactions.

Scholars like Deely, Nöth, Salthe, and Santaella had already initiated a biosemiotic approach to habits in nature, viewing them in broader terms that go beyond mere biological processes.[8] However, as demonstrated in this article, the contemporary concept of habit in biosemiotics is not confined solely to the Peircean viewfrom which partially diverges; it may encompasses a rich history shaped by various thinkers across different fields, as we showed quoting various philosophers which dealt extensively with habits and nature. This broader lineage offers perspectives that align with but also expand upon Peirce's ideas. This initial contribution points towards the need for continued inquiry into these multifaceted interpretations to further refine the concept of habit within biosemiotics. By revisiting and expanding these earlier perspectives, we aim to open new avenues for understanding habits as potentially pervasive phenomena in nature, influencing both biological organisms and environmental relations in a more comprehensive, semiotic framework. This

[8] Sharov (2024) has recently expanded on this theme by adopting an approach aligned with John Deely's theory of virtual semiosis, while Zengiaro (2022) has applied a methodology grounded in Giorgio Prodi's correspondence theory.

rethinking is needed for further advancing the theoretical and methodological discussions in biosemiotics.

As an example, the topic of habits in nature and society, from a biosemiotic and ecosemiotic perspective, has regained significant importance in the analysis of climate change (Zengiaro, 2024b). Addressing such a complex issue requires transdisciplinary approaches, as traditional methods struggle to account for the intricate relationships between organisms, their environments, and social-political systems. In this context, it's crucial to rethink our relationship with nature through the lens of habits, particularly considering that rapid environmental changes may prevent the stabilization of these habits.

The study of social and environmental habits offers valuable insights into how we can better manage environmental crises, biodiversity loss, soil depletion, and other ecological challenges. Moreover, it sheds light on the social, discursive, and interpretive dimensions of individual and collective behavior in the present. Biosemiotics, by rethinking the role of habits, positions itself as a discipline capable of filling the gaps in our understanding of complex environmental phenomena. This perspective is significant not only for environmental management but also for fostering a deeper comprehension of the interplay between biological, social, and ecological systems, which is fundamental for addressing the climate crisis.

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