BIO-EXPERIENTIAL INVESTIGATION:

IMPLICATIONS OF ENVIRONMENTAL CHANGE FOR HUMANS AND NATURE

IN LIGHT OF THEIR INTERCONNECTEDNESS

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A Thesis submitted to the School of Graduate Studies in partial fulfilment of requirements for the degree of

Doctor of Philosophy

Interdisciplinary

Philosophy, Environmental Humanities, Environmental Science

Memorial University of Newfoundland and Labrador

Mai 2024

St. John's, Newfoundland

Canada

Dedication

To autonomous and exploratory thinking,
in correspondence with an embodied human-nature relationship.

Acknowledgement

I would like to thank Memorial University of Newfoundland and Labrador and the Interdisciplinary PhD Program for making it possible to expand thinking across traditional disciplinary boundaries.

Thank you to my supervisors Dr. Sean McGrath, Dr. Gabriela Sabau and Dr. Jens Soentgen.

Many thanks to my loved ones, especially my grandmother, who taught me to see nature with an open heart and an awake mind. Special thanks to Dr. Daniel Altdorff and his love, patience, and support.

Lastly, I wish to express my gratitude to nature and the arts, which have inspired me profoundly and sustained my strength throughout this journey.

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1 Introduction

1.1 Entering the Complexity of a World in Polycrisis

A multitude of crises characterize the situation in which humanity currently finds itself and forms the overall background of this work. According to the Global Sustainable Development Report 2023, the confluence of crises has led to a situation that is more concerning than anticipated, largely due to the slow implementation of crises responses (UN, 2023, p. XVIII). To understand the world in polycrisis, we must consider the state of the environment and natural systems, the condition of human beings, and its relationalities. Beginning with the natural environment, we are witnessing what is sometimes referred to as the sixth mass extinction—the first caused by human activity—characterized by an unprecedented magnitude and pace of biodiversity loss (Ceballos et al., 2017). This development is closely linked to global climate change, another major factor responsible for the current substantial changes (IPCC, 2022). For example, extreme events are more frequent and extensive, causing profound negative impacts on all realms of the world, including marine, terrestrial, freshwater, and polar regions (IPCC, 2022) Moreover, biodiversity loss and anthropogenic climate change are interrelated and compounded with changes in land use and land cover that have a fundamental impact on earth (IPCC, 2022). We are seeing deterioration of vital soil quality (Qiao et al., 2022) and other negative impacts from changes in ecological structure, such as reduced landscape heterogeneity, posing serious threats to natural and human health (Hendrickx et al., 2007). Throughout this thesis, soil is the meaningful and repeatedly used key example of how the cycle of life, and thus health, is deeply interconnected between nature, such as soil, and humans. Regarding soils, the chemical glyphosate, a critical active ingredient in many herbicides, is frequently detected. Today, it is found globally in water, food, animals, and humans (Xu et al., 2019). Another critical pollutant in soil and water is antibiotics (Jufer et al., 2020). Furthermore, land cover and soil, which constitute the planet's largest carbon sink, play a critical role in climate change

processes and the regulation of greenhouse gas emissions. However, they are increasingly shifting from functioning as carbon sinks to becoming sources (IPCC 2022; Grinand et al., 2017). In addition, there is the introduction of other modified materials, such as the unprecedented and continuous accumulation of plastics in different size variations[1], changing, for instance, the state of the marine environment and aquatic ecosystems (Thushari and Senevirathna, 2020). In this context, the full extent of these anthropogenic environmental changes, both at global and local scales, as well as their synergistic and cumulative effects on the planet, remains largely unknown.

If we then take a closer look at human beings, we find ourselves deeply entangled in these crises, not only as a source but also as a receiver of their tangible effects. One manifestation of this is the multifaceted and extensively documented human health crisis, which encompasses a range of issues such as increased prevalence of chronic diseases, mental health disorders, and the emergence of new pathogens driven by environmental degradation and global interconnectedness (e.g., IPCC, 2022; WHO, 2017). In the context of this work, greater emphasis is placed on this situation compared to the "financial and democratic" crises (Rosa et al., 2016), which are occurring simultaneously and are nonetheless strongly interconnected. With respect to health and well-being, this work examines a negative trend in human vision, specifically the significant global increase in myopia over recent decades. By 2050, this condition is projected to affect half of the world's population (Holden et al., 2016). Furthermore, the above-mentioned human-disturbed soil health has been shown to affect human health through reduced nutrient quality or quantity, as well as the accumulation of agrochemicals (Orgiazzi 2021). This connection is further highlighted by intensive research into the interactions between the human microbiome[s] and the earth microbiome[s] (Thompson et al., 2017). Recent findings on the soil microbiome are anticipated to have profound implications

[1] E.g. megaplastic, macroplastic, mesoplastic, and microplastic.

across all areas of life (Mishra et al., 2023). Apart from the complex ecotoxicological effects, there is the growing concern regarding the challenge of *anthropogenic sensory pollution* affecting both humans and non-humans alike (Halfwerk and Slabbekoorn, 2015). Various forms of air pollution exist (Cohen et al., 2017; WHO, 2021), especially in areas with high-intensity anthropogenic activity (Potts et al., 2021). In terms of air quality, there are ongoing concerns related to increasing air traffic (Moreno et al., 2023), as well as the impacts of rising space debris (Palmroth et al., 2021). The fact that the atmosphere is an integral part of earth's microbiome, and that any changes or pollution in the air also affect the *aeromicrobiome*, further underscores the vulnerability of this living environment to anthropogenic changes (Amato et al., 2023). Moreover, we are also confronted with increasing global light pollution both on land and across the ocean (Falchi et al., 2016). The light environment includes not only daily light and dark cycles, but also annual and lunar cycles that have been stable over geological and thus evolutionary time periods. Artificial light at night, on the other hand, is increasing rapidly worldwide and affects all levels of biodiversity, from genes to ecosystems (Hölker et al., 2021). Noise is another major agent of pollution on land and in the marine environment (Sole´ et al., 2023). In parallel, noise means the absence of silence and thus another absent path for health and existential development. The World Health Organization (WHO) considers noise as one of the most important environmental stressors that has a negative impact on public health (WHO, 2011). Furthermore, if light and noise are considered more broadly as forms of energy, anthropogenic electromagnetic fields and their still poorly understood negative effects on the natural balance of ecosystems, as well as on humans and non-humans, should also be addressed (Sole et al., 2023). Finally, anthropogenic environmental changes relevant to the present work also include various forms of densification, such as increased building and population densities (Ripple et al., 2017). This is particularly evident in the context of the urban turn, where more people officially live in urban than in rural areas since 2018 (UN, 2019).

Overall, both human and non-human systems, as well as other natural systems,[2] can be characterized as highly susceptible and vulnerable to these and other anthropogenic environmental changes (IPCC, 2022). Given the interactions and cascading nature of these current environmental and ecological challenges, as well as the fact that most "planetary boundaries" and ecological "tipping points" have been transgressed (Rockström et al., 2009; Richardson et al., 2023), we are facing what can be viewed as an all-encompassing *planetary health crisis* (Whitmee et al., 2015).[3] This condition has been primarily driven by human activity and is leading to a transforming epoch known as the Anthropocene (Crutzen, 2002). The Anthropocene is marked by unprecedented, more unpredictable, and more extreme natural events and phenomena. In contrast, the preceding Holocene is now regarded as a relatively stable reference epoch that we are gradually leaving behind (Richardson et al., 2023). From another perspective, the Anthropocene can also be characterized by the disconnection and decoupling of humans from nature. For example, humans have distanced themselves from natural ways of living and become de-synchronized from natural rhythms.

The multifaceted crisis referred to here as part of the Anthropocene is approached in the present work as a *human-nature [dis-]connection problem* (Bratman et al., 2019; Frumkin et al., 2017). This concept will serve as an overarching theme connecting the included manuscripts. If we understand the current "nature" of human existence as the decisive driver of catastrophic local ecological events and changing global earth system processes, the relational role and meaning of the human-nature [dis-]connection become of central importance. In this context, the fact that humans themselves have caused this situation holds several meanings and deeper implications. Causal explanations, for example, lead to important social and economic responsibilities within the politics of sustainable development. They also generate discourses

[2] In this thesis, „natural systems" are used in the sense of a „dynamic physical, physicochemical and biological components of the Earth system that would operate independently of human activities" (IPCC, 2022, p. 2916).
[3] Consider also the first Health Day at the 28th UN Climate Change Conference (COP28) that led to the *COP28 Declaration on Climate and Health*.

on ecological justice, addressing both present generations (intragenerational justice) and future generations (intergenerational justice) as key normative pillars of sustainability (WCED, 1987; Glotzbach and Baumgärtner, 2012). Nevertheless, explanations are often simplistic and remain abstract, as causation cannot be directly perceived (Deutsch, 2012). In causal attempts to understand, less clear aspects can be lost, and insufficient attention is given to complexity – especially a deeper existential understanding of why humans found themselves in this global crisis in the first place. Such an understanding is fundamental to the necessary transformation and shaping the future of humanity, especially in relation to the natural environment and life-related issues. Linked to this are discussions and efforts surrounding synthetic biology, one of the most recent developments within the life sciences (Simons, 2021), as well as the controversial attempts to promote Additionally, the fields of artificial intelligence (AI) and autonomous robotics could lead humanity down entirely new developmental trajectories, directions and challenges. The potential for fundamental changes through AI, commonly referred to as “"machine learning” and “deep learning” methods (LeCun, 2018), will raise new questions about human productivity, creativity, and purpose or meaning. In this respect, it is vital to carry and cultivate knowledge and wisdom about human way of being, living and life itself.

1.2 Bio-Experiential Crisis and Eco-Relational Competence

In response to the polycrisis outlined in the introductory chapter, this thesis addresses a fundamental knowledge gap concerning the human condition, grounded in the premise of a bio-experiential human crisis tied to a vital domain of human existence. This crisis appears to contribute to the perpetuation of the ecological predicament, impede sustainable solutions, and exacerbate the implementation deficits in socio-ecological transformations. Addressing this gap

requires studying the human system of experience[4] as inherently interrelated with the environment, and particularly with nature. This approach necessitates an interdisciplinary and integrative approach and is opened here as a so-called “bio-experiential project”[5], insofar as this designation proves heuristically useful. Importantly, the project is conceived as open and ongoing in response to human-nature relationalities, meaning its terminology may evolve and adapt to future advancements in knowledge. At this stage, "bio-experiential" primarily refers to the body, understood in its multidimensionality, encompassing both its bio-physical and existential or experiential dimensions, as the central standpoint for engagement and investigation. Accordingly, the body is not understood as a self-enclosed entity but as an interrelated bio-marker of functional health and a meaningful existential-marker of bio-experiential existence. In other words, human beings actively engage with the world through bodily lived experience, bridging biological and existential domains. While the analytical differentiation of bodily dimensions may appear reductionist, it is a necessary step toward understanding the ongoing interdependencies underlying the claimed human existential crisis, which does not exist in isolation from the surrounding world. Ultimately, however, the human being must be re-integrated and understood as comprehensive whole, constituting what can be referred to as bio-existence, which necessarily includes its environmental relations. This encompassing perspective requires a philosophical act of interpretation, enabling the re-integration of analytically derived partial perspectives into a bio-existentially expanded understanding of the human-nature/environment continuum.

Accordingly, it is necessary to extend phenomenological research on embodied experience to explore and integrate the interconnectedness and interdependence between the functional (*bio-*

[4] Note the distinction between knowledge gained through experience or practical learning (e.g., procedural learning) and theoretical or cognitive learning.
[5] *Bio-experiential* and *bio-existential* are used interchangeably, with the former plaing greater emphasis on human experience itself while remaining integrative within the broader and more encompassing domain of existence.

logical) and experiential dimensions of human existence. These dimensions, moreover, exist in dynamic relation with environmental surroundings, which are increasingly shaped by complex changes arising from anthropogenic influences. These human-induced changes interact with and accelerate natural processes, creating new dynamics that fundamentally alter the conditions of both human and non-human ecosystems. In this context, the whole body is examined as the medium of human experience with the changing (natural) world, and through this lens it is also considered a prerequisite for eco-relational competence.

Moreover, the body is innovatively positioned as living method that simultaneously reveals the emergence of lived knowledge, being an active epistemic agent endowed with permanent meaning. This framework enables an exploration of how the body mediates and co-creates human-nature relationalities, including meaningful exchanges with natural phenomena and environmental changes.

A central theme of the bio-experiential project is the ecological relationality, which sets the focus on the qualitative and vulnerable connection between living beings and the environment. This approach challenges a global tendency toward the reification of the body, nature, and relations (Hoffmeyer, 2008).

By investigating human-nature [dis]connectedness, the bio-experiential approach transcends anthropocentric views. It includes the inter-bodily resonance or relationality between humans and other life forms—plants, animals, ecosystems, the earth system, or even celestial bodies. In this context, the body perspective is not confined to human bodies alone.

In addition, the project integrates the study of how humans relate to their own bodily existence and stresses *self-knowledge* as a foundation for active relationality with others and the environment. It also addresses the under-researched area of living-lived body knowledge and bodily self-awareness, which are crucial for eco-relational competence and vital for fostering a

sustainable approach to nature. Notably, the eco-relational role of the body has not been consistently studied or approached from multiple perspectives. By adopting a bio-experiential approach, this project can provide novel environmental concepts that uncover previously unexplored human-nature connections. These concepts deepen our understanding of interconnectedness and promote, in a natural way, ecological awareness recognizing it in the existence of eco-relational everyday living.

It is important to emphasize the intended nature of this project as an open and ongoing endeavor to respond to the dynamic and ever-evolving relationalities between humans and their environment.

1.3 Overview of Manuscripts

A brief overview of the contribution of this work will be given in the following. The thesis comprises at its core three different manuscripts. Each of these interdisciplinary works incorporates different sciences, which are listed in part below. The various scientific perspectives and insights are tied together and bridged by the integrative work of the "all-encompassing science" of philosophy and an applied overall framework (see *Chapter 2.3.1*). The three developed *bio- existential environmental concepts* can now be briefly presented.

The first manuscript "*The Rise of Myopia and Human Existence in the Near-Zone*" (*Manuscript 1*; submitted), explores the subject of increased human myopia, particularly as a phenomenon accompanying modern living conditions in anthropogenically altered environments. To this end, an existential and experiential perspective is adopted that incorporates, supplements and thus expands the view of traditional visual sciences. The concept of the near-zone was established here to uncover how nearsightedness can change the human way of life and existence by revealing it as disconnected from distance and spaciousness. Furthermore, it has

been shown that this phenomenon has fundamental consequences for human relational abilities and competencies, with distant nature literally falling out of human sight. It has also been found that this mode of existence, characterized by detachment from the distant environment, can give rise to new forms of human movement–physical, emotional and otherwise affective.

In addition, visual sciences such as neuroscience and ophthalmology, along with studies on urban growth, architecture, and design in connection with green and blue infrastructure, are potentially impacted by such developments. In this context, sustainability sciences have been identified as insufficiently addressing issues related to the understanding and preservation of open spaces. This under-researched meaning of open space and distance is partially explored here, highlighting its relevance for both human existential well-being and physical health.

The second manuscript presented here, entitled "*Change of Nature and the Concept of Living-Lived Biodiversity*" (*Manuscript 2*), examines ecological change and the unprecedented loss of biodiversity. It draws extensively on current biodiversity research, including a critical analysis of various biodiversity indicators. The central question explored is whether and how human experience can experience ecological diversity, change and loss over time. To address these questions, the manuscript draws on the philosophy of time, particularly regarding the temporality of the body. This highly interdisciplinary project combines biology and philosophy to explore the issue of biodiversity and its changes in contemporary contexts. Additionally, the study incorporates insights from environmental psychology and ecology, utilizing critical concepts such as "environmental amnesia" and "shifting baseline syndrome." The study is further supplemented by empirical data on changes in natural phenomena, gathered from the first-person perspective over a period of twenty years. The overall result is the conceptualization of the current situation of biodiversity as embodied, termed "living-lived biodiversity[loss]."

The third and final manuscript addresses the sky-environment in the Anthropocene epoch and is called "*The Loss of the Sky-Blue: Changes in the Sky-Environment*" (*Manuscript 3;*

published). This work on the sky-environment should stimulate a necessary discussion in aesthetics and beyond regarding possible changes that deviate from natural dynamics and variability. Therefore, the new concept of "sky-blue beauty" is introduced to capture an environment vulnerable to possible anthropogenic environmental changes. The environmental issues addressed here focus on anthropogenic sensory pollution, such as air pollution, and its experiential and perceptual and thus aesthetic Special attention is given to the sky-environment, which is increasingly exposed to traffic, as informed by air sciences. Traditional aesthetic concepts such as "familiarity" and "everyday experience" are revealed to be precarious and no longer applicable in the changing epoch of the Anthropocene. This shift presents new challenges for philosophical aesthetics and the theory of beauty. Consequently, this research differentiates modes of human experience by focusing on the living-lived aesthetic experience and the accompanying lived knowledge, offering a complement to objective knowledge about the sky-environment.

2 KEY CONCEPTS, METHODS & THINKING PRACTICES

2.1 Health and Well-Being

"*The earth is his nurse*."[6]

The following reflects on the complex topic of health and well-being, which forms an integral component of this broader bio-existential project to explore human-nature relationalities in the Anthropocene. To this end, the discussion first addresses health and well-being in humans, then in natural systems, and finally in their interdependence. From this perspective, the issue of human-nature [dis-]connection will be further examined. The aim is to demonstrate how the relationship between humans and nature can be understood as being in crisis, particularly in the

[6] Original in German: "*Sein Säugmutter ist die Erden*". M. Maier. Atalanta fugiens. p. 16.

context of health and well-being. The concept of natural balance, along with the consequences of disrupted life regulation, is especially insightful in this regard.

To begin, it is essential to establish a fundamental analytical distinction between the functional and existential dimensions of health, which will be maintained throughout this thesis. Here, the concept of "health" is applied in relation to life functions, encompassing the physiological, organic, and bio-chemical processes of human and non-human systems. In contrast, for the existential perspective of health, the term "well-being" is used rather than "health."[7] Although there remains a particular focus on the existential perspective in this thesis, the functional perspective cannot be considered secondary. Rather, both the functional, health-related aspects and the existential, well-being-related aspects are emphasized as interdependent and equally significant, collectively contributing to a comprehensive understanding of the human bio-existence under investigation. From this viewpoint, the body is understood not only as a *bio-marker* of functional health but also as a meaningful *existential-marker*, with their interdependence becoming clearer over the course of the thesis.

2.1.1 Human Health in Crisis

As noted in the introduction, a growing body of evidence highlights the existence of a multifaceted modern crisis in human health (Whitmee et al., 2015). This crisis is also reflected in the widespread use of terms such as "health" and "well-being." The WHO defines health as "complete physical, mental and social well-being and not merely the absence of disease or infirmity" (WHO, 2021, p. 2), suggesting an understanding of health that extends beyond its

[7] Note that the IPCC definition of *well-being* refers to „existence" in this way: „A state of existence that fulfils various human needs, including material living conditions and quality of life, as well as the ability to pursue one's goals, to thrive and to feel satisfied with one's life" (IPCC, 2022, p. 2927). In contrast to this work, the IPCC also uses the term „ecosystem well-being", which refers „to the ability of ecosystems to maintain their diversity and quality" (ebd.). According to the understanding used here, it seems more appropriate to speak of „health", rather than „well-being" when referring to the ecosystem.

functional role. However, this holistic perspective stands in contrast to the rise of so-called "noncommunicable diseases" (NCDs), which include "cardiovascular diseases, cancers, chronic respiratory diseases, diabetes, and mental health conditions, together with neurologic, endocrine, gastrointestinal, renal, allergic[8], and autoimmune disorders" (Frumkin and Haines, 2019, p. 262). Particularly concerning is the growing prevalence of mental health disorders (Prescott et al., 2022) and the "poor wellbeing among children and young people," described in England as "escalating" (Walshe et al., 2023). Importantly for this work, "many risk factors for NCDs are environmental in origin or may be influenced by the environment" (Frumkin and Haines, 2019, p. 262). Notably, the bioaccumulation of plastics in the human body and the diverse impacts of nano- and microplastics on human health present critical concerns, including evident negative health effects, many of which are, to date, only partially seunderstood (Winiarska et al., 2024).[9] However, environmental contributions "are routinely overlooked" (p. 262). Similarly overlooked are the existential effects of environmental changes that affect human beings. This connection is explored in *Manuscript 1*, where the concept of "mismatch disease" was used to describe the changing environmental conditions related to human eye health with existential implications. Functionally, the discrepancy between the natural needs of eye health and the lack of balance between distance and near vision in modern lifestyles were emphasized. Light and space are among the most important environmental factors and living conditions addressed. The contribution of combined risk factors and behavior is important and responds to a common limitation of studies assessing potential mismatch refractive error diseases, which mostly focus on a single environmental factor.

[8] E.g., see how ubiquitous allergic conditions as expressions of ecological change affect human health and well-being: Prescott et al. Exciting Anthropocene. 2022b.

[9] The wide range of potential health issues—such as "respiratory disorders (e.g., lung cancer, asthma, and hypersensitivity pneumonitis), neurological symptoms (e.g., fatigue and dizziness), inflammatory bowel disease, and even disturbances in gut microbiota" (p. 1)—complicates the human health risk assessment in this context.

Overall, health status serves as a fundamental indicator of the impact of environmental change on human and natural systems. The *body* plays the vital role in this context, manifesting as both a *bio-marker* of health and an *existential-marker* of well-being (see *Chapter 2.2.6*). Accordingly, this bio-existential project aims to explore and identify connections between the functional-bodily and existential-experiential dimensions of the human being, emphasizing their role as a precondition for *eco-relational competence*.

One final aspect of the relationship between humans and their changing environments is closely tied to the intensities of urbanization. The annual report referenced above dedicated an entire chapter to this complex issue, summarizing the impactful developments as follows:

"*The city has become the prototypical human habitat, representing a global shift in both demographic and land use patterns. More than half of humanity now lives in urban areas, and with nearly all global population growth occurring in cities, that proportion is expected to reach two thirds by 2050. Much attention focuses on megacities of more than 10 million people, such as Mexico City and Sao Paulo, Cairo and Lagos, Karachi and Delhi, and Manila and Jakarta, but nearly half the world's urban dwellers live in a growing number of relatively small cities with fewer than 500,000 inhabitants and where population increase is faster*" (Frumkin and Haines, 2019, p. 268).

In addition to the positive aspects of urban life, such as socializing and prosperity, numerous studies confirm the negative health effects of urban living on individuals, particularly due to densification trends and the broadly defined anthropogenic sensory pollution, which includes various associated stress factors (WHO, 2016).

2.1.2 Human-Altered Nature

Global changes in human expansion and ways of life impact natural systems and the environment on both local and global scales, creating complex feedback effects on humans. In particular, anthropogenic alterations in land use and land cover are key drivers of the unprecedented loss of macro- and micro-biodiversity[10] (Ceballos et al., 2017). The complex issue of biodiversity changes and loss and its impacts on human health is increasingly being researched (Robinson et al., 2024; Nriagu, 2020). In addressing this pressing issue of our time, soils emerge as a vital and meaningful concern. They are among the most biodiverse realms of the natural environment (Sun et al., 2023). Creamer et al. (2022) define "soil health"–following a nuanced discussion of the term "health"–as "the continued capacity of a soil to function as a vital living ecosystem that sustains plants, animals and humans" (p. 2). In this context, soils and their functions exemplify the interconnectedness of nature's health and human health, highlighting a critical lack in soil health risk assessment (Deel et al., 2024). However, the health of the living ecosystem of soil is evidently compromised by human activities, which manifest through various pathways of interaction, such as crop production and intensive agricultural practices, ultimately leading to the impoverishment of food's nutritional quality (Basak et al., 2021). Illustrating the complexity of soil health and its potential interdependence with the health of plants, animals, and humans, Creamer et al. (2023) argue that ecosystem health, understood as the functioning of an ecosystem, is not confined to a single function associated with one specific process but instead encompasses an overall *multifunctionality* that integrates all functions and their interrelated processes (p. 10). This raises the question of whether humans, with their inherent limitations, have fully comprehended and understood all the involved processes and interdependencies. This issue is further underscored by one of the key aspects of

[10] E.g., S. Sariola and F. Gilbert. Toward a Symbiotic Perspective on Public Health: Recognizing the Ambivalence of Microbes in the Anthropocene.

soil multifunctionality: its relationship to the critical challenge of the "currently undocumented loss of microbial genetic and metabolic diversity" within both human and non-human biomes (Peixoto et al., 2022). Increasing evidence highlights the interconnected health impacts between humans and nature concerning the earth's microbiome, resulting in a new "microbiome signature of the Anthropocene," which is "characterized by a shift towards global homogenization, diversity loss, r-strategist (that is, fast-growing) microbes and often multiresistant pathogens" (p. 1727). Such disruptions to ecosystem functioning, along with the interrelated health of humans and non-humans at microbiological levels, are "*often followed by dysbiosis (that is, the disruption of microbial networks and functions that impact symbiotic relationships within a holobiont) and facilitate disease. Dysbiosis is also associated with severe chronic diseases and long-term biotic stress that are well-documented for humans and crop but remain understudied in wildlife and natural vegetation*" (p. 1727). This highlights a significant knowledge gap in understanding the interrelated impacts on the health of living systems, which has received far less attention despite its potential to further exacerbate the ecological crisis.

A critical thought on the aforementioned paper addresses the human measures proposed to mitigate environmental disruption. The suggested use of supposedly beneficial microbes as an alternative to the "chemical approach to disease" represents –despite its probably "healthier" treatment –yet another form of anthropogenic interference in natural balance processes. The call for "the rapid development of probiotic applications to the environment" raises legitimate concerns about replicating the issue seen human applications. Compared to the natural diversity of human microbiomes and soils, artificial supplementation appears overly isolated and reductionist. This concern is further validated by the broader challenge in biodiversity research: the fact that most species remain undiscovered and undocumented (IPBES, 2019). Given these critical knowledge gaps and the general limitations in human understanding of natural

complexity and diversity, the effectiveness of such anthropogenic interventions must also be questioned.

However, it is worth quoting here a summary of anthropogenically altered environmental conditions that affect health developments:

"*These changes undermine many of the natural systems that underpin human civilization and have the potential to reverse the progress in health and development achieved in recent decades. These changes include climate change, biodiversity loss, freshwater depletion, tropical deforestation, overexploitation of fisheries, ocean acidification, soil degradation, changes in nutrient (nitrogen, phosphorus, and others) cycling, and environmental loading with persistent toxic substances*." (Frumkin and Haines, 2019, p. 262)

Significant in this cited passage is the concerning indication that the health impacts of anthropogenically altered environments may lead to regressive developments in foundational health. As a result, the future health of people and planet could be even more severely impaired.

Finally, in addition to the ecological scales described at the micro and macro levels, a global perspective of the earth body as a whole earth system can be adopted. The concept of planetary boundaries, for example, considers earth system processes on a global scale (Rockström et al., 2009). Planetary boundaries provide a scientific framework for understanding of anthropogenic perturbations, including their nonlinear interactions and the resulting cumulative effects on the overall state of earth system. In terms of the global environment, it is evident that most planetary boundaries have already been transgressed, critically disturbing the integrity of the functional biosphere[11] (Richardson et al., 2023).

[11] *Biosphere* is defined as „The part of the Earth system comprising all ecosystems and living organisms, in the atmosphere, on land (terrestrial biosphere) or in the oceans (marine biosphere), including derived dead organic matter, such as litter, soil organic matter and oceanic detritus." (IPCC, 2022, p. 2901).

2.1.3 Human-Nature Connectedness

The connections between humans and nature have garnered increasing attention within the diverse field of sustainability science (Kajikawa eta l., 2014). Multidisciplinary research on human-nature connectedness (HNC; Ives et al., 2017) has provided growing evidence that nature plays a crucial role in promoting and maintaining human health and well-being, both physically and mentally (Zhang et al., 2024). For instance, the rising prevalence of mental health disorders has been shown to improve with increased access to and engagement with natural environments (Bratman et al., 2019). Nature has the capacity to mitigate stressors, in particular this has been shown in relation to *green spaces* (WHO, 2016) and *blue spaces* (White et al., 2021). In addition to these well-documented benefits, other types and colors of nature are increasingly being recognized and explored for their potential health benefits (Li et al., 2023).

Furthermore, a substantial body of scientific literature has emerged, presenting multiple hypotheses on the human-nature connectedness, with the most well-known being the *biophilia hypothesis* (Kellert and Wilson, 1993). Biophilia is known as an innate human tendency to connect with nature and this insight is receiving growing attention in terms of *biophilic design* and in urban planning (Panlasigui et al., 2021). Furthermore, there is the *attention restorative hypothesis* (Kaplan and Kaplan, 1989) and the *stress reduction hypothesis* (Ulrich et al., 1991), according to which health and well-being are beneficially influenced by natural environments. With regard to the positive effects of human-nature connectedness, it is important to note that the existence of nature and human access to it are fundamental preconditions. Only under these conditions can a beneficial relationship or connection be established.[12] However, the exact nature of the dependence between these enabling factors remains poorly understood.

[12] Consider that contact does not equal connection.

Given the growing recognition of the interconnectedness and interdependence of human and natural systems in complex ways, and in light of the precarious state of the functional health of both, holistic concepts such as "One Health" and "Planetary Health" are gaining increasingly importance. For example, the Kunming-Montreal Global Biodiversity Framework provides the following definition: “One Health is an integrated, unifying approach that aims to sustainably balance and optimize the health of people, animals and ecosystems. It recognizes the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent” (CBD, 2022).

Importantly, the latest global biodiversity framework places biodiversity “at the heart of the sustainable development agenda, recognizing the important linkages between biological and cultural diversity” (CBD, 2022). Moreover, “[B]iodiversity is fundamental to human well-being and a healthy planet, and economic prosperity for all people, including for living well in balance and in harmony with Mother Earth. We depend on it for food, medicine, energy, clean air and water, security from natural disasters as well as recreation and cultural inspiration, and it supports all systems of life on earth” (CBD, 2022).

The concept of “Planetary Health” is used in a similar way today, aiming to demonstrate the links between human actions and behaviors and their impact on natural systems, with a focus on the future health of the living planet (Whitmee et al., 2015). Planetary health “underscores that human health cannot be uncoupled from the health of natural systems within the Earth’s biosphere” (Logan et al., 2021).

This interconnectedness can be further illustrated through the previously discussed issue of soil health and its various potential pathways by which soil health impacts the health of plants, animals, humans, and entire ecosystems. These effects may manifest through direct toxic impacts, such as radioactive or chemical contamination, or though specific nutrient deficiencies or excesses that have consequences for both human and non-human health. Furthermore, there

may be underexplored positive effects of soil health, such as those arising from direct physical contact with soil, which could have beneficial implications for health and well-being.

This holistic understanding of interconnected health forms the underlying theme of this work and is reflected in contemporary global environmental agendas, including those referenced in this work, from the Intergovernmental Panel on Climate Change (IPCC), the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and the Convention on Biological Diversity (CBD). Furthermore, aspects of planetary health are incorporated in the United Nations' *17 Sustainable Development Goals* (SDGs) and the United Nations' *Agenda 2030*, which is intended to serve as a global action plan for people and planet.
In conclusion, it can be argued that environmental and climate policy is, inherently, a form of health policy.[13]

2.1.4 Eco-logical Balance

In the context of health and well-being, the term "balance" or, as quoted above, "sustainable equilibrium," holds particular relevance. Nevertheless, the concept of balance is often treated as self-evident and rarely elaborated in more detail. However, for the anthropogenic environmental changes along with their existential living conditions examined in this work, a profound understanding of balance appears indispensable. It is therefore essential to analyze the extent to which existing knowledge about equilibrium or balance can contribute to understanding this bio-existential field of inquiry and to consider how the concept might need to be refined or expanded to address its specific demands.

[13] In Germany, the German Advisory Council on Global Change (WBGU) and the German Advisory Council on the Environment (SRU) have spoken out in favor of the need to research and integrate this relationship in report(s) on "Environment and Health" (2023).

Health and well-being can be considered as manifestations of the intelligence of life or as expressions of eco-logical balance, encompassing its self-regulating processes. This applies to both human and non-human systems. For example, the balance of the Earth system as a whole includes the "naturally" regulated, or balanced, water cycle of the planet (Gleeson et al., 2020). Or, the maintenance of internal stability within both human and non-human physiology, alongside its adaptation to dynamic environmental conditions, is captured in the concept of biological homeostasis. Homeostasis, introduced by Walter B. Cannon in his seminal work *The Wisdom of the Body* (1932), is defined as "the coordinated physiological processes which maintain most of the steady states in the organism" (cited in: Billmann, 2020, p. 4). Although these states are often referred to as "equilibria," they more accurately represent a continuous process oriented toward and striving for bodily stability, rather than a fixed state of equilibrium. Hence, one might also refer to an "freedom for variation" (Toch and Hastorf, 1955). This notion of biological freedom as a fundamental aspect of life stands in stark contrast to static states of equilibrium or inanimate stagnation. Furthermore, it provides a basis for discussing the necessity of freedom and openness as intrinsic to life, a topic explored in greater detail elsewhere (see *Chapter 2.3.4*).

In addition, the maintenance of health in a living human involves active adjustment to predictable and unpredictable changes, known as "allostasis" (Sterling, 2012). In humans, the brain is regarded as the efficient facilitator of a complex anticipatory regulation process. Sterling describes this process as follows:

"In summary, efficient regulation depends on the brain's sensing the current state, integrating this information with its prior knowledge to optimize its regulatory decisions. By also relaying current messages to higher levels, today's "lessons" become tomorrow's "prior knowledge". This is the allostasis model" (Sterling, p. 9).

These bodily calculations rely on a variety of factors that form the basis of prior knowledge, some of which are genetically programmed, others taught by parents, and still others shaped by life experience (p.10). Again, we find that brain and body are inseparable intertwined in achieving human health as balance within the context of the environment. Consequently, investigating relationality on a bio-existential level requires, in this context, a holistic perspective – one that views the human being as an integrated body/brain-mind-environment continuum (see *Chapter 2.2* ff). In such a relational context, "holistic" also implies a dynamic process than can not be captures as a settled whole in the sense of a fixed substance or entity. Instead, it emphasizes the relational process that integrates these various aspects, constituting the holistic perspective being pursued, albeit without achieving it in a fully complete or absolute sense. This incomprehensibility of life in its full dimension for the human being alludes again to the elsewhere raised aspect of openness and the freedom inherent in eco-logical life.

It is relevant to recognize that only a limited range of functional variability allows a living system to be considered healthy. The internal state of a natural system exists in a relational process – continuously striving for balance - *with* the external state and the environment. However, it is crucial to acknowledge that this health-preserving biological range is inherently constrained in both its dynamism and adaptability. This limitation highlights the fundamental vulnerability of life[14], emphasizing the delicate balance required for its sustenance.

Particularly in the context of research on anthropogenic environmental change, balance has emerged as a key theme of this thesis. A biological or experiential baseline, or threshold, is essential as a reference for identifying a healthy state, against which future deviations and less healthy states can be compared. In the bio-existential biodiversity research conducted here (*Manuscript 2*), it became clear that baselines for a "healthy state" or a certain experience of it

[14] *Vulnerability* is here understood as the "propensity or predisposition to be adversely affected" and includes elements of „s*ensitivity* or susceptibility to harm and lack of capacity to cope and adapt" IPCC, 2022, p. 2937.

are lacking. Similarly, in the work on the blue sky-environment, it was shown that experiential baselines can shift unnoticed, leading to a sky that is not blue becoming a new norm of experience. The critical problem remains that the deterioration of natural health–such as biodiversity or the sky-environment–due to anthropogenic pollution often goes unperceived and unexperienced. As a complex and under-researched phenomenon of this epoch, this can be summarized as human "environmental amnesia" (Kahn and Kellert, 2002).

2.1.5 Human-Nature (Dis)connection Problem & Vulnerable Processes

As outlined in the health perspectives on human and natural systems discussed so far, the connection between humans and nature presents a complex challenge, both practically and theoretically. This complexity is particularly evident in the context of the fundamentally changing epoch we are experiencing, where the full impacts and consequences of various anthropogenic environmental changes remain poorly understood. The question, therefore, remains as to whether, and to what extent, exposure to nature or connectedness with nature humans is essential for maintaining functional health, balance, and existential well-being – irrespective of potential adaptions to these environmental changes. Interesting in this context is the research on "technological nature", which refers to technologies that "in various ways mediate, augment, or simulate the natural world" (Kahn et al., 2009, p. 37). Nature, perceived through ubiquitous screens, has become a dominant mode of mediated and indirect contact with the natural world. The authors conclude their empirical work: "We as a species will adapt to the loss of actual nature. How could we not? We either adapt or go extinct. But because of biophilia – because of our evolutionary need to affiliate with nature-we will suffer physical and psychological costs" (Kahn et al., p. 41). On other words, humans are a resilient system that will likely adapt and survive, but at what costs? These "costs" of disconnection from nature involve a range of feedback effects on human beings. Notably, the relationship between health,

well-being, and urban life offers numerous indications for rethinking the quality of human-nature connections and life. Never before has so much of humanity been so distanced from nature, with 50% of population now living in urban areas, a proportion that is projected to reach 70% by 2050 (Dye, 2008). Nonetheless, there are poorly designed cities (versus the trend of "biophilic cities"), inadequate housing and crowding, noise and air pollution that can "directly threaten the health and well-being of urban residents" (Furkim and Haines, 2019, p. 269). Living in urban areas also means living predominantly indoors, which often results in less bodily activity and a sedentary lifestyle (Lin et al., 2023). Part of the multifaceted disconnection from the natural world occurs in a desynchronization with natural rhythms. For example, in terms of decoupling from the light and dark cycles based on natural sunlight, there is scientific evidence that insufficient sun exposure has become a public health problem (Alfredsson et al., 2020). Less obvious is the influence of the lunar cycle on human and non-human systems in respect to cyclical variations in activity, which is also compromised by night-time light pollution (Falchi et al., 2016).[15] Certainly there are fewer studies on the influence of lunar phases on humans than non-humans, but there are associations with sleep activity (Turanyi et al., 2014) and health-related behaviours such as aggression or mood cycles in humans (Wehr, 2017).[16] Currently more apparent are the challenges of being connected to nature in the face of the disruption of familiar seasonal rhythms. Temperate climate zones, with distinct cyclical, seasonal variations, are undergoing fundamental changes under climate change, with profound effects for human and non-human health. For forests and plants in temperate zones, new environmental stressors such as heat waves, droughts and "false springs" are occurring (Grossman, 2023). However, there are also great gaps in our knowledge, for example with regard to plant vulnerabilities to heat waves (Breshears et al., 2021). The increasing frequency

[15] See numerous publications by Franz Hölker's research group on light pollution and ecophysiology at the Leibnitz Institute of Freshwater Ecology and Inland Fisheries.

[16] Indigenous knowledge is worth mentioning here, especially with regard to the moon and its acknowledged influence on humans (e.g. menstruation cycle or aggression). For example, J.C. Gaudet, D. Caron-Bourbonnai: It's in our blood: Indigenous women's knowledge as a critical path to women's well-being. 2015.

and intensity of heat waves and other extreme weather events also have negative impacts on human health and well-being (Weilnhammer et al., 2021). In the context of the bio-experiential project, a key issue arises: the silent adaptation to new experiential norms and the shifting of experiential baselines. This phenomenon is already evident in the framing of heatwaves as “the new normal” (Stillmann, 2019). In addition, changes in seasonal dynamics – especially driven by climate warming – further disrupt critical ecological processes, such as the functioning of soil microbial communities. Soil and its diversity, frequently referenced in this thesis as indicator of the interconnectedness of healthy life, illustrate the broader implications of environmental imbalance. A relational perspective on the interconnectedness of life becomes particularly evident when disruptions to their function are shown to have the potential to alter the global carbon cycle, (Guo et al., 2022), thereby impacting life systems on a planetary scale.

One last compromised aspect of a natural balance is worth mentioning in this context because it is closely linked to the aforementioned anthropogenically altered light conditions. This is the increasing disruption of the circadian rhythm. The central but fragile function of a biorhythm is important for all life, from bacteria to humans, in that it is "responsible for maintaining the balance of physiological activities” (Bhadra et al., 2017, p. 57). Again, the term “natural” in the context of “balance” refers to biological functions as part of bodily health that have evolved with a limited range of tolerance and adaptability. However, these were anthropogenically altered influencing variables of a vulnerable balance process of complexly regulated human and non-human systems. It is reasonable to conclude that anthropogenic disruptions of natural balance, as part of the general decoupling and disconnection from nature, also have consequences on an interconnected bio-existential level.

2.1.6 Conclusion

The exploration of health highlights the human-nature[dis-]connection in various aspects. Particular emphasis is placed on the rhythmic and spatial decoupling from nature, along with its known and unknown consequences, underscoring the necessity of understanding both the concept and the real-world presence of the "natural" as a threshold for functional health. It has been shown that natural balance processes are vulnerable to anthropogenic disruptions, which are part of the broader trend of decoupling and disconnection from nature, with significant consequences for planetary health.

However, adequate research into the interconnected bio-existential consequences of imbalances and dysbalances remains insufficient. Much less is known about whether and how changes in the natural balance, along with the disconnection from nature, affect the bio-existential level. The manuscripts in this thesis aim to address these gaps. An example of the spatial disconnection from external nature, combined with an anthropogenically altered light regime, is examined in greater depth in *Manuscript 1*. This analysis is further connected to altered bodily movement and compromised visual and experiential contact with the environment.

This thesis seeks to expand the health dimension of life beyond a purely functional perspective by incorporating bio-experiential relations and competencies. One question that arises from this chapter is whether there are bio-experiential or bio-existential balance values or thresholds, similar to the physiological or biological mechanisms that maintain the internal milieu against external environmental changes?

However, the following definition from the "Planetary Health Manifesto" illustrates its encompassment: "Planetary health is an attitude towards life and a philosophy for living." This underscores the need to adopt a holistic and integrated approach to health, recognizing the deep

interconnection between human well-being and the health of the planet (Horton et al., 2014, p. 847).

A final important conclusion, which has been discussed earlier in this chapter and will be repeatedly addressed throughout this work, is that humans have significant gaps and limitations in their understanding and insight into the complexity, diversity, and hiddenness of nature, as well as its role in the health of the planet. In the broader context of healthy life, this might even extend to the possibility of an “extended ecology of cosmic interaction" (Bateson, 1972, p. 311).[17] This unbridgeable gap or lack of understanding should also be integrated into policymaking, with action plans reflecting the vast unknowns of nature, while recognizing their potential to maintain health and well-being.

Furthermore, when considering planetary health, the knowledge gaps raised here may not only pertain to our understanding of the external natural world, including cosmic dimensions, but also to our knowledge of our own bodily nature and its interrelationships. This bio-relational dimension will be addressed here, as without incorporating bio-experiential factors and processes, transformative efforts and policymaking to halt and mitigate human-made biodiversity loss, climate change, ecological degradation and pollution are unlikely to be sustainable.[18]

[17] For this work, it means including what K. Wilber defines as “Kosmos”: “The Kosmos contains the cosmos (or the physiosphere), the bios (or biosphere), nous (the noosphere), and theos (the theosphere or divine domain)-none of them being foundational”, p. 45. See also here Chapter 2.3.4, p. 64.
[18] For example, perspectives that „there is no such thing as sustainable seafood in a dying ocean“, Paul Watson.

2.2 The Body as Living Method and Knowledge

"*The wind carried him in its belly."*[19]

2.2.1 Introduction

Historically, phenomenology is known for its rejection of scientism, both as a methodological and ontological stance, particularly in its claim to possess exclusive knowledge (*Chapter 2.3.2*). Within this view, phenomenology is often characterized as a science that also rejects naturalism, from which can be followed a critique of its neglect the objective body and its natural physiological, organic, biological, and chemical functions. As a result, phenomenological research tends to miss the biological entanglements of the body, focusing instead exclusively on the phenomenal body. The bio-existential project seeks to address this limitation by expanding phenomenological inquiry to encompass the integration of the phenomenal body with the physiological-biological body.

As emphasised throughout this dissertation, the phenomenal and biological dimensions of the body are not mutually exclusively but deeply intertwined. Since the phenomenal-bodily appearance is generally holistic–meaning that the bodily experience *with* phenomena initially emerge as a unified whole[20]–this work aims to deepen the understanding of the respective dimensions of the body and their interactions within the context of the environment.

While analytical differentiation is necessary for the purpose of gaining knowledge in this respect, it must ultimately be reintegrated into a comprehensive human-body-environment

[19] Original in German: "*Es hat ihn der Wind getragen im Bauche.".* M.Maier. Atalanta fugiens. p. 12.

[20] The perceiving subject or body responds apparently as a whole, engaging in global reactions that reflect the integrated nature of bodily perception. This notion aligns with Merleau-Ponty's idea of grasping a phenomenon as a whole within the horizon of a situation, emphasizing its immediate appearance. This perspective resonates with Gestalt psychology, which emphasizes moving from the whole to its parts, recognizing a whole as irreducible to the sum of its parts. Merleau-Ponty contrasts the synergetic whole—perceived directly by the body—with a unity derived through "a synthesis of recognition in the concept" [PP372].

perspective. Consequently, this thesis argues for the expansion of phenomenological research to encompass these interconnected dimensions.

To substantiate such claim, the manuscripts presented elucidate the interconnectedness and interdependence of these different dimensions of the body, such as its functioning in the dynamic environment (e.g., visual health) alongside with the experience and existential relation with the world (e.g., seeing in the distance). The intra- and inter-bodily intertwinements and bio-dependencies, recognized as vital preconditions for the parallel existential relationship with the environment, appear to be underexplored and insufficiently studied, particularly in philosophical discourse and its dialogue with sustainability research contexts. This issue is addressed in the present thesis by considering the body as the center of human lived experience, particularly in the context of active engagement with natural phenomena and environmental changes. The finding presented across different manuscripts demonstrate this perspective, introducing and elaborating on novel bio-existential environmental concepts grounded in the human body.

Furthermore, it is important to note that, unlike the growing applications of phenomenology in psychological, therapeutic, and related contexts, this work does not primarily focus on the subjective dimension in terms of individual and diverse human experiences. Instead, it aims to identify and explore the general characteristics and structures of human experience with the environment. While these structures are recognized as dynamic and experiences as situational, bio-existential aspects of human experience can be linked to the human-nature [dis-]connection problem.

This chapter will introduce the body as an integral component of the methodology employed, offering an alternative to traditional scientific approaches for understanding current ecological phenomena and environmental change. The bodily approach provides a living, experiential method of meaningful knowledge generation that complements the objective findings and

explanations typically rooted in the separation of subject and object. The chapter will outline the trajectory of conceptual development and the foundations for the newly developed bio-existential environmental concepts. A key guiding methodological question throughout this work is: At what level of analysis am I currently operating? This question acknowledges the presence of multiple, distinct levels of analysis, with the body–alongside its experiential understanding with the world–serving as one such level, albeit the central focus of this study. Given the subject's inherent complexity, an overarching framework is employed to integrate various analytically distinct perspectives, analyses and findings, within which the body-centred approach is embedded (see *Chapter 2.3.1*).

In the course of the work, however, the analytical steps are often intertwined rather than clearly separated. Structurally, another section –building on the critical discussion and reflection of terms – aims to clarify the terminology used consistently throughout this dissertation (see *Chapter 2.3.2*). It is first necessary, therefore, to revisit some key ideas, concepts and recent research developments related to the body, which will be addressed in the following steps:

First, will be looked at how body-mind-environment relationship can be approached and understood. General aspects of the body, such as vulnerability, emotions, sensibility and/or sensitivity, will be raised, alongside the concept of "embodiment." While the concept of embodiment is widely used across numerous disciplines, making it impossible to encompass all its meanings or influences, this chapter will focus on relevant and interconnected aspects within philosophy, cognitive science, and environmental psychology. [21] A critical perspective will then be applied to the phenomenological heuristics used to approach the body, followed by an in-depth examination of its various dimensions and the associated challenges. Linked to this is the issue of an explanatory gap between analytically differentiated dimensions of the body.

[21] Neuroscience and psychology are becoming closely related fields. Therefore, the preferred term 'mental' is used interchangeably with 'psychological' throughout this work.

The body-focused approach is further complemented by an inevitable evolutionary perspective, as thinking across species necessitates an evolutionary view of the body while also addressing an increasing mismatch with modern environments.

Subsequently, the philosophy of the body is explored in greater depth through the works of Maurice Merleau-Ponty and Eugen Gendlin. Finally, this discussion is then complemented with a look at the late Heidegger, whose methodological impulses provide an alternative understanding and integration of the concept of *Leib* [phenomenal body].

2.2.2 Bodies in Theory

Holistic approaches to health and wellbeing that involve the whole body and person are increasing, as argued in the previous chapter. In this context, the human body has been discussed in the emerging field of psychoneuroendocrinoimmunology (PNEI), which focuses on the psyche-brain-immunity system and treats the mind and body as a single, integrated entity. The incorporation of both psychology and biology, studied as bidirectional pathways and connections, has been described as a revolutionary paradigm shift:

"*Research in recent years has revolutionized the medical and psychological view by contributing a profoundly unitary and psychosomatic understanding of the human being and highlighting the intimate relationship between physical, emotional, and psychological aspects*" (Bitzer-Quintero et al., 2022, p. 3).

This revolutionary paradigm shift underscores a holistic understanding of the human being, emphasizing the interconnectedness of body and mind through the intricate interplay of physical, emotional, and psychological dimensions, while calling for greater attention to how these are influenced by and interconnected with environmental conditions.

Notably, in scientific literature, the terms "mind" and "brain" are often used interchangeably, without clear distinction; however, in this thesis, the brain is consistently regarded as an organic

part of the body, integrated into the broader concept of the "body" whenever that term is used in this work. Consequently, the term body encompasses the brain and its activities, which are understood as the "mind"–an active phenomenon emerging through the bidirectional, continuous, and complex communication processes that characterize body-brain integration.

In this respect, the seminal work of Varela et al. (1991/2016) called *The Embodied Mind* helps, by connecting philosophical phenomenology and cognitive science, to replace the idea of the brain as disembodied input-output function with the concept of an embodied mind. The embodied mind is understood as *enactive*, meaning it brings forth a world not only through inner-bodily interactions but also through its coupling and interaction with the environment. In this view, enaction is described as "specifically designed to be a middle way between dualism and monism" (p. 202), thereby escaping the object-subject separation by avoiding the dualist division of mind and body as distinct entities, as well as the monist reduction of one to the other, such as treating the mind purely as a function of the brain. In other words, the investigation "remains removed from the predominantly objectivist/subjectivist mood of most contemporary science" (Varela et al., p. 212). In such a relational and therefore ecological context, information is not merely processed and represented by a brain-machine, but is lived and experienced in co-existence, with meaning co-created in a shared world of significance (p. Varela et al., p. 207). This perspective is essential for this work, as it views the body not as isolated, but as an integrated entity of body-brain-mind-environment. Furthermore, this understanding of co-existence and exchange inherently generates and carries meaning, producing meaningful information or lived knowledge.

Building of this holistic view, a perspective of interconnectedness, albeit with variable understandings of the considered dimensions of the body-mind-environment coupling, has been recognized and adopted in various fields. It is not only in the cognitive sciences that so-called

4E or 4EA approaches have been further developed (Palacios-García et al., 2022).[22] These frameworks take into account different tendencies of body-mind-environment interplay, such as embodied, enactive, embedded, extended and affective dynamics. [23] This shows the importance, among others, of considering emotional and affective tendencies as co-constitutive conditions for cognitive and experiential processes. In this regard, Duke et al. (2021) propose a new "*era of affectivism*" as a "potential natural successor to both the behaviourism and cognitivism eras." They argue that affectivism would "naturally incorporate both perspectives" (p. 818), bridging the gap between traditional cognitive models and a more integrated, emotion-inclusive understanding of human experience. Affective sciences, which are a "rapidly growing interdisciplinary field of study devoted to all aspects of affect and emotion" (Sander and Scherer, 2009, p. 16),[24] contribute to this shift. In the context of ecological relations studied here, the notion of "*e-co-affectivity*" helps to describe affectivity in different forms and localized interfaces of life (Oele, 2020), emphasizing the interconnected and context-dependent nature of emotional experience. In these manuscripts, the term "affect" broadly refers to the receptivity of any living body, which presupposes its openness and an intrinsic knowledge of its relation to the environment. This encompasses the potential vulnerability not only of human bodies but also of cellular bodies, plant bodies, animals and even entire ecosystems (e.g., *Gaia hypothesis*, Margulis and Lovelock, 1997). The vulnerability of bodies can manifest emotionally or affectively, such as in basic avoidance of pain and damage (Deisseroth, 2021). Additionally, valence–often described as the negative or positive tone to a felt experience–is a central construct in affective sciences (Sander and Scherer, 2009, p. 10). Valence as a component of affect and emotion is also described as the hedonic "bipolarity" of experience (p. 10). In relation to emotion, Thompson provides an interpretation of the dynamics of affect by

[22] E.g., see „The 4E approach to the human microbiome" (Palacios-García et al.).
[23] E.g., „The Oxford Handbook of 4E Cognition" (2018).
[24] For more detail see „Oxford Companion to Emotions and the Affective Sciences" 2009.

citing Patôcka's understanding of "e-motion" as a manifestation of a so-called "'primordial dynamism' of the lived body" (Thompson, p. 378). Emotion, understood as motion emerging from the dynamic interplay between poles, does not align with valence, which is often interpreted as a simple "behavioral or affective plus/minus sign." Instead, emotion is better described as emerging within "a complex space of polarities and possible combinations" (p. 378). In the discussion in the chapter "Ambiguity and the Openness of Life" we find emotions as graded rather than polar energies and the polar tension as an evolutionary fundamental for life processes (see *Chapter 2.3.3*)

Moreover, emotions are intensively studied in the environmental sciences as key outcomes and associations between nature exposure and health (Jimenez et al., 2021). Beyond health, expressions of the body, such as emotions, serve as carriers of body-environment relationality, thus representing lived knowledge or co-created meaning–a thought already introduced with Varela's *Embodied Mind*. This lived knowledge also implies the "existential attitude of being in the world" [PP115], highlighting the deep connection between embodied experience and the environment. The relationship between well-being and existential character is further reflected in body knowledge: "bodies know what well-being is," underscoring the intrinsic, experiential knowledge embedded within the body's interaction with its surroundings (Galvin and Todres, 2018, p. 324).[25] In this sense, the body is viewed as a meaningful carrier of living-lived bio-experiential, and, thus, existential knowledge. It is therefore consistent to associate embodiment with life itself: "[E]mbodiment implies a life history, active, uninterrupted participation in life" (Hoffmeyer, 1996, p. 115). This life story also includes an evolutionary time dimension, with embodied knowledge rooted in past lived experiences in (natural) environments (s. *Chapter 2.2.3).*

[25] See *Chapter 2.1.* and Routledge Handbook on Well-Being.

Another form of embodied knowledge manifests in the sensibility of bodies. Here, a distinction is made between s*ensibility* and *sensitivity*, which relate to the previously discussed dimensions of the body: biology and experiential (phenomenal). While the concept of sensibility, as studied in the field of aesthetic research[26], pertains to the experiential dimension of the body, sensitivity refers to the physical or biological constitution and reaction of the body. The latter is particularly relevant in the context of growing health concerns regarding human system (over)reactions, such as the increasing prevalence of "hypersensitivities" (e.g., Brinkworth and Valizadegan, 2021).

Non-human bodies, such as plant bodies, are also receptive and reactive to their environments, most notably in their natural inclination toward sunlight, a phenomenon known as heliotropism (Serrano et al., 2018). Plants are also "interested" in avoiding harm, such as excessive heat, as evidenced by studies on heat stress (Jagadish et al., 2021), another environmental change driven by anthropogenic climate change that affects both human and non-human bodies. It is therefore unsurprising that plants are receiving increasing attention in the discussions of *empathy* (Marder, 2012) and even in the context of "plant minds" (Maher, 2017).

Moreover, with regard to the concept of embodiment, cultural differences must be considered. Akira Ikemi, for example, notes that there is no direct equivalent for the term "embodiment" in the Japanese language. Instead, the prefix "em" refers to the idea of something being "put into" the body. Ikema proposes the term "com-bodiment," suggesting that "the body points beyond itself 'altogether with' (com-) the universe." (p. 25) According to this view, the "body is seen as a processing-generating itself with the whole universe at every moment of its living." The author refers to this process as "combodying" (p. 25).

[26] E.g., see M. Johnson and J. Schulkin. *The common currency of our aesthetic sensibility*.(2020). Or, K. Mandoki. *The indispensable excess of the aesthetic: evolution of sensibility in nature* (2015).

Finally, despite the extensive discourse on embodiment, there is also criticism, as presented by Sheets-Johnston in *Embodiment on Trial* (2015). Sheets-Johnstone argues that the concept of embodiment alone is insufficient for a comprehensive understanding the body, claiming that "the practice of embodiment produces static rather than dynamic understandings of everyday life" (p. 23). In contrast, the author emphasizes the concept of movement as a more dynamic approach to understanding the body in the world, as perspective that also informs the discussion in the present thesis.

2.2.3 A Critical View of the Body's Different Dimensions

A central approach to understanding the body and how it relates to and with the environment is based on the analytical distinction commonly made in phenomenology between the phenomenal or lived body (German: *Leib*) and the objective or material body (German: *Körper*).[27] Critically, it should be remarked here that due to the increasing circulation of phenomenological terminologies, original meanings of the dimensions as well the reason for their separation are often misleadingly blurred or lost.[28] To illustrate this, consider an example from phenomenological medicine, where Drew Leder engages with "phenomenology of embodiment" from a view of pain and "illness", as opposed to "disease" (2022, p. 146). In respect to the phenomenological distinction of the human body addressed here, he uses the concept of the "lived body" from the philosophical origins of "Husserl's 'Leib' in German or Merleau-Ponty's corps propre." However, he sets the lived body in contrast to "a non-living material body (*Körper*)" or "a physical object with size and weight" (p. 140). The author also distinguishes between the body I have, for "Körper," and the body I am, for "lived body," seeing both as part of "an existential ambiguity that characterizes human experience" (p. 143). This distinction is widely accepted in phenomenological research. For instance, Merleau-Ponty,

[27] For more details of the usage here and implied rejections see *Chapter 2.3.2*.
[28] The problem is addressed in more detail in the *Chapter 2.3.2.* "Phenomenology and hermeneutics"

emphasizes the notion that "I *am* body," rather than merely *have* a body [PP104]. Thomas Fuchs builds on this distinction by referencing Helmut Plessner's philosophical anthropology, particularly the concept of *Leib-sein* [being-*Leib*] and *Körper-haben* [having-body] (Fuchs, 2015). Similarly, Hermann Schmitz, through his New Phenomenology, offers a comprehensively developed understanding of the *Leib* within a phenomenological "pluralistic" conception of the body (Schmitz, 1965/2019).

However, does Leder suggest that the "material" body is "non-living" and not as alive as the phenomenal or lived body? This claim may seem dubious from a medical perspective. It seems to allude to the phenomenological division in which the "objective" body is the material body that can be seen by others (e.g. third-person perspective), as by a doctor when diagnosing a disease. Leder offers here an understandable critique of a "pervasive scientific materialism yielding a biomedicalized view of the body that has spread to the general public" (143). But is he not simply countering this with an exchange when he criticizes the material body and favors instead the "lived body"? This is further reinforced when he denies the material body a self, the *Körper* is "non-identical to self," while he ascribes it to the lived body (p. 143). In this context, the meaning of self remains rather unclear and appears to be simply equated with the lived body. Leder seems to disqualify the material body due to its association with "disease." He bases this argument on his critique of the dominant "objectifying disease-model," which he suggests leads to the "alienation" from the lived or felt body, which shall capture the first-person perspective of an "illness" (p. 143).

There is a noticeable variation in the treatment and associated meanings of seemingly identical terminologies within the philosophical-phenomenological view of the body. However, the analytical distinction between the objective and phenomenal body is crucial for deeper understanding, serving as a heuristic that requires further clarification.

2.2.4 Reification or Disconnection of Specific Body Dimensions

If we consider the criticism discussed so far from a phenomenological-medical perspective, it can also be framed as a critique of the reification of the body. This is precisely what Thomas Fuchs, philosopher and chair of the German Society for Phenomenological Anthropology, Psychiatry and Psychotherapy, does when he identifies Western culture as being in a "process of reification" (2015, p. 151). Accordingly, Fuchs speaks of the "[*I]ncreasing reification of the lived body into an instrumentalized and manipulated body*" (p. 152). If we adhere to the phenomenological distinction of the body mentioned earlier, we must question what Fuchs really means when he refers to the reification of the "lived body." The phenomenal or lived body is characterized by its extensive engagement with and surpassing of the material or physical body, while being in relation with the external world. Can this conceptualized principle of the living body truly be reified? Or would it be more consistent, in light of the established phenomenological distinction, to argue that it is the dimension of the body understood as material that becomes more pronounced and emphasized? In that case, it is the objective or physical body–such as expressed in the body image–that becomes reified and overemphasized. Meanwhile, the living-lived or phenomenal body might regress, detaches, and may even become disconnected from this material dimension. In this sense, it seems appropriate to claim a *Leib-Vergessenheit* [*Leib*-forgetfullness]. However, contrary to Fuchs' interpretation, this forgetfulness of the *Leib*–or of being a body–would imply an overemphasis of the material body, rather than the materialization or reification of the phenomenal body. This overemphasis is indeed affirmed by Fuchs when he speaks of the "dominance of the body in our culture," for example, as a "distortion of the body image."[29] Thus, it is the objective, material body that becomes overly accentuated, not the lived or phenomenal body.

[29]Original in German: "Sicherlich spielt für die Entstehung der Störung die Dominanz des Körpers in unserer Kultur eine maßgebliche Rolle, und die Verzerrung des Körperbildes, des *body image*, bei den Patientinnen treibt dessen allgemeine Verzerrung in der Gesellschaft nur auf die Spitze." (p. 151).

I argue against the prevalent thesis of the supposed dominance of the body in our culture, even though the phenomenon of *Leib*-forgetfulness[30] often seeks to be compensated by an increased emphasis on the physical dimension of the body. What becomes clearer, however, is the legitimate importance and meaning of the whole or integrated body in human life. In conclusion, the reification of the body, as discussed earlier, represents a detachment from the living-lived, experiential body (*Leib*) by overemphasizing the objective, physical body (*Körper*). This ultimately undermines the living-lived experience, which, in order to reach its full potential, requires the whole body, thereby diminishing active engagement and the associated lived understanding of the world.

2.2.5 Explanatory Gap in the Integration of Body Dimensions

Leder's perspective on pain and illness/disease noted above, brings him to claim "a rift" between the lived body and the physical objective body. Importantly, he implies that this body "polarity" also exists independently of dysfunction, as these would only "exaggerate that rift" (p. 146). Notwithstanding, it is not entirely clear how he understands the relationship between these different bodies in his proposed healing strategies.

Nevertheless, to draw an analytical distinction between the phenomenal body (*Leib*) and the objective body (*Körper*) raises the problem of their connection and may add to an arguable body-mind problem a so-called "*body-body problem*" (Thompson, 2007). According to Thompson, there exists an explanatory gap not "between two radically different ontologies (mental and physical), but between two types within one typology of embodiment" (p. 237/244). Similarly, in relation to the stated "*mind-body-body problem*," Hanna and Thomson

[30] Recall here Heidegger's concept of the forgetting of Being, which is not only a philosophical critique but also an existential diagnosis of the modern world. Human beings live in a way that ignores Being itself as such, and are instead trapped in a world of calculability, functionality, and technology.

(2003) ask "how can something be at once a subjective mind (as phenomenological defined), a living and a lived body or animal (as defined by ethology), and an objective material thing" (p. 3)? The "animalist" solution they provide is that neither the mind nor the material body are "metaphysically or explanatory autonomous, but instead they are metaphysically complementary aspects of the *Leib* or animal" (p. 9). This is reminiscent of the aforementioned evolutionary perspective "bodies were there first." However, it should be noted that the *Leib* is here considered as a "metaphysical and conceptual" basis, with mind and *Körper* being the dual aspects of the *Leib* (p. 2)

Thomas Fuchs also follows an *aspectivism* in terms of the phenomenological distinction of the body, albeit with a different meaning. He describes *Leib* and *Körper* as double aspects of a living being and claims an everyday kind of unaware shifting between these so-called "two different p*erspectives* or *attitudes*" (Fuchs, 2020, p. 2). In this way he writes, in reference to Husserl, that "through a change of attention" the touching right hand (*Körper*) can become an "*feeling hand,* […], a part of the bodily subject (*Leib*)." This suggests a "shift" from the hand initially perceived as *Körper* to hand experienced as *Leib*, potentially following a linear progression. The implied separateness between the two dimensions of the body becomes further emphasized when Fuchs conceptualizes *Leib* und *Körper* as existing in a "tension-filled relationship" (*Spannungsverhältnis*) and as "two poles of our existence between which we continuously oscillate" (Fuchs, 2015).[31] This sharply contrasts with the inseparability of bio-existence proposed in this work, which emphasizes the intertwinement, interdependence and mutual support of the biological (*Körper*) and the living-lived body (*Leib*). The idea of linearity and succession between the body dimensions reflects my interpretation of Fuchs' conception of their functioning. This interpretation suggests a sequential unfolding in the interplay between the physical body (*Körper*) and the felt body (*Leib*). However, this notion of linearity and

[31] „Im erwachsenen Leben bezeichnen Leib und Körper ein Spannungsverhältnis, zwei Pole unserer Existenz, zwischen denen wir fortwährend pendeln." (Fuchs, p. 149).

succession can be critically examined, as bodily experience often manifests as a simultaneous and holistic phenomenon in which both dimensions inherently co-emerge and support one another. Even at early stages of awareness, glimpses of conscious perception—whether of the physical or the felt body–remain intertwined within bio-existence. Following this separation, Fuchs attempts to reconcile this "dual aspectivity" (Fuchs, 2018) within the "grounding unity of living being" (p. 210) or "the living being's intrinsic unity" (p. 215). Nevertheless, conceiving the relationship between body dimensions in terms of linearity or a "shifting" body experience risks reducing the complexity of bodily living to a more abstract and oversimplified framework and therefore missing interrelations. This view of linearity also aligns with a scientifically causal mode of reductionist thinking, to which this work offers an alternative. It seeks to integrate simultaneity, emergence and potential non-duality in the understanding of bodily living with the world. [32]

However, life or living ultimately plays a foundational role and illustrates the necessary integration of phenomenology and biology. In this context, Thompson specifies the following philosophical task: "An important philosophical task is to show how there can be an account of the lived body that integrates biology and phenomenology and so goes 'beyond the gap'" (p. 237). This statement underscores the importance of bridging these two disciplines to develop a more comprehensive understanding of the two dimensions within the integrated whole body. By combining insights from both phenomenology and biology, we can gain a deeper appreciation of the relationship between the lived body and its biological foundations and dependencies.

[32] „Non-duality" or „non-dual being" is used throughout this work to denote a mode beyond separte subject-object thinking" and a more unified mode of being with oneself and the world. Regarding nondual traditions see K. Wilber, 2000. P. 695f. and 717ff.

2.2.6 Evolutionary Perspective on the Body as Bio-marker and Existential-marker

From an evolutionary perspective, the human body is a fundamental and integral part of nature. In this context, the body plays a primary role in the evolutionary process, as biologist and biosemiotician Jesper Hoffmeyer explains: "The body was there first, and only in the course of time (evolutionarily seen) did bodies develop brains sophisticated enough to support a psychological life" (2008, p. 178-179). Likewise, Merleau-Ponty underscores the inseparable body-nature connection, stating: "[N]ature inside of us must have a relation with nature outside" (N, p. 206). This connection can be understood as the body's dependence on its natural environment, requiring essentials like clean air, water, food, and shelter. However, today this vital relationship is increasingly disrupted by anthropogenic environmental changes, leading to a mismatch between the still-natural body and the modern, abuilt environment. The hypothesis of evolutionary mismatch, as discussed in relation to health and wellbeing, must also be considered in light of the body's exposure to a rapidly changing environment.

For example, the issue of altered human movement explored in this thesis relates to the widespread insufficiency of physical activity in many parts of the world (Gurven & Lieberman, 2020). As the authors note, this decline in physical activity contributes to mismatches between our evolved biology and modern environments, leading to the rise of diseases in "Western, Educated, Industrialized, Rich Democracies" (p. 330). The lack of movement and the increasing trend of humans becoming an "indoor species" (Peeters et al., 2021, p. 1) can thus be interpreted as a fundamental neglect of natural bodily needs. It is crucial to emphasize, within the scope of this thesis, that this is not merely a general health issue but also an existential one. In this context, it is noteworthy that studies now indicate obesity poses a greater health risk than being underweight (Di Cesare et al., 2016). Building on these considerations of the evolved human body, *Manuscript 1* introduces the concept of the "near-zone existence" highlighting a new

pattern of human movement shaped by an overemphasis on living in indoor, dense, and/or confined environments.

Anthropogenic environmental changes are a central theme in all the manuscripts presented in this thesis. They can pose challenges to the body, whether human or non-human, when they occur at a pace that exceeds the body's ability to adapt. Another key issue is light and its changing conditions, particularly the increase in both the radiance and extent of artificial light at night (Kyba et al., 2017; Falchi et al., 2016) and/or insufficient exposure during the day to sunlight (Alfredsson et al., 2020). Considering that the body depends on solar movements around the earth over 24 hours, there is a basic level of the evolution of the circadian mechanism that connects all living bodies. Susceptibility and vulnerability to environmental changes, such as diurnal changes in the form of day and night, applies to all living bodies "from bacteria to humans" (Bhadra et al., 2017, p. 49). Although there may be some variability due to bio-individuality, there is still a limited tolerance range for each body, as discussed in the chapter on health (*2.1.4 Ecological Balance*). According to Bhadra et al. (2017), when external cues change beyond the body's biological clock tolerance level, it can cause health issues. The authors also note that in addition to diurnal changes, there are annual changes reflected in the duration of day and night. It is important to emphasize that the consequences of altered light conditions are not yet fully understood, not only in terms of bodily functionality, but also in terms of experiential and existential consequences. For example, the paper "The loss of Sky-Blue" draws attention to anthropogenic sensory pollution, introducing a discussion on how altered light and air conditions can affect human experiential relation with the blue-sky environment.

In summary, this section has shown that the body occurs as a significant *bio-marker* for the relationship between humans and their environment. Furthermore, the body as a bio-marker is deeply linked with the existential dimension, which concerns the changing ways of living and

experiencing an anthropogenically altered environment. The designation of the project as "bio-existential" thus encompasses the body as both aa bio-marker and an existential-marker, emphasizing the inseparability of the biological and existential aspects of the body in relation to life. Within this view, the shifts in existential and experiential ways of engaging with space, movement, light, natural diversity and the sky-environment form the central themes of this thesis.

2.2.7 Philosophy of Bodies and Embodied Empathy

Building on the foundation laid in the previous chapters, this discussion will further explore the philosophy of the body through Eugen T. Gendlin's critique of certain aspects of Merleau-Ponty's approach. Gendlin's critique is articulated in his text "*The primacy of the Body, Not the Primacy of Perception"* (1992). Although the concept of a "primacy of perception" is often associated with Merleau-Ponty, it is relevant to note that this phrase does not appear in his seminal work, "*Phenomenology of Perception*" (1945/2014).[33] Nevertheless, Gendlin–a philosopher and psychologist– acknowledges Merlau-Ponty as, in a sense, a rescuer of the body, emphasizing the body as an "orienting center of *perceiving*" rather than merely being perceiv*ed* and a center of *motion*. Nonetheless, according to Gendlin, Merleau-Ponty's work on the body retains a "sensing from inside" that upholds an "internal-external orienting center of perception," thereby perpetuating a sense of separation and duality. Gendlin aims to demonstrate this persistent divide between the perceiver and the perceived. At its core, this critique of duality relates to the "primacy of perception," which, in this view, entails the separation between subject (the perceiver or "body-subject") and the world (object). To illustrate the problem of a sustained object-subject dualism, Gendlin draws a comparison between the human body and the body of a plant:

[33] See in particular in the footnote of the translator's introduction, p. 488.

"*The plant is an interaction directly with its environment, without a perceptual datum in front of itself. Its body does not first exist and only then interact. Rather, its growth and life-processes consist of environmental interaction. And our bodies also consist of such environmental interaction processes. That kind of interaction is surely prior to the having of presented perceptual data"* (p. 343). And the text goes on to explain that "*perception makes it seem that living things can contact reality only through perception. But plants are in contact with reality. They are interactions, quite without perception. Our own living bodies also are interactions with their environments*" (p. 344).

Rather than assuming that perception of the world comes first, Gendlin argues that bodily interaction with the environment precedes perception. This proposition is particularly relevant to the work presented here, as it underscores potential similarities between human and non-human bodies. Bodies, in general, do not merely perceive their environments; they *are* the environments, engaged in a continuous exchange with it. This exchange is one of meaning, where information is constantly shared. Since this meaningful interaction is ongoing, there is a continuous becoming of the body *with* its environment. This assumption is also relevant to our earlier discussion on health and well-being, particularly in relation to the body's ongoing interaction with its surroundings. It serves as a reminder that every change in the environment–whether anthropogenic or natural–affects the body and its natural history, potentially leading to its alterations that raise the question of whether these changes maintain, improve, or diminish bodily condition and health.

This perspective also connects to the broader discourse on *empathy.* In this context, empathy can be understood as arising from shared bodily interactions with the environment, grounded in our relational bodily existence. For instance, in Merleau-Ponty's later *Nature* lectures, he introduces the notion of "Einfühlung" [N, p. 209; "empathy"], describing it as standing "in a relation of *Einfühlung."* This concept of empathy emphasizes an embodied understanding that

emerges from direct, interactive bodily being with the world, rather than from a detached, perceptual stance. In this regard, Thompson extends "bodily empathy" as "the coupling of our human lived bodies with the bodies of other beings" not only to animals but also to bacteria (Thomspon 2007/2010, p. 165). Aligning with this comprehensive understanding of life as shareable bodily being, including single cells, he describes empathy as "a multifaceted experience rooted in the spontaneous and involuntarily resonance of two living bodies with each other" (p. 165).

Another important aspect of bodies is that they are inherently in motion. This motion—whether emotional or physical—can also be communicated through the body. For instance, the perception of a bird high up in the sky–can one not also feel its movement within our own body? This example can be understood better through the concept of "kinaesthetic empathy," which is especially known in the art of dance and performance art (Wood, 2016). Here, the body appears empathic to the experience of shareable movement.

What immediately follows from this is the *shared vulnerability* of bodies, which is also rooted in the fundamental fact that bodies are alive or animated (Sheets-Johnstone, 2016). The bodily comprehension of vulnerability, in this context, including bodies of plants, animals, and bacteria, can also be extended to ecosystems. For example, coastlines that are vulnerable to anthropogenic impacts are represented in so-called "vulnerability maps" (Handiani et al., 2022). Living bodies and systems of nature can be understood as vulnerability, that is "*Empfindbarkeit*" [N, p. 209], or as Gendlin describes it, "the body's self-sentience" p. 345). These concepts collectively reveal a connected level of bodies across species and systems, highlighting the idea of "interbeing" [N, p. 208].

The interconnectedness is further emphasized by Merleau-Ponty's assertion that "intersubjectivity is first intercorporality" [N, p. 273], which also brings attention to Merleau-Ponty's arguable designation of the body as subject. This raises the question of whether the

body, traditionally viewed as an object or instrument, can truly be considered a subject in the philosophical sense, particularly given the body's role in experience and perception. However, the distinction implied by these designations would reinforce the traditional object-subject dichotomy, which is intended to be shown as overcome in the context of living-lived experience.

Overall, this emphasizes the profound body-relationality inherent in all living beings and systems, suggesting that our shared vulnerabilities and experiences resonate deeply across the species boundaries and within diverse ecological contexts.

Returning to Gendlin, the main point thus far is that the "body *is* an interaction in/with the environment" rather than merely *consisting* of interactions (345). However, Gendlin also emphasizes that the body senses "our human situation" (p. 344), and "senses itself living-in its whole context-the situation" (p. 345). He asserts that the "body-sense is the situation, inherently an interaction, not a mix of two things" (p. 347). In this view, the body incorporates both the body-interaction and body-situation, perceiving more than just individual sensory information while understanding it bodily and, therefore, holistically. This suggests an implicit kind of body-knowledge, often referenced in these works, which provides an alternative to reflective and intellectual ways of gaining knowledge. *Holistic* here encompasses the knowing body as an experiencing and living whole or "the interactional whole-body by which we orient and know what we are doing" (p. 352). Gendlin argues that the body obtains implicit information about its environment by being interaction *with* it and living on with this information through functioning, moving and/or thinking (p. 350). The bodily-sense, also known as the "felt sense" in Gendlin's body therapy approach (Gendlin, 2007), plays a functional role in guiding our actions and motivating our next move. This sense is based on our "familiar bodily sense of the intricacy of our situations" (p. 346), as described by Gendlin. In other words, "[L]iving bodies imply their own next steps" (p. 349) and the "*living body is an ongoing interaction with its environment; of course, it therefore is environmental information*" (p. 349). The body's next

step, influenced by the environmental information it carries in a given situation, relates back to the aforementioned values of health and well-being, highlighting the deep and ongoing interconnection between the body and the environment.

Gendlin argues that his perspective of the body as interaction with the environment advances Merleau-Ponty's notion of bodily openness in perception, extending beyond the experience of sounds, tastes, and colors that remain in an external and thus separate world. This separation in Merleau-Ponty's understanding of bodily perception can be questioned, as shown in *Manuscript 3*, which explores a living-lived experience with the sky-blue environment. However, regarding the critique of a persistent division or duality that has not been overcome, Merleau-Ponty discusses the body in a late interview with Jean-Paul Weber, published in Le Monde in 1960. He affirms his position that "the body is both the seer and the seen, which as such is not a duality but an indissoluble unity."[34] In contrast to Fuchs' earlier connection between the hand that touches and is touched, Merleau-Ponty emphasizes unity, implying simultaneity rather than linearity or causality. This view concerns the body as a wholeness, encompassing simultaneous contributions of the phenomenal and biological dimensions. A formulation from the *Nature* lectures further elucidates his standpoint: "The experienced object is located within my bodily experience as if in a 'cocoon' (N, p. 366). This indicates that what is experienced in and with the external world has been internalized and embodied, becoming part of the bodily unity or what can be termed a "whole-body."

Finally, regarding a philosophy of the body, the concept of temporality must also be considered. In contrast to objective and measurable time, such as clock time or calendar dates, temporality broadly refers to lived time as experienced through the body. In this context, *Manuscript 1* focuses on whether and how one can experience environmental change, particularly the loss of

[34] D. Moran. The Phenomenology of Embodiment: Intertwining and Reflexivity. P. 286. In: The Phenomenology of Embodied Subjectivity. Ed. R. Thybo Jensen and Dermot Moran. 2013.

biodiversity. The concept of "living-lived biodiv[loss]" thus establishes a temporal relationship with natural phenomena rooted in bodily being and experience. Here, "living-lived" refers to a present experience that encompasses the past experiences and the future as "anticipated retrospection" [PP475]. Therefore, "presence is not locked within itself but transcends itself toward future and past" [PP483]. Merlau-Ponty refers to this as the "course of time," signifying a passage of the present into the past and a passage of the future into the present [PP476]. Noticeable here is the openness and mobility of time, also called "true time", in contrast to "constituted time" (by a detached observer), which is described as "immobile" [PP476 f.]. In relation to the dominant subject-object dualism and the alternatives to it that are developing, constituted time is found to be distinct from the "living time" described here, which refers to its relationality in the "free-floating temporality" in which the subject is time. Merleau-Ponty connects the movement of time with the *movement of life* [PP485]. Moreover, as we noted that the body is the subject for Merleau-Ponty, he further argues that "the subject is temporality," understood as the essence of "living time" (PP488]. In other words, "I am time," and everything converges in the present or presence of me as being a body–"We are always centred in the present, and all of our decisions emerge from there" [PP490].

2.2.8 Martin Heidegger and the Call for *Leib*-phenomenology

Heidegger's work is anything but known for focusing on the body. Consequently, his statement in the context of the *Zollikon Seminars* (1972) and discussions with psychiatrist Medard Boss, that "the bodily is the most difficult"[35] (p. 139), is particularly striking. The assertion that the bodily is the most difficult may refer both to its conceptualization and to its investigation, suggesting that a corresponding phenomenology of the *Leib* [phenomenal body] remains to be articulated according to Heidegger. Is this still the case today?

[35] "das Leibliche das Schwierigste ist"

This paper argues that Heidegger's assertion remains relevant today and seeks to contribute to this discourse within an interdisciplinary approach. The present work integrates the whole-body, particularly the concept of *Leib*–the living-lived dimension–as an essential part of the methodology that Heidegger helped to inspire. Heidegger identified the "*Leib*-problem" as fundamentally a "problem of method" (p. 140). He contends that natural science understands the being of things as objective, characterized by measurability (p. 128). Thus, the object–understood as "something, that stands (over) against"–is approached through measurement, which Heidegger reveals as a dominant way humans relate to the world. This measuring relationship and behavior to the object (p. 128) is employed in the natural sciences to pursue scientific objectivity. While this method can be applied to the physical body, such as in the case of an eye examination and subsequent objective diagnosis of myopia, it is not applicable to the *Leib*. It is the "*Leiben des Leibes*" as a way of existing that, according to Heidegger, resists this human measuring way of relating. He contrasts this objectifying method of "mere understanding of something as something" to his proposed method of engagement and actualization (p. 141): "*Es galt, dieses Sicheinlassens in die Seinsart, in der sie immer schon sind, eigens zu vollziehen*"[36] (p. 141). Or, "*Eigens Sich-einlassens in unser Verhältnis zu dem Begegnenden, in dem wir uns schon immer aufhalten*"[37] (p. 143). According to Heidegger, one task of phenomenology here is importantly "sich nicht Gegen dieses Sicheinlassen zu sperren"[38] (p. 143). He also views "method" as a "Weg zu uns selbst"[39], where the "I" is acknowledged as non-isolated (p. 144). It is important to note that Heidegger, in connection with his method of "engagement" (*Sich-einlassens*), also rejects the notion of the subject, which is part of the objective technique of investigation along with the object.

[36]It was necessary to specifically fulfil this acceptance of *the way of being* in which they have always been.
[37] To get involved in our own relationship to the encountered, in which we have always resided.
[38] not to shut oneself off from this engagement
[39] path to ourselves

In this sense, this work aims to understand experience, among other dimensions and modes, as a holistic concept. This possibility in the flow of various stages of experience is alternative to the common dualism of object and subject in that the experiencer is not thought and experienced as separated from the world and the experienced.

2.3 Overall Framework and Practices of Philosophical Thinking

"*No more speaketh our wisdom!*
The world now shall hear us no more.
Descend!
To Erda!
Descend!"[40]

2.3.1 The Central Role of the Body in the Bio-Existential Project

The interdisciplinary informed bio-existential project presented here consistently incorporates the body as an alternative approach to living-lived knowledge about human relationalities with ecological phenomena and environmental changes. When Heidegger suggests to complement the techniques and technologies of the scientific method with an alternative method of approaching the world through the integration of the *Leib* (see *Chapter 2.2.8*), this approach then existentially implies self-understanding of the human being. In this sense, human self-contact, including body-knowledge with oneself as well as with the environment, constitutes a revealing "bio-anthropological"[41] practice as part of the bio-existential project. *Self-knowledge is also a body practice*. In accordance with the introductory claim of a bio-experiential human crisis, this is the focal point of the topic and the opportunity for developing solutions. The body perspective is accordingly focussed on the living and thus bodily engagement as well as the necessary human capability to relate to/with others, the environment and oneself. Such a whole-body perspective must consequently also mean that "[W]e must therefore take the path to ourselves" (p. 144).[42] Here, self-knowledge or self-contact does not mean detached intellectual realization, but a *bodily practic*e integrated into life. At the same time, however, this does not

[40] Original in German: „*Zu End' ewiges Wissen!/Der Welt melden/Weise nichts mehr:-/hinab zur Mutter, hinab!* R. Wagner. Der Ring des Nibelungen. Götterdämmerung. WWV: 86D.
[41] I use the term "bio-anthropological" inspired by J. Hoffmeyer, who used it to describe positions such as those from G. Bateson that consider the "human mind as a particular instantiation of a nature that is in a deep sense itself *minded*" (p. 28). Here the term is also generally used to designate the human-nature connection and implied knowledge, while *bio*- also refers to the *organically minded body* in its rootedness in nature.
[42] Heidgger: "Wir müssen also den Weg zu uns selbst gehen."

mean occurring exclusively in the body, as this would in turn mean an intellectual-existential disconnection. But the thesis is about integrative thinking of body, mind and environment.

Notwithstanding, the body could be shown as co-active and engaged in different ways and intensities. It became evident, for example, that (inner-)bodily communication can be absent, which can lead to the problem of *reification of the body* described in various places. The physiological body appeared in detachment from the living-lived or phenomenal body, which also does not allow alive experiences with the environment and can lead to the mentioned *reification of relation* (Hoffmeyer, 2008). This refers to the philosophical and practical task addressed in these works: capturing and integrating *being a body* or *being Leib,* which substantially contributes to addressing the posed human-nature [dis-]connection problem. Only through the regeneration of humans' self-contact, achieved by re-integrating of *being a body*– as opposed to exclusively *having a body – can* a re-connection with nature in lived experience, and thereby long-term change, be realized. Consequently, an essential component of the overall method employed in these works is rooted in the living, whole human body. However, this cannot be considered in isolation from the interpretative and analytical work surrounding it. The overall approach, therefore, encompasses multiple levels of investigation, which will now be more systematically shown. In this process, the body will be further illuminated as a living method and knowledge.

(1) As Merleau-Ponty highlights, the return to the world precedes knowledge [PPix]. In the context here, this can mean that there must first be an initially lived experience with natural phenomena or environmental changes in order to be able to speak of lived or bodily co-acquired knowledge. Rather than at the level of cognition and reflection, it is necessary to first address this kind of living-lived experience and way of existence. The terms "lived" and "phenomenon" indicate a particular form of experience as well as the possible qualitative differentiation of experience in general. The explication of qualitative difference posed a particular challenge to

the research, as for example discussed in “The Loss of Sky-Blue” (*Manuscript 3*). In the work on biodiversity (*Manuscript 2),* however, experiencing biodiversity over time revealed a particular lived knowledge of nature as experienced. At this level of analysis, the terms “whole” or “holistic” became meaningful. They refer to the body as an experiencing whole, encompassing both the act of experiencing (*how*) and the experienced (*what*) within a holistically lived context or situation. Moments of lived experience can arise that are undivided –transcending the presumed boundary between inner and outer worlds–and exist within the flow of experience, free from a subject-object distinction. This represent a central theme of the investigation into human experience with natural phenomena: these moments of experience are meaningful, especially regarding their implications for human bio-existence. Although such encompassing moments can only be intermittently sustained within a continuous and diverse flow of experience, they undeniable occur. Moreover, they not only transcend the object-subject divide but also the boundary between human and non-human, revealing the potential for a non-dual existence and a broader connectedness with life.

Grasping and describing this wholeness remains the most challenging aspect of analysizing living-lived experience. Yet, it is crucial to resist the “dualistic tendency to separate subjective experiences into physical and mental categories" (Gilam et al., 2020, p. 17). Instead, it is through the *Leib* dimension that the expansion of experiential and emotional phenomena into the open world becomes possible. The dimension transcends the organic boundaries of the physical body (bio-) while remaining fundamentally anchored within

Within this bio-existential foundation, the broader context of life is revealed, as further explored in the discussion on the relationship between bodies (e.g., *Chapter 2.2.5).* This inquiry represents and ambitious effort to better understand a unity of life rooted in the body. It seeks to employ the body not only as a lived phenomenon but also as a methodological lens for achieving an integrated comprehension of existence, grounded in the fabric of lived life. By

situating the body at the center of this exploration, the analysis highlights its capacity to serve as both a foundation and a mediator of meaning. The body's inherent dual role—both as a biological entity and as a lived, experiential *Leib*—enables the integration of diverse layers of human bio-existence, providing an essential framework for understanding the interconnections between self, others, and the natural world.

(2) In a further step toward achieving an integrated understanding through the body, reflective distance must be adopted. Disambiguation and differentiation, as well as the interpretation and analysis of experience, occur at a reflective and critical distance–outside or following the immediate experience itself. One focus lies on the *how* and *being* of the lived experience, while another examines the appearances and the revealed nature of the phenomena experienced. At this stage, the situational whole and the context dependency of this experience must also be thoroughly considered.

As part of an interdisciplinary-informed analysis, the identified aspects, participants and characteristics are examined from new perspectives, enabling the formulation of novel questions. For example, research into space–specifically in connection with the bio-experiential investigation of human myopia–also paid attention to urban growth research, such as various forms of density. This analysis uncovered not only experiential implications but also interconnected relational and existential consequences in human life. A new perspective on human movement through the environment emerged, encompassing not only physical movement through space but also emotional and energetic flows within the body and in interaction with its surroundings.

The affective sciences contributed significantly to this understanding. Additionally, the phenomenological-hermeneutic methodology (see Chapter 2.3.3) was deeply integrated into this process, enabling the utilization of interdisciplinary knowledge for analysis and interpretation. By bridging disciplinary boundaries, this approach sheds light on the dynamic

interplay between human experience, bodily existence, the environment and natural phenomena.

Finally, Merleau-Ponty emphasizes the need to "familiarize us with a new genre of reflection" [PP 288]. While the translator asserts that "this new genre of reflection is, of course, phenomenology" [PPxxxi], I remain skeptical of such exclusive certainty. Although phenomenology is undoubtedly central to Merleau-Ponty's project and forms a significant part of this approach to understanding the body, it is essential to acknowledge the inherent ambiguity in the process of accessing bodily knowledge. Thus, it seems necessary to maintain openness and avoid restricting our understanding to a single method that is currently available. For further discussion, see the section on ambiguity (see *Chapter 2.3.4*).

(3) The investigation of human experience in a holistic context presents special requirements, as it must account for the consideration of distinct contributing knowledge systems, including physical (e.g., organic, biological), mental, and affective dimensions, as well as evolutionary aspects (e.g., human history, development, memory) and, crucially, environmental influences. Ultimately, all of these distinct observations and insights must be integrated into an overall perspective. This integrative effort reflects one of philosophy's core capabilities as an *all-inclusive science* with a focus on the "big picture." It represents the final stage of sense-making, where preceding levels of meaning are interpreted for a deeper understanding and integrated into a more encompassing body of knowledge. While Merleau-Ponty points toward a structural unity (e.g., *Gestalt*), empirical or experiential evidence also suggests the possibility of an explanatory unity within the life process.

The *living-lived body* offers an example of such unity, providing a form of embodied knowledge that transcends the mere aggregation of its components. However, a comprehensive exploration

of metaphysical thought and spiritual awareness—particularly in relation to non-dual being—falls beyond the scope of this thesis, despite its relevance to these themes.[43]

2.3.2 Terminological Clarity

Although the German term *Leib* may seem somewhat old-fashioned, I will continue to use it due to its historical reference of key thinkers such as Heidegger and because its re-description and re-conceptualization remain unfinished. Once this task is adequately accomplished, a more fitting termination of the complex and boundless dimension of bodily experience will likely emerge. Until then I will use "*Leib*" as well as "phenomenal body." I will also refrain from using the term "lived body," which is often cited in the literature. Instead, I will adopt the compound "*living-lived body,*" which, though more cumbersome, more precisely captures the temporality of the body. The common term "lived body" seems misleading, because it only designates the "lived" past, but not the situated but continuous present that is important here. This continuum, expressed in the present continuous tense with an integrated past tense, also encompasses anticipation and the present of the future. However, the future should not be captured grammatically alone, as this would lead to an impractical construction such as "living-lived-will-live/becoming-body." Moreover, this approach would imply a fixed future, thereby stripping it of its essential openness. Nevertheless, it must be conceived as contained within this fluidity. To summarize, it is important to maintain an openness to the contingency of life and its anticipation, as conveyed through the designated continuum and the language chosen to represent it.

Finally, a note on avoiding the term "consciousness" in this work. On the one hand, a reference to consciousness would evoke a multi-layered and differently orientated rich discourse that the scope of this work cannot do justice to. The approach here rather follows Merlau-Ponty when

[43] For such an overall intergrative approach, see K. Wilber , *Sex, Ecology, Spirituality.*

he writes, “replace consciousness with existence, that is with being in the world through a body “[PP p. 548].

2.3.3 Phenomenology and Hermeneutics

“*Wer bloß an meiner Pflanze rieche, der kennt sie nicht,*
und wer sie pflückt, bloß, um daran zu lernen, kennt sie auch nicht.”[44]

In general terms, phenomenology can be understood as the “discovery of the possibility of research in philosophy.”[45] As a research method, phenomenology is used in the present work to explore the relational human existence that is embedded in a wider world. In particular, phenomenology offers a “way of access” [SZ 35] to the being or nature of human experience and existence, which is of central interest in this thesis, especially with regard to natural phenomena and environmental changes.

However, a closer look at phenomenology today shows that it is an expanding field. This may indicate, among other things, a need for an understanding of contemporary human existence that previous approaches, such as in psychology, have not been able to capture. Yet, due to phenomenological diversification of phenomenology and the deviations from its philosophical origins, it is impossible to assume a single method or uniform way of thought and attitude. [46] This problem will be illustrated by the fact that the phenomenological terminology used is more confusing than consistent in its meaning and applications. Among the various subfields of phenomenology that have emerged in recent decades is *neurophenomenology*, which combines neuroscience and phenomenology. In its early years Varela et al. studied, for example, “momentariness” and “mindfulness/awareness practices” in experimental settings (1991/2016,

[44] F. Hölderlin, Hyperion, p. 7. English translator: “He who merely smells my plant does not know it, and whoever picks it just to learn from it does not know it either”.
[45] “Entdeckung der Möglichkeit des Forschens in der Philosophy”, cited from Heidegger’s Prolegomena zur Geschichte des Zeitbegriffs by Figal (2000, p. 36).
[46] See above all the thorough analyses by Dan Zahavi, starting with “Husserl’s Phenomenology” (2003) up to more recent works on the confusion with mindfulness discourse.

p. 72f.).[47] Or, in *microphenomenology*, phenomenologically trained interviewers lead untrained interviewees to so far inaccessible aspects of experience, which results in micro-phenomenological interviews, as described by Petitmengin et al. (2019). Both, neurophenomenology and micro-phenomenology are examples for phenomenological data production in the form of empirical first-person descriptions. Based on such information can be identified generic structures in the subjective experience and follows an analysis and assessment (Petitmenging et al., 2019).

To maintain clarity here, in contrast to such individual-psychological perspectives, or first-person perspectives, this work is more indebted to the philosophical origins of phenomenology, particularly its roots in Martin Heidegger. Although Edmund Husserl is generally regarded as the founder of philosophical phenomenology, Heidegger distances himself from his teacher. He wrote in 1917 that he could not accept Husserl's phenomenology as "a final position" (Großheim, 2021, p. 574). The Heidegger scholar Günter Figal explains Heidegger's distinction of his phenomenology from Husserl's through the "hermeneutical turn of phenomenology" (Figal and Espinet, 2011, 496f.) Hermeneutics is generally known as a science of interpretation, in which texts, for example, "could only be understood in the grand context of a philosophy of life" (Ocker, 1999, p. 329). Heidegger's "hermeneutical intuition" is adopted in the present work as "an integral possibility of life itself" and as "the very possibility of human life for understanding" (Figal, p. 496-97). With regard to understanding, Figal distinguished between two forms in the early Heidegger. On the one hand, there is "everyday understanding" where things are understood as handy in the encounter, such as Heidegger's famous hammer example [SZ69]. n the other hand, there is what Figal calls "self-understanding," described as "the essence of phenomenology as soon as phenomenology is conceived as being integrated in life" (p. 497). Self-understanding in this sense, and thus hermeneutic phenomenology, can be traced

[47] Varela, F. (1996). Neurophenomenology: A Methodological Remedy for the Hard Problem. Journal of Consciousness Studies, 3(4), 330–349).

back to *life,* which self-understanding co-integrates with the world. In Heidegger's words, we find our "*Dasein,*" his term for human existence, in the state of "being-in-the-world," [SZ72] Or more accurately, *Dasein* is an entity – the human being - while existence "designates the Being of this entity" (Slaby, p. 554). *Dasein* as Being-in-the-world has "immediate access of the world" through one's being in the world that is coupled through intuitive[48] understanding with the world. The "hermeneutic intuition" can be primarily understood as the being of Dasein (Figal, p. 499). When Heidegger connects philosophical hermeneutics with phenomenology, hermeneutics is not used as an epistemological theory of interpretation, but understanding is recognised as "non-theoretical" because it is conceived as "the very possibility of human life itself" (p. 497). This way of self-understanding of human beings in its existence must be considered in these works as a ground of the pursued bio- existential and experiential understanding.

Going deeper into phenomenological theory, Being of *Dasein* or *existence* are analysed "ontologically," in view of Heidegger's hermeneutical turn of phenomenology that is "thus supplied by an ontological turn" (p. 498). Ontology is concerned with "Being" and aims "to explain Being itself and to make the Being of entities stand out in full relief" [SZ 27]. The focus on Being in Heidegger's work "Being and Time" is distinguished from so-called everyday encounters of beings [*Seiendes*] or entities that are subject to ontic analysis. What characterises *Dasein* in its ontic constitution is its "mode of concernful engagement with its own [b]eing" [49] (Slaby, 2021, p. 554).

Heidegger articulates the "fundamental question of philosophy" about the Being of entities and ultimately the meaning of Being in general [SZ27/28]. In this respect, he criticizes historical ontology for presupposing Being instead of inquiring into it. Exactly this assumed self-evidence

[48] In Heideggers time „intution" was not further differentiated – today one could debate about child development and trained or learned skills versus, for example, „instincts" that are naturally in the sense of inheritated.
[49] Here, „*B*eing."

or scientific certainty of things and phenomena calls phenomenology into question and makes it very valuable for this work. Phenomenology is thus understood by Heidegger as a method of inquiry of Being, stating that "[*O*]*nly as phenomenology, is ontology possible*" [SZ35]. Again, it is important to emphasise the aforementioned mindfulness with regard to the different levels of analysis. On the ontic level, entities are encountered in the practical context of life as *what* they are [SZ35]. Being, however, cannot be grasped in the same way, but rather appears in the *how* of existence [SZ27]. The thesis presented is particularly concerned with these guiding how-questions, which should lead to the exploration into the essence and meaning of human experience with natural phenomena. Phenomenology also manifests here as the "science of phenomena" [SZ28], while a phenomenon is encountered in its way of "*showing-itself-in-itself*" [SZ31]. In summary, this refers to the much-quoted maxim of phenomenology "*To the things themselves!"* [SZ27]. With regard to a phenomenological approach to things or phenomena themselves, however, Heidegger also writes: "The way in which Being and its structures are encountered in the mode of phenomenon is one which must first of all be *wrested* from the objects of phenomenology" [SZ36]. A wrested object of phenomenological research in this work was, for example, "distance," which was accessed and newly explored in the mode of the phenomenon in its Being and its phenomenal structure in relation to nearness (*Manuscript 1*). The central and recurring aspect of hiddenness of existence and concealed structures of experiences of phenomena is also alluded here. However, with regard to the hermeneutic aspect of phenomenology and the philosophical practice und thinking method relevant for this work, it can be summarized that "[P]hilosophy is a universal phenomenological ontology, and takes its departure from the hermeneutics of *Dasein* [SZ 38], thus of the human being and its existence. Furthermore, the practice of interpretation is a central method for making sense of data or generating meaning from rather fragmentary findings, which, as already mentioned, can extend into the philosophy of life. In the meantime, however, the natural sciences have also recognized that their supposedly objective data or data are dependent on the interpreters

themselves, as well as the context and situation. However, there must be a different form of accessing and interpreting something like human experience and existence in the world and the knowledge gained in its immediate encounter with natural phenomena. Heidegger writes “that which shows itself is the Being of entities, its meaning, its modifications and derivatives” [SZ 35]. A part of the philosophical task in the works presented here therefore consists of finding and describing phenomena from this alternative, meaning non-objective, but phenomenological stance and attitude. Nevertheless, "the meaning of phenomenological description as a method lies in *interpretation*" [SZ37] and this understanding proceeds from *Dasein*, according to Heidegger, as the center of understanding. This is also a point that Figal’s critique and the further development of the hermeneutic-phenomenological approach addresses. According to Figal, the world is here only a “non-objective scope of being” [50] and the material world of objects on its own is missing. Figal thus follows the objective turn of hermeneutic phenomenology (p. 500) and addresses the “primary distance of the objective matter itself in relation to Dasein or subjectivity” (p. 501). Figal argues for the “independence of thingliness” and “autonomy of things” (p. 503/504), and aims to “rehabilitate the objective itself” (p. 504). This is an important aspect to consider in the phenomenological research of this work, as it acknowledges the existence of things without “their involvement in our practical enactments” (p. 504). It is further significant here that this perspective allows me to “step back from my involvement in the world, pause to reflect on” something that “stands over against” me (p. 504). This indicates a method of possible distance and reflection and “the exteriority of the objective itself” ultimately makes *theoria* possible (p. 504). *Theoria* as well as the enabling *logos* [SZ32] is an essential and unifying part of scientific phenomenological research and is emphasised as one of the different levels of investigation (see *Chapter 2.3.1*). *Turning to things themselves*, as the phenomenological maxim cited above states, then also involves being able to maintain

[50] “der ungegenständliche Spielraum des Seins”

distance and to give objects and phenomena the "*openness* in which and through which they can show themselves as themselves" (p. 504; see *Chapter 2.3.4).* The objective appears here as the "phenomenality of the phenomenon" or the "letting-be of what shows itself from itself" (p. 505). In this sense, Figal understands phenomenology even as an "intensification of hermeneutical reflection" (p. 505).

Coming back to the interpretation of the phenomenon, which is not be interpreted from *self-understanding* of an enacted phenomenon in the sense of interpreting myself from the point of *Dasein,* but "presenting the distant object itself" (p. 506). According to Figal, interpretation is *presentation* that it is "the mediated presence of something, brought about by a presenter, that is in itself given although it is not in his presence" (p. 506). Instead of understanding interpretation as through myself or Dasein, which would be a re-presentation through my understanding, here, importantly "[*i]nterpreting first means being absent oneself when letting the objective show or present itself from itself"* (p. 506). This is a central component of the method used and the understanding of the instrument of interpretation in these works.

However, the research method that shall "vividly bring the things to view, but only discuss them in as far as the things show themselves from themselves" (Großheim, p. 577), seems to be a difficult task, which leads directly to an accusation often made against phenomenology. Can there really be an independence of the experiencer from the experienced phenomena? Or if and how can humans and scientists achieve and/or maintain distance and objectivity and explore and understand the world and its objects/phenomena free from all biases and social-cultural contexts? In this respect, Heidegger wrote in the *Introduction to Phenomenological Research*, which could also be an unspoken motto of this thesis: "not unprejudiced, which is utopian […]. Not free of prejudices, but open to the possibility of giving up a prejudice in the right moment by dealing with the thing itself" (Großheim, p. 576). Or in the words of Merleau-Ponty who

famously declared in respect to the "phenomenological reduction" [51] that the "most important lesson from the reduction is the impossibility of a complete reduction" [PP14]. From this view, it was and is an important epistemological step for sciences, to recognize that it is not possible to distance oneself completely from a subjective position and from a whole context. Nevertheless, as argued above, the pursuit of an objective distance remains a valuable insight and a necessary level of thinking practice in phenomenological-hermeneutical research.

Finally, a brief turn to the phenomenon in its possibility of questioning the separation into a subject and an object. In Figal's "presenting" and "letting be" of the thing in openness there must also be a unified moment instantiated without the already reflective distance. This moment is the moment of openness in which the "thing" can show itself as itself. Here, no subject stands separated or opposite the perceived and opposite the world. Once the subject is instituted, a distance is already established and then *logos* and *theoria* follow with naming and changing and re-presenting. But it is only possible to "step back" from something in which I am "in", like an experience in openness as a subject-object independent experience. Phenomenology thus offers not only a methodological approach but also an alternative way of analyzing and integrating the lived experience and revealed knowledge or phenomenal structures. This in some ways contradicts Thompson's suggestion that phenomenology is purely "descriptive" and not explanatory. He argues that one needs a theory to explain, which he does not find in phenomenology. However, as shown here, theory is an integral component of the overall philosophical research, which is what phenomenological investigation makes possible.

[51] Also known as part of Husserl's "transcendental idealism" [PP12] and an assumed "unity of consciousness" [PP14].

2.3.4 Ambiguity and Openness of Life

"*No one is fully saved, and no one is fully lost*"[52]

The bio-existential project undertaken in this thesis is constantly challenged by the ambiguity of human existence and life itself. Merleau-Ponty described the human being, for instance, as a "*genius of ambiguity*":

"*For man, everything is constructed and everything is natural, in the sense that there is no single word or behavior that does not owe something to mere biological being – and at the same time, there is no word or behavior that does not break free from animal life, that does not deflect vital behaviors from their directions (sens) through a sort of escape and a genius for ambiguity that might well serve to define man*" [PP 230].

An unambiguous approach would imply a monodisciplinary view of human existence, particularly with respect to the body, where one either adopts a purely physical perspective rooted in biological processes or views humans and their bodies solely as cultural constructs shaped by social and historical influences. In contrast, what is considered ambiguity in this context is often framed in Western thought as a dualism between the cultural and natural realms. This dualistic perspective reflects the tension between human beings as products of both nature and culture, a conceptual separation that has shaped much of Western philosophy. However, the approach explored here seeks to extend phenomenology by considering the human body as both 'rooted in nature' and 'transformed by culture' [PP240]. In this sense, the task is to tolerate this ambiguity and also to make it more understandable within this bio-existential project, instead of conceiving it, as Hoffmeyer does, as 'two alienated sides of our existence' (1996, p. 94).

To consider ambiguity, when examining human existence and experience from the perspective of the body, is to understand the body's unity as always simultaneously 'implicit and confused'

[52] M. Merleau-Ponty, Phenomenology of Perception [PP210].

[PP240]. For example, in the 'double sensations' [PP122] the "ambiguity as touching body and as touched body" [PP124] is revealed. When I touch someone (or something), I am always touched back by the other body, be it human or non-human. At the same time, I can distance myself from it and recognize myself as part of this living-lived bodily entanglement.

Among the multiple ambiguities concerning the body is that none of the alternative or polar conceptualizations exist exclusively or 'purely' in the sense of unambiguous thinking, whether physiological or psychological, biological or phenomenal, natural or non-natural, nature or culture, genetics or epigenetics, etc. This seems to indicate a necessity of/for freedom. Therefore, Merleau-Ponty attempted to overcome the either/or alternatives by focusing on the "pre-objective" perspective and the existence of being in the world through the body [PP108]. However, as we have seen, being in the world is also characterized by ambiguity such as of biological and personal existence, which also encompasses an ambiguity of the body. Carried further, both forms – the ambiguity of being in the world and ambiguity of the body – are captured by Merlau-Ponty philosophy in the "ambiguity of time" [PP114]. They are not mutually exclusive but interwoven and the "ambiguity of time" is part of the body that is regarded as the "subject of time." This understanding of time, as *temporality of the body*, led to the development of the bio-experiential environmental concept of *living-lived biodiversity* [*Manuscript 2*]. Here, it is important to note that the "body takes possession of time and makes a past and future exist for a present" [PP286/7]. The present is essential for understanding freedom in this context. The "field of presence" or the "autistic evidentness" [PP114] of human experience is where one is one with and as body. And since "it is necessarily 'here,' the body exists necessarily 'now'" [PP174]. The body thus *lives* time and *is* time. In this way, it "presents itself as the totality of being" and can "solidify our life" [PP114]. Solidity in the present, when the body allows us to "center our existence" in the present, but at the same time "prevents us from centering it completely" [PP114]. Here is freedom offered by the ambiguity and thus the

openness of life - “so long as we are alive, our situation is open” [PP506]. The “temporal structure of our body” [PP175], which reflects the temporal structure of human experience, signifies a fundamental openness that exists in the present–an embodiment that emphasizes bodily being in the present. The passage of time in the present is simultaneously open to both the past and the future. This idea resonates with eco-phenomenological thought, which suggests that “there is no richer dimension of relationality than time” (Wood, 2001, p. 80), emphasizing an open temporal relationality.

However, freedom in relation to time, or more precisely temporality in the described sense, also implies its placelessness. As time is seen as “a movement of a life that unfolds” – because it is dynamic and living, it “has no place” [PP485]. Merleau-Ponty summarizes the so far traced idea by stating that “the ambiguity of being in the world is expressed by the ambiguity of our body, and this latter is understood through the ambiguity of time” [PP114].

Another ambiguity concerns the distinction between the inside/internal and outside/external environment and their ecological relations and interdependencies. For example, the biological perspectives can focus on the internal constitution of an organisms, such as the gastrointestinal tract, which has a system boundary[53] within and against the body and creates its own maintained milieu with its own multispecies[54] community. Nevertheless, as part of the whole-body, it also participates in the protective effects of the outer body skin towards the *Umwelt* and external conditions. Based on such more or less permeable and precarious inside-outside boundaries within an organism as well as in relation to the environment, the system must imply openness for functioning (Nielsen et al., 2020). Looking at the system of a cell, the smallest autonomous unit of life with an “internal identity” (Thompson, p. 153), life becomes even more complex. System biology can even identify life rhythms in the biological system of a cell (Goldbeter et

[53] The function of this boundary is to let nothing in and nothing out. If this function of the intestinal wall is disrupted, this can lead to diseases such as "leaky gut".
[54] See the emerging field of *multispecies studies*. E.g. van Dooren et al. 2016.V

al., 2012). Cellular rhythms, such as circadian rhythm, are coupled with external environmental factors like light. This was highlighted in the work on human myopia, concerning the light-sensitive cells of the eye (*Manuscript 1*). Consequently, in the context of anthropogenic environmental light pollution, effects can be traced back to the cellular level and thus to life processes. This is not decoupled from existential life, as such interconnections were attempted to show in the manuscript on myopia as well. These biological-existential correlations are difficult to prove, as they cannot be proven alone on the causal-scientific level, but follow more complex paths of life. Indicated here is the phenomenological distinction between the biological-organic body and its transcendence through the being of the living-lived body, which can exceed even earth's boundary, like a possible expansion impulse into the cosmic dimension.[55] For example, according to Hermann Schmitz's *new phenomenology* concerning the phenomenal body, there is a receptive expansion in the sense of opening the body "to the universe," for example when lying in the grass, and an accompanying inner bodily expansion (Schmitz, 2009, p. 76). Moreover, "cosmic expansion" is possible when, for example, by way of sensing of a "mysterious power over the cosmos" (p. 78). Accordingly, we find here a further ambiguity or polarity of the body, which Schmitz describes in general terms as the "bodily primal impulses of constriction and expansion" (p. 121). These are "combined as tension and swelling into an oscillating play" (p. 121). [56]

Another perspective often referred to in this work is that of evolutionary research, which confirms such prevalence of polar dynamics and finds polar typologies in many cultures. It draws particular attention to the intellectual activity of humans and the "tendency to resolve complex events and inputs into polar categories" (Orians, 2009, p. 274). Orians argues that the "strongly polar conceptual structure of our science" is an evolutionary legacy (p. 276), as it

[55] „The Kosmos is the unending All" (K. Wilber, p. 47), emphasizing openness. Wilber uses the term „the All" instead of the „Whole" to show the sum total of whole/parts. Therefore it is an „unending series of whole/parts".
[56] Original: „Die beiden leiblichen Urimpulse Engung und Weitung sind als Spannung und Schwellung zu einem oszillierenden Spiel verbunden".

seems the case not only for ecology, but also for philosophy. Two evolutionary explanations have been proposed for the human tendency to polarize complex inputs: “First, informational input to the brain must be reduced; second, action is fundamentally polar” (p. 275). Viewing actions and decisions as binary seems at first to contradict the complexity of life discussed above. However, it is understandable that an organism must be able to process complex information in rapid polar reactions, such as fleeing or fighting. We have also already seen how life can also be understood as a kind of continuous opponent processing. However, the appropriate human actions are not always polar-based and many decisions require more time to understand and cope with complexity. This complexity includes, for example, human emotions that affect us in a graded rather than a polar way. By participating in the process of life, we learn and accumulate knowledge and ways to navigate complexity in a reasonable way, perhaps leading to wisdom that can be described as beyond dual thinking. This is also captured when Ken Wilber writes that “[*W]isdom* knows that behind Many is the One” (2000, p. 337). In this sense, human wisdom would be different from pure reactivity and simplified dual decisions. Even more so when wisdom is united with “compassion”, which according to Wilber “sees that One is Many” (p. 337).

A final approach to the openness of life and freedom in terms of its relevance to this work is the interpretation of Heidegger’s phenomenology of human existence as a “*phenomenology of freedom*.” In this regard, Günter Figal derives the following definition from his analysis of Heidegger's work "*Being and Time*":

“*Freedom is the openness of human existence itself, the possibility of relating to a world, and thus also the openness of this world. Thus freedom never belongs to human beings alone - as if it could be localized in their thoughts and experiences - it belongs to the essence of the world in which human existence takes place*” (Figal, 2000, p. 404).

The openness referred to here can be related to life itself and also includes the human existential space of possibilities. A hermeneutic philosophy, phenomenologically intensified as described above, attempts to access such living space. In this respect the works presented here explore the existential space of possibilities by necessarily preserving freedom. Nevertheless, openness does not mean vagueness in theory and philosophical practice. Clear insights and profound understandings can also be provided against the background of maintained openness and ambiguity. In this sense, freedom as openness in thought and in the attempt to better understand life is "not only [as] an original discovery by Heidegger", but a general "*philosophical task*" (Figal, 2000, p. 405). [57]

Specifically, when exploring the existential and experiential dimension of human existence, as we have seen, openness must be maintained to follow the continuous flow of experience and life as living. This implies avoiding any final determinations, fixations, or ideological closures, allowing Merleau-Ponty to speak of "*experience beneath every ideology*" [PP265]. Such a dynamic mode of experience precedes any form of construction and must, therefore, also transcend dualistic and divisive epistemic assumptions—such as the separation of subject and object—often implicit in language.

Even if one uses the term "subject" for the body and time, as Merlau-Ponty does, this can easily give rise to the rather familiar yet misleading epistemic stance. This stance tends to focus on determinate understanding and definition, which should be avoided here, as it fails to grasp the open nature of life and cannot do justice to it. Rather than a rigid division into subject and object, a more open and processual way of thinking and interpreting is more appropriate for understanding the living and ambiguous mode of human existence and fostering the possibility

[57] "Freiheit ist die Offenheit menschlichen Daseins selbst, die Möglichkeit, sich in einer Welt zu verhalten, und damit auch die Offenheit dieser Welt. So kommt Freiheit nie allein dem Menschen zu als könnte man sie in ihren Gedanken und Erlebnissen lokalisieren -, sie gehört zum Wesen der Welt, in der sich menschliches Dasein vollzieht."

of a non-dual relationship with the environment. However, this does not prevent taking a theoretical standpoint and contemplating and studying an entity or phenomenal existence, which is just another level of inquiry in the overall framework of philosophy (see *Chapter 2.3.1*).

2.4 Nature and Natural Conditions

2.4.1 Introduction

"*Confusing speech with language is little better than calling an automobile a beep-beep*."[58]

Viewpoints that recognize humans as part of nature and thus also dependent on natural living conditions have already been addressed from an evolutionary perspective. In addition, "natural" - as opposed to anthropogenic - played a substantial role in the chapter on health and well-being (see *Chapter 2.1*ff). With regard to the Anthropocene[59], the question of how humans "fit into the natural world that produced us" (Hoffmeyer, 1996, p. 96) must be adapted.[60] Today, one may ask "how a second origin of life (building on the problem of the first origin of life) either in the form of a discovery of extraterrestrial life, life developed in a laboratory, or machines equipped with abilities previously only ascribed to living beings, will change how we understand and relate to life. (Peerson et al., 2019). With regard to such lines of questioning, or eco-theoretical debates that deny the existence of nature, and in view of a human-dominated Anthropocene, it is claimed that nature is too easily abandoned. More precisely, it is claimed that there is a connection, that nature is abandoned in thought because it is not present in lived experience and human existence either. When nature is treated exclusively in detached theoretical thinking or as a rather abstract natural service or function in political-economic contexts, this seems to promote the aforementioned reification of nature relations as well as a

[58] Hoffmeyer, 1996, p. 103.
[59] The criticism of Donna Haraway and Isaballe Stenger is heard here, but the term "anthropos" is not considered here from a power-relational or anthropocentric perspective. Rather, Anthropocene fits the central problem of the human force in the bio-existential project better than *Capitalocene* or *Chthulucen*e (Haraway, 2016).
[60] E.g., adaptation as process of adjustment to current ideas of philsophy of life.

general disconnection from nature. This can be related with the fact that nature's "benefits" are primarily preserved and maintained for the functioning of humans, while its existential well-being play a subordinate role. Although several contemporary environmental policy agendas incorporate the concepts of "intrinsic values" and "relational values" of nature (e.g., *IPBES Global Assessment*, 2019; *EU Biodiversity Strategy for 2030*, 2020; *Ecuador's Constitution*, 2008) and classify diverse values (Pascual et al., 2023), they often appear as abstract approaches and disconnected from human experience and capabilities to act differently. The issues raised are closely linked to the problem of the human-nature (dis)connection introduced at the beginning. The question now is what meaning "natural" holds in today's "human-built world" (Hughes, 2005). To this end, we will take a very brief look at theoretical and practical eco-discourses and identify relevant questions concerning the bio-existential project.

2.4.2 Real-Nature is Endangered Nature

It was not so long ago that environmental movements emerged, such as in the late nineteenth century in North America or "Victorian environmentalism" (Prendville and Haigron, 2020, p. 14ff), recognizing nature as vulnerable to human impacts. [61] In various ways and with varied intensity in both action and theory, people began to engage in the preservation and protection of nature. This can be red as continuing to today's variety of "grassroots environmentalism" dedicated to "environmental justice" and "trying to create sustainable communities" (Staggenborg, 2020). A fundamental cornerstone of longstanding efforts to conserve biodiversity is the protection of *natural space*. According to the "Protected Planet Report 2020", which assesses the state of protected and conserved areas around the world[62], approximately 15% of the world's land surface and inland waters are designated as protected areas (UNEP-

[61] For a historical overview see Pepper, D. 1996. Modern Environmentalism; for a overview of the history of nature conservation see Hardenberg et al., 2017. The nature state: Rethinking the history of conservation.
[62] It is a final report on the status of Aichi Biodiversity Target 11.

WCMC and IUCN, 2021). This is still below the Strategic Plan for Biodiversity and in particular below the 17% required by Aichi Target 11 (CBD, 2020; SDG, 2015). With regard to the discussion here about what nature still encompasses and means today, it should be noted that the main purpose of protected areas is to promote and protect *natural conditions*. For example, the complete absence of artificial light at night in protected areas, which is often not guaranteed, as is the case in one of Africa's largest protected areas (Zheng et al., 2021). It is not trivial to be reminded today that *nature* exists as nocturnal darkness. However, the "death of environmentalism" (Schallenberger and Nordhaus, 2004) was proclaimed because modern environmentalism began to view the environment as a "thing," which influenced its environmental politics, for example, becoming more interested in "selling technical solutions" (p. 217). Further criticism expressed by these authors can also be understood more generally: "The arrogance here is that environmentalists ask not what we can do for non-environmental constituencies but what non-environmental constituencies can do for environmentalists" (p. 218). Worth noting is another trend in today's environmental activism the so-called "post-apocalyptic environmentalism" (Cassegård and Thörn, 2022). In this view "catastrophic losses [are] experienced as already having occurred, as ongoing or as impossible to prevent, rather than as a future risk or threat." This is to avoid some of the concerns of the early environmentalists, which could too easily be described as "apocalyptic", according to these authors' interpretation.

In addition to the environmental movements, however, there are considerably more attempts at politicization today, including the emergence of the interdisciplinary field of *political ecology* (PE). PE combines theory and action, critically considering the social-political construction of nature, but also the interactions of *real-nature* with cultural, socio-political and/or technological factors (e.g., Escobar 1999). Debates around "neo-liberalization" of nature or "post-neoliberalism" (Yates and Bakker, 2013) occur here. PE engages with the realities of nature, particularly in relation to internationally exposed and criticized forms of unsustainable

extraction and various methods of appropriation of natural resources. For example, “green grabbing” for fuel or food (Fairhead, 2012). Nature, as part of the draining *Capitolocene*, dominated by the “technoscene” (Hornburg, 2015), has acquired the quality of a “*cheap nature,”* as it is considered a “infinite” supplier of energy, raw materials, labor and food (Moore, 2013).

Staying with the appropriation of nature, it seems to be an undeniable and revealing aspect of today's human relationship with nature, which in such contexts is often also referred to as “environmental services” (MA, 2005) and “natural capital” (Polasky and Daily, 2021). Gernot Böhme criticized the almost complete material appropriation of nature in the essay "The question of a new understanding of nature" and linked this diagnosis to a twofold human crisis **(**p. 125).[63] What is particular interesting for this work is that in addition to an “outer crisis of humans”, which concerns the relation to the “ecological crisis” (p. 127), he also identifies an *inner crisis of the human being* pertaining its relation with nature (p. 126). He speaks here of “mental deprivations,”[64] that stem from an “transformation of our environment into a total human inner world that cuts us off from the experience of 'nature out there.'"[65] This points to the human-nature[dis-]connection problem and is echoing the finding of one of the manuscripts with the identification of a dominant human existence in the *near-zone* (*Manuscript 1*). Therein, the relation with distant nature was problematized as literally falling out of human sight.

Not much seems to have changed since Böhme criticized the human material relationship with nature in 1981. A prevailing view of nature as an economic value persists and maintains humanity’s commitment primarily to global growth, as evidenced by the SDG’s (e.g., SDG 8 & 9) and the language used for “nature.” In view of the fact that the global limits to growth have been exceeded, discourses on good life beyond growth (Rosa and Henning, 2017), “post-

[63] Die Frage nach einem neuen Naturverständnis.
[64] „psychische Deprivationen“ (p. 126).
[65] “Es ist die Verwandlung unsere Umwelt in eine totale menschliche Innenwelt, die uns von der Erfahrung der ‘Natur da draußen” abschneidet” (126).

growth" (Rosa et al., 2016), or "de-growth" (Trainer, 2020) have initiated necessary critical debates here. Globally, however, a different trend seems to remain predominant. One example of the latest political-economic approach to nature is the UN framework "The System of Environmental-Economic-Accounting-Ecosystem Accounting" (SEEA EA; 2021). This framework is being acclaimed as a "historic step towards a new way of looking at and valuing nature." The framework offers an accounting approach to measuring ecosystems and their services that is grounded in real-world nature. However, there appears to be a significant gap and categorical difference in terms of approaches taken. On the UN Department of Economic and Social Affairs website, Elizabeth Maruma Mrema, Executive Secretary of the Convention on Biological Diversity, explains how this framework supposedly represents a step forward toward sustainable development: "*As governments to the Convention on Biological Diversity get ready to agree and implement a framework that will recraft our relationship with nature, this new framework will provide an impetus for an accurate accounting of the value of biodiversity*."[66] In terms of its "accurate" measuring approach of natural diversity, it is not surprising that the framework is supported by the first AI tool based on the "Artificial Intelligence for Environment and Sustainability (ARIES)" This is a "platform for rapid, standardized and customizable natural capital accounting."[67] A predominant numerical and economic measurement and valuation of incomprehensible natural diversity appears questionable and in need of supplementation with regard to the future conservation of natural diversity in terms of "sustainable" transformation. Especially when one considers the profound fact that most biodiversity has not yet been recorded and discovered (see *Manuscript 2).* The appropriate description of "incomprehensible" or intangible natural diversity, as it eludes humans and their counting and other assessment methods, points here to the open complexity

[66]https://www.un.org/en/desa/un-adopts-landmark-framework-integrate-natural-capital-economic-reporting (Accessed, 13.04.2024).
[67]https://www.unep.org/news-and-stories/press-release/un-launches-first-artificial-intelligence-tool-rapid-natural-capital (Accessed, 13.04.2024).

of natural life, including its hiddenness and invisibility. Specifically, in relation to the aforementioned area-based conservation history, the human understanding of *ecological connectivity* and a necessary interconnectedness of PAs, such as between land and sea, is relatively recent (Xiaodong et al. 2018; CBD, 2020).[68] In other words, before humans developed an understanding and methodologies for the assessment of terrestrial and marine connectivity, it was not recognized that nature necessarily requires a "well-connected" space for its health and function. Now these natural spatial conditions are being realized and addressed through efforts to conserve connectivity through "ecological networks and corridors (Hilty et al., 2020).[69] Consequently, human's limited comprehensibility of nature makes it even more difficult to "accurately" measure and assess the impacts of human destruction on nature as well as the accompanied existential consequences of processual separation from nature for humans. Therefore, the aspect of an exceeding human comprehension and uncountable hiddenness of nature and its diversity must be integrated into responsible and sustainable future decisions and actions.

2.4.3 Is Nature back in Society?

A general approach to conceiving nature in mostly anthropogenically transformed environments is a gradual presence of nature, for example, as more or less "green infrastructure" (IPCC, 2022).[70] Kahn et al. (2018), for example, using evolutionary and ecological psychology, to identify *patterns of human-nature interaction* that are categorized "along the continuum of wild to domestic" (p. 4). The "relatively wild" (Lev et al., 2020) nature seems to be increasingly re-emerging in human society, following a possible need that is worth pursuing here for a

[68] See „Protected Planet Report 2020", Chapter 8 „Well-Connected": 2012, „the science of measuring connectivity was in its infancy". https://livereport.protectedplanet.net/chapter-8.
[69] In 2020, the IUCN WCPA Connectivity Conservation Specialist Group (CCSG) published the IUCN Guidelines for Conserving Connectivity through Ecological Networks and Corridors.
[70] „*Green infrastructure* includes planted and remnant native vegetation, soils, wetlands, parks and green open spaces, as well as building and street-level design interventions that incorporate vegetatin"(IPCC, 2022, p. 2912-13).

moment. As we have already noted in relation to functional health and existential wellbeing, the increasing calls for connection with nature can draw on the extensive literature on the benefits of nature exposure and *nature therapy* (see *Chapter 2.1*ff). Furthermore, calls for "re-connecting with nature" have led to initiatives such as the *Inner Development Goals* (IDG, 2020), which aim to cultivate the human skills and capacities necessary for making progress on the SDGs (Zelenski et al., 2023). From the perspective of this thesis, connecting with nature is mediated by the human body, which is also at the centre of such observable re-wilding trends. For example, from Japan arrived the now commonly known practice of *Shinrin-Yoku,* also known as *Forest Bathing*, by "taking in the forest atmosphere through all of our senses" (Song et al., 2016). Experiencing nature through the human senses also encompasses a newly discovered desire to connect more closely with the natural soil. This apparent need is supported by footwear science and ergonomics, which recommend wearing healthy, minimalist footwear (Ararchchige et al, 2020), and emphasize the benefits of barefoot walking (Franklin et al., 2015). Furthermore, grounding techniques and *earthing the body* practices have emerged as methods to reconnect humans with the earth and heal from disconnection that can lead to altered energy levels and contribute to the epidemic of non-communicable diseases (Jamieson, 2023). Also, part of the human lifestyle concerns the evolution of the human diet, where the human body appears to be genetically incompatible with the modern diet - an idea known as the discordance hypothesis (Turner and Thompson, 2013). There is a general increase in awareness, at least in Europe and America, of organic food, that is, food that has not been treated with chemical fertilizers, pesticides and herbicides (Murphy et al., 2022). This issue is particularly significant today, given the concerning levels of Glyphosate and antibiotics present in our soils. These contaminated soils stand in stark contrast to the once-natural, healthy soils that supported the old tradition of eating soil as medicine (Aufreiter et al., 1997). Unfortunately, in the Anthropocene, such practices are no longer feasible. Additionally, emerging dietary patterns, such as the Paleo diet, which emphasize the consumption of wild foods typically consumed

during the Paleolithic period, are gaining attention as alternatives (Jönnsen et al., 2009). The fact that evolutionary eating behavior has gained immense popularity can also be read as a response to the aforementioned evolutionary mismatch diseases (e.g., *Chapter 2.2.6*), in addition to the amplifying influence of social media and economic drivers (Ruffett and Collard, 2023). Negative health and well-being consequences associated with deviations from natural behaviors are counteracted when people become aware of nighttime darkness and avoid artificial light and screen time (Green et al., 2018). This reconnection with natural rhythms, such as the circadian cycle, is seen as a potential remedy for modern health issues exacerbated by technological and societal changes.

However, the question arises as to whether these tendencies merely promote a more "natural body" in the aforementioned objective sense, reflecting societal body image (e.g., *Chapter 2.2.4*), or if the *living-lived body* is truly engaged? Does the adopted lifestyle simply serve functional health and/or ideological sustainability? Or does it signal a distinction rooted in lived knowledge, one that emerges from an active human-nature connection and also implies a more sustainable approach to the environment (e.g., using less electricity at night). Such sustainability may not stem from external pressures (e.g., media, politics), but rather from a *natural*, meaning interconnected way of living with life itself.

2.4.4 Rational-Experiential Dysbalance & Flatland Ontology

With the broad ecocritical discourse of the late twentieth and early twenty-first century up to more recent posthumanist approaches, speaking of a dead nature became popular and the concept of "nature" continues to be understood as rather outdated (Morton, 2007; Žižek 2008).[71]

[71] E.g., D. Wesling. Placing the work of Timothy Morton within material ecocritism.; S. LeMenager, T. Shewry, K. Hiltner. Environmental Criticism for the Twenty-First Century. Oxford: Routledge. 2011. Ecocriticism extends to posthumanist arguments that challenge human "exceptionalism," encompassing relations with animals, plants, machines, and/or hybrids: G. Aloi, S. McHugh. Posthumanism in Art and Science: A Reader.

Since then, the "end of nature"[72] has been extensively discussed and critiqued (Stenger, 2015; McGrath, 2019). Nevertheless, one prejudice that persists in ecocritical contexts and will now be used for further reflection is the widespread dismissal of so-called Romanticism.[73] Romanticism is frequently criticized for a supposed lack of political action or efficacy (Morton, 2007; Žižek 2008), which is then often linked to an allegedly general "romantic attitude" associated with luxury[74] and consumerism (e.g., Morton, 2000). At the same time, consumerist behaviour –describable as a "deep interest in acquiring material items" (Stearns, 2012, p. 281) – is fueled by the prevalent belief that "we have had two centuries of Romantic gushing over ennobling experiences of wilderness" (McGrath, 2019, p. 73). An so-called "romantic attitude" is simplistically associated with wilderness, pristineness, beauty and/or the sublime,[75] terms that are rarely elaborated upon and remain superficially applied. In contrast, within aesthetics, concepts of "beauty" and "pristineness" or the "sublime belong to a long and diverse tradition of critical academic discourse, where they are treated as complex and ambiguous in character and meaning.[76]

What needs to be made more transparent is a fundamental issue that this work repeatedly encounters: the mixing of different levels, such as rational or ideologically connoted judgement, with the lived experience precedes the former. Moreover, it shall be shown a dys*balance* between a scientific or intellectual attitude – expressed, for example, in ecocritical dismissal of romantic attitude – and the quality of a living-lived experience. The subject of this thesis–the

[72] B. McKibben. The end of nature.

[73] It is often unclear whether the reference is to the Romantic period—varying across art forms like literature and music, and across countries (notably Germany)—or to a general so-called romantic attitude, independent of a specific period.

[74] The attraction of/to beauty is today easily labeled as (unnecessary) material *luxury* in order to be discredited. But Romanticism, in its connection of nature and beauty, shows an evolved element of life and the natural "excess of beauty" that can be found everywhere in nature itself (Mandoki, 2015). If you want to devalue natural abundance and beauty, then you are in the cultural realm of branding or even in the ideological realm.

[75] E.g., expressed in *Sturm und Drang* (the German name for the early Romantic Movement) which links the experience of beauty wilderness and naturality.

[76] See debates around reassessing the Kantian sublime, e.g., E. Brady "The sublime in modern philosophy" (2013), the development of "Evolutionary Aesthetics", e.g., S.A. McDowall "The beauty and the beast" or a recent overview from O. Kiianlinna (2023).

living-lived experience of (natural) phenomena or bio-experiential understanding–must be shown to precede subsequent labelling and determination. Only after this living-lived experience of a natural phenomenon can it be termed "natural beauty." In other words, objectively or rational acquired knowledge (*about* something) can be found in opposition to a lived understanding *with* nature (e.g., callable *romantic attitude*).

The intellectual distance to and detachment from lived understanding hypothesised here recalls the traditional philosophical-phenomenological critique of *scientism,* which claims the exclusive authority of knowledge (e.g., Zahavi, 2004/2009). Fundamentally, a misunderstanding arises if one understands the living (romantic) experience of nature as daydreaming of natural wilderness and contrasts it as such with the supposedly higher intellectual activity of the mind. The point is not to criticize or defend daydreaming, but merely to point out a false categorical juxtaposition. I would like to expand on this. Human experience of beauty in nature is not "romantic" per se. It can be interpreted as romantic from a "outside," objective perspective. Nevertheless, beauty can also be understood as inherent to nature from an evolutionary (McDowall, 1920; Mandoki, 2015) or biosemiotic perspective (Kull, 2022).[77] In contrast to a conceptualization and experience of beauty, the argument is often raised that nature includes savage and brute life forms, and it certainly does, including humans. But the brute side of life does not change the fact that there is also what can be named and experienced by humans as "beauty." The point here is not so much to find a consensus on which expression of nature can be called "beautiful" or "wild." Rather, it is about whether and how humans can have access with nature in this sense. To this end, the concept of sky-blue beauty is established in *Manuscript 3* to capture and explore a particular living mode of experience within its varying dynamic flow. This mode of experience stands in contrast to the "blindness" of "common sense," which only perceives the sky in a limited way: "all I see is the same sky, blue or grey!"

[77]. Biosemiotics is a field of research that combines semiotics and biology.

(Žižek, 2008, p. 58/59). However, in addition to concrete access to nature and a helpful ecological awareness, it seems to require a capability or eco-relational competence that these expelled "romantics" had to possess before they could be held responsible for their overly "ennobling" experiences. A critique of over-refinement through the experience of nature is therefore the second step before the first. It overlooks the fact that a bio-existential access through a living-lived experience of natural phenomena such as wilderness is initially necessary–as is granted to the romantics–and that the in this sense understood "romantic attitude" precedes the subsequent possible determination as "beautiful."

Now, it becomes even more difficult when trying to reflect and conceptualize the moment of wholeness lived in such an experience with nature that shows no dissociation between subject and object or mind and matter – as discussed in the sky-environment manuscript. The possibility of non-dual being within living-lived experience happens before the "synthetic activity" of our mind (Žižek, p. 57). While, Žižek, for example, claims that the mind imposes the whole – like an intellectual activity – an idea – into the world. And he separates this intellectual step or activity from experience, which can, according to the rational-ego, only follow the enabling mind: "in order to be able to experience it as a well-ordered meaningful Whole" (p. 57). What kind of process is this supposed to be if the mind constructs a whole and only then we might experience a whole? This involves another reason for declaring nature dead. Nature re-presents here the idea of wholeness that does not exist or has nothing in common with real-nature. One assumes that "nature" falsely suggests safety and certainty and that humans would find protection in the arms of "Mother Earth."[78] However, according to critics such as Žižek, this protection does not exist – Žižek's actual relationship with his mother could be a contributing here - and is argued to be necessary for recognizing human beings in their autonomous responsibility, ultimately aiming to achieve human political potency.

[78] Notably, the Convention on Biological Diversity uses the phrase „Mother Earth" (CBD, 2022, p.4).

Back to the imposed wholeness through the disembodied mind (rational-ego) or the exclusive pursuit of unity through the *logos*, the mistake lies in not recognizing the possibility of a holistically lived experience *with* nature. An experienced and felt moment of non-dual being does not find this lived meaning of wholeness *given* by nature – or, as some critics similarly claim, from God. For these critics, Nature must be as "dead" as God. What is overlooked is that human beings co-create the meaning of wholeness in moments of experience *with* nature. This co-creation–which, as discussed extensively, requires a certain openness of the human body instead of our rational faculty–enables experiences of wholeness (*Manuscript 3*). If this is a *romantic skill*, then it is one we should cultivate. Furthermore, I argue that the living-lived, experiential knowledge involved offers a deeper understanding – one that comes from within – compared to abstract, dogmatic, ideological, or externally imposed political claims.

One final note on the aspect of experience and the concept of "wholeness," which carries with it a partially negative connotation. However, in this context, it does not take the "Regress Express" to a lost paradise or the idea of a simple return to "pure nature" (Wilber, 2000, p. 473). Ken Wilber offers a compelling critique here of a regressive "romantic worldview," framing it as part of a limited, dualistic perspective which he also termed "flatland ontology" (p. 442). He exposes the confusion between *dissociation,* understood as a form of alienation, and *differentiation*, which he identifies as "the necessary prerequisite for a new and higher integration (and thus a deeper and wider Wholeness)." He formulated a critique of "the Romantics" that is acceptable in this context and does not conflict with the defense of a "romantic attitude" as a competent lived experience. His critique highlights how the Romantics "took any differentiation as a sign of dissociation and fracture, a sign that a prior 'union' had been torn asunder, a sign of a *lost paradise*" (p. 471). Thus, a possible wholeness in the lived experience with the environment is assumed here, which differs from a regressive step into the past, back into a dubious unity with nature. Instead, non-dual being in the lived experience of everyday life is pursued as one possibility among different modes of experience.

The thesis presented here aims to overcome dualistic and limiting either-or thinking in favor of transcending possibilities. This rejection also explains why approaches like ecocentrism or physiocentrism, but also phytocentrism,[79] are deemed insufficient. While these approaches make valuable contributions by raising awareness against human-centred thinking and ethics, they often privilege one dimension over others or absolutize nature or the biosphere, thereby neglecting human culture or the "noosphere."[80] The limited thought of "flatland ontology," in this sense, obstructs "going *forward* to a higher but not-yet-emerged integration" (p. 471).

When Zizek writes that nature is "whose homeostasis is disturbed and derailed by human interventions" (p. 56), this disturbance can also be understood as extending to human's own sense of balance. This distorted human balance pertains not only to "science and common sense (…)," but, as demonstrated here, to the relation between abstract rational thinking and living-lived experience. It is only through such a dysbalance that one can come to "believe" that "nature is already in itself 'second nature,' its balance is always secondary" (p. 56). This belief reflects a disconnection from what can in analogy be termed first or lived nature. Ultimately, declaring nature dead also entails declaring bodily experience–and the knowing body itself–dead. This *intellectual-existential dysbalance*, as argued here, further deepens the problem of human-nature[dis-]connection central to this thesis.

In conclusion, while the mind can construct an intellectual idea of wholeness, it misses the fact that wholeness can also be *lived with the body.* Thus, mind and body are equals, neither superior to the other, but complementing one another as integral and dynamic parts of life.

[79] M. Marder. For a Phytocentrism to Come. 2014.
[80] Wilber uses "noosphere" for the dimension of the mind besides "physiosphere" (matter) and "biosphere" (life) as preliminary terms, p. 15 and p. 553.

3 The Rise of Myopia and the Loss of Distance and Expanse

3.1 Introduction

Human distance vision is in an alarming state worldwide, as evidenced by a significantly increasing prevalence of myopia, with projections that 50% of the global population being myopic by 2050 (Holden et al., 2016). The distance vision impairment, or myopia, already affects "approximately 80% to 90% among senior high school students in parts of East and Southeast Asia" (Jonas et al., 2021) and currently affects 30-50% of adults in the United States and Europe (Cai et al., 2019). To avoid over-simplification of the multifactorial condition myopia, the International Myopia Institute (IMI) provided standardized terms and definitions (Flitcroft et al., 2018), which this paper will consistently use. Therein myopia is generally defined as: *"A refractive error in which rays of light entering the eye parallel to the optic axis are brought to a focus in front of the retina when ocular accommodation is relaxed. This usually results from the eyeball being too long from front to back, but can be caused by an overly curved cornea and/or a lens with increased optical power. It also is called nearsightedness*."

Whether it is myopia due to axial elongation or the smaller proportion of myopia called refractive myopia, both are generally referred to here as myopia. This also includes different degrees of myopia, as there is currently "no agreed quantitative threshold" to distinguish them (e.g., myopia – high myopia; Flitcroft et al., 2018). However, the current critical situation of human eye health with respect to myopia cannot be explained by genetics alone (Cai et al., 2019). Therefore, myopia should also be considered as an environmental or mismatch disease (Berenbaum et al., 2018), with anthropogenically altered environmental factors playing a major role. Accordingly, the Task Force Myopia (Modjtahedi et al., 2021) points to the link between the increasing prevalence of myopia and the role of urbanization when it emphasizes that reduced outdoor exposure is a key to the development of myopia. Although the individual and combined components and interactions involved in this "outdoor exposure" are still debated,

current evidence suggested that light is a key contributor (Zhang and Zhu, 2022). Open questions relating to this issue, such as the minimum light intensity required outdoors to prevent myopia development, do not consider that, in contrast to the commonly lower light intensities indoors (Lin et al., 2023), there is often insufficient natural full-spectrum light available outdoors in urban areas as well (Alfredsson et al. 2020), e.g., due to dense development and "grey space" (Potter et al., 2023). In the context of myopia and eye health in general, open distance and spaciousness appear to be another significant environmental factor that requires more attention. Especially if one assumes a trend towards narrowing, with population density contributing to myopia being less considered here, but narrow and constricting living spaces (Choi et al., 2017). Research showed that per capita space has been shrinking in many cities (Wu et al., 2021) which can be linked to the concerning fact that myopia is more common when children live in smaller and confined housing types, or even with increasing floors (Wu et al., 2016). "Crowding" was a concept used not long ago to examine the negative psychological experience associated with not having sufficient physical space to meet one's behavioral needs (Choi et al., 1976). Human vision is an example of an inherently demanding behavior in which a narrowing development can interfere with eye care and function.

On the other hand, there are also counter-developments to a disconnection of humans from natural spaciousness, expressed in recent discourses on healthy living such as healing (Sternberg, 2009) or [enhanced] therapeutic landscapes (Völker and Kistemann, 2015), as well as bioinspiration and biomimicry (Chayaamor-Heil, 2023), which expand awareness of the potential impact of design, architecture, and the built environment on human behavior, well-being, and health. It demonstrates that the artificial separation between humans, their bodies, and natural spaciousness can be questioned, which includes the obstruction of human distant vision at issue here. Hence, an already increasingly limited space, in the sense of open and wide space, is assumed here to affect the interconnected health of humans and the environment(s) in non-obvious ways, about which myopia can inform us more.

3.2 Prerequisites for an Alternative Myopia Investigation

More holistic and situated approaches to health are also beginning to emerge in Western medicine and can be thought of as part of the possibility of a transformative paradigm shift toward planetary health (Prescott and Logan, 2019). In this regard, Heidegger spoke presciently during the *Zollikoner* seminars and his conversations with psychiatrist Medard Boss when he stated: "It would be necessary in medicine to search for the possibility of the essence of being human. If one searches for fundamentals in the causal-genetic sense, one gives away human in advance, and misses the question, what human is" (Heidegger, 2021, p. 243).[81] Without disregarding the contribution of genetics, this highlights the overall goal of the present investigation: to offer an alternative perspective on myopia, as the genetic approach alone cannot fully explain the recent epidemic trend in myopia (Dolgin, 2015). Considering Heidegger's understanding of the "ontological phenomenon" *privation* as "not being healthy" (Heidegger, 2021, p. 58) helps to conceive of the disease myopia not only as an impairment of the eyes, but as an unhealthy condition of the human body, and furthermore to include the whole human being in its coexistence with a world that also encompasses suspect environmental factors. The emphasis that one cannot adequately grasp the "essence of being sick without a sufficient determination of being healthy"[82] will provide an orienting contextual function regarding the study of the human visual experience with distant space. In addition to the functional dimension of health, it is the existential dimension that points here to the signifying and meaningful fact that vision is both a near and the most distant sense (for now) of the human being, which can reach beyond the earthly world and see the moon.

Definitions of near vision in myopia research describe visual performance of a mean near distance of less than 60 cm, and near tasks are usually performed at about 16 to 20cm (Lin et

[81] "Die Wesensmöglichkeit des Menschseins zu suchen, täte Not in der Medizin. Wenn man nach Grundlagen im kausalgenetischen Sinne forscht, gibt man den Menschen zum vorhinein preis, verpaßt die Frage, was der Mensch sei."
[82] "Das Wesen des Krankseins nicht ohne zureichende Bestimmung des Gesundseins angemessen fassen kann." (p. 59).

al., 2023). In the present investigation of myopia in existential terms, the two central spatial qualities–*nearness* and *narrowness* (e.g., here; local) and *distance* and *spaciousness* (e.g., there; global)–are defined not in numerical terms, as they are in environmental psychology. Accordingly, narrow spaces can be defined as “limited spaces that are relatively isolated from the outside world, with restricted access and poor natural ventilation” (Wu et al., 2021), which in this context includes the familiar indoor living space of a myope, even if this requires a visual aid. Spacious *spaces*, on the other hand, are “spaces with larger horizontal distance and wide range of view” (Wu et al., 2021). In terms of place, is relevant here that "[p]laces have finitude"(Gieryn, 2000) while space appears to reach into endlessness, like the sky. This allows space, or spaciousness in general, to be viewed and determined as less clearly culture-based and more humanly experienceable. Contributing to this might be that visual features such as “colour, shape, depth, and horizontal and vertical structures” are “deeply engraved in our being” (Lengen, 2015). More importantly, light must be added as a major environmental determinant of myopia (Zhang and Zhue, 2022) with corresponding differences in places or spaces. Spaces and spaciousness here are thought of more as the outside world or are based on a kind of spaciousness that at least extends into the outside world and is thus associated with brighter and more natural full-spectrum light (Ye et al., 2019).

In contrast to physical space, valuable phenomenological insights into the ways in which human/body-world/environment are intertwined can provide access to space in experiential terms with the premise that “being-in-place is a fundamental ontological structure of being human” (Seamon, 2018, p. 105), where place here always potentially extends into space and distance. Nevertheless, an exclusively phenomenological approach is avoided here, since the study of seeing and experiencing distant space and spaciousness is inseparable from the consideration of the organic body and the impaired function of the eyes.

However, in Leder's phenomenology of healing we find the notion of "lived space" that "becomes contracted and disordered" (Leder, 2022, p. 138). In myopia,[83] spatial constraints in living, experiencing, and understanding are observed, not due to physical pain, as Leder studied, but related to the physical limitation of the human eye in seeing with no distance. In reference to "lived space," therefore, the concept *living distance*[84] is used here to consider not only the eyes, but the whole human body and being in living and co-experiencing place and space sustainably over time. For the application of such phenomenological concepts of space – in contrast to, for example, architectural spatial plans that operate with measurements and units[85] - the analytical differentiation between biological and phenomenal dimensions of the human living body is required. Regarding myopia, the organ eye is part of the organic-biological body that is co-determined in its function by its coupling with the *environment.* Here we find, among others, the influential environmental factor of light that can contribute to the prevention or progression of myopia. Considering that "cognition depends directly on the body as a functional whole and not just the brain" (Thompson, 2016, p. xxvi), it is nevertheless necessary to mention the mediating brain when the eyes may be linked to mental and cognitive changes in myopia, especially in relation to light.[86] In addition, light-dependent visual processes affect human mood (Fernandez et al. 2019) and emotion regulation (Bedrosian and Nelson, 2017), extending body ecology to the phenomenal dimension of the body. The phenomenal or living-lived body[87] describes the transcendence of the biological dimension through co-created affective and emotive movements, as well as bonds with place and spaciousness, such as the experience of *living distance*. Considering that visual processing and emotional responding are closely linked,

[83] Myopia is always referred to in its uncorrected form.
[84] To the extent known, Merleau-Ponty once mentions „lived distance" [p. 299], which is modified here as „living distance" to signify the lived and thus still potent way (suatainable) of experiencing spatial distance.
[85] For example, see Merleau-Ponty's remarks on "lived space" [PP332f].
[86] *Natural* in this work for the relationship between the human body and light denotes that the body is under circadian control of the sun and the brain is considered its "master clock" (Reinke and Asher, 2019).
[87] Hereafter, "living-lived" is always used in tandem synonym with "phenomenal body" and signifies the specific temporal structure of bodily experience as *lived* past continuing in the present (sustaining) and into the future (including coming from the future).

a concrete question in this context concerns how transfer movements between the human body, such as emotions, also considered as aroused energies (Colombetti and Harrison, 2018), and the environment, such as near or distant space, are affected under myopia.

Finally, developments in sensory substitution and extension based on new findings, for example, of neuroscience (Eagleman and Perrotta, 2023) make it possible that we can now hear with our skin (Perrotta et al., 2021). This suggests that there may be extended or replaced ways of perceiving and experiencing distant space and spaciousness than with human eyes and currently known variants such as acoustic inputs, multimodal combinations, or the human imagination.

3.3 Living Distance before Calling it Distance

Focusing on a phenomenological definition of place as "any environmental locus that gathers together experiences, actions and meanings spatially and temporally" (Seamon, 2018, p. 105), "locus" seems to refer to something that is in close sight. It is more surprising then when Seamon describes the actual scope of place as ranging from a close room environment to a geographic region. The core problem with this issue of connectedness to and with place at different scales in the context of myopia seems to be the extent to which this definition of place is based on human experience derived from visual perception. For example, in their work on how urban blue space and attachment to water space contribute to health and well-being, Völker and Kistemann (2015) quote one participant: "[…] whenever I *see* the Rhine […] I feel a sense of home" (p. 202, italics added). In the attachment to urban open space, we find here how it is seeing, like the Rhine in the distance, that makes an experience of emotional bonding possible in the first place. Regarding the experience of distance, Merleau-Ponty (2014) writes in a spatial-temporal perspective, "we can only understand the perception of distance as *a being in the distance*" (p. 277). Obviously, it is not a task of running into the distant in order to be near

to it, thus demonstrating that physical presence makes physical distance impossible. Indeed, this is not trivial, since vision emerges as our most distant-reaching and expansive sense, enabling access to and experience of distance and spaciousness. The experiential engagement of the eyes in and with distance brings distance into being and unfolds as a living experience that discloses a relationship between the human being and the distant space, such as the Rhine, that can be captured by the concept of "*living distance.*" To be in the distance means to live an experience with distance (as distance) and therefore *living distance* is a specific relation made possible only through distant vision. Despite the opening role of the eyes, it is important not to conceive of them in isolation, but to see the eyes as the human body attending to this experiential call of life. Therefore, by seeing and experiencing distance and spaciousness in such a living-lived mode, the experiencer is connected in a way that involves affective and emotional processes in mutual contact encompassing a felt and lived understanding with space. The lived distance can then also stimulate more cognitive processes that add intellectual forms of experiencing and understanding to the multi-layered complexity of experience. This results in at least two human ways of experiencing space and accessing knowledge of open space, one via the living-lived experience and thus understanding, the other via intellectual-processed and thus more physically-distanced and objectified experience (up to more proceeding stages). Manifestations of these variants of spatial experiences occur less in an orderly and sequential manner, but may be interwoven within moments in the flow of experiential life.

In this respect, different qualities of visual experience – both near and distant – are already indicated here, as the distinction between "looking" and the "staring" can illustrate. For example, Heidegger understood mere "staring" as a mode of experience in which one "has-something-only-before-oneself" without an immediate understanding what one "sees" (Heidegger, 2006, p. 149). Nevertheless, it is a visual experience, though a kind of empty seeing or staring, without the living-lived mode of experience in which what is seen might change something for the experiencer. Like staring, looking is connoted when William James writes

about the experiencer as a "knower" who is "in the game, and not a mere looker-on" (James, 1878, p. 17).

However, living distance has demonstrated that "vision makes something possible" (Merleau-Ponty, 2003, p. 279), and without seeing and living distance, humans are more likely to develop affective and emotional as well as cognitive distance from the distant or non-near environment. In other words, under the precondition of near-sightedness, something like distant nature can literally fall out of human sight and thus out of human awareness and care. Consequently, "sensoriality is an investment" (Merleau-Ponty, 2003, p. 279) when we can come closer to the distant and all that is there through seeing, be it the Rhine or the Other, taking the "passage to an outside world" (Merleau-Ponty, 2003, p. 279). Here, an existential dimension of seeing near as well as distant surfaces as part of the aforementioned pursued essence of being human in visual terms, revealed through the mutual necessity of near and distant space, in which nearness –physical, emotional, and cognitive– is interconnected to and with the external and distant world. Vision as "the structure of being" (Merleau-Ponty, 2003, p. 180) therefore includes seeing near *and* far, and extends the "existential developmental task given by the call of well-being" (Galvin and Todres, 2018, p. 337) to include the necessity of distance in an existence of an overemphasized nearness. Another essential difference from a more general "experience of space" as one dimension of place appropriation among others (Völker and Kistemann 2015) is that living distance emerges and operates by virtue of the body being at its *root* – therefore, we can share this experience with others [including nonhuman *bodies*] in a more living-lived, and in this sense, less fallible way. Less filtered in the living-lived understanding of space, for example, its vulnerability or beauty, means, even though misunderstandings may arise in subsequent propositional and rational conceive-abilities, vital cues for human agency and transformative actions. In addition, not only is living-lived distance more bodily and thus more

"truly"[88] sharable between humans and non-humans, but lived understanding can also escort the experience more sustainably. A sustainable experience of space implies that it has become part of the (*lived*) past – as lived distance or spaciousness - and thus part of the memory [in the continuous present that works from and into the future].

Finally, it must be noted that living distance requires human *attention,*[89] in the sense of the visual distinction that one must first *look* in order to *see* (e.g., Merleau-Ponty, 2014, p. 241).

3.4 Human Near-Zone

In contrast to attention and awareness is the process of human habituation to the experience of place and space**,** which Merleau-Ponty (2014) describes in relation to the human body as follows: "*Places in space are not defined as objective positions in relation to the objective position of our body, but rather they inscribe around us the variable reach of our intentions and our gestures. To habituate oneself to a hat, an automobile, or a cane is to take up residence in them, or inversely, to make them participate within the voluminosity of one's own body*" (*p.* 144–45). Familiarity and lived comfort, described in such a mutual dependent way of closeness to a place and its objects, are found in additional culturally and socially shaped concepts as "home" (Völker and Kistemann, 2015) or "homeworld" (Seamon, 2018), but can also be described more existentially as a rather content-independent human "comfort zone." The space of a human comfort zone is not statically fixed, but flexible and subject to change, can shrink or expand, like the voluminosity of the body described by Merleau-Ponty. Similarly, the space of a so-called near-zone, which is introduced here for the place and space where myopes mainly reside. The space of a near-zone also seems to be flexible at first.

[88] E.g., this raises new considerations regarding the following Aristoteles-based view on sight: as the "foundation of knowledge, of memory, of experience and of truth. It also means that knowledge, memory, experience, and truth, are fundamental ways in which sight expresses itself" (Rossi, 2006).

[89] There are different reserach perspectives on visual attention and how to regulate it, for example, narrow versus broad focus of attention. E.g., Goodhew, S. The breadth of visual attention.

When attentiveness emerges within an habitual existence in the near-zone, it is likely to become more focused on near space, thereby reducing experience with and the relational, living-lived understanding *with* distance and spaciousness. Since Jaeggi describes a deficient relation as alienation[90] (Jaeggi, 2014), this can also be transferred to the description of the human relationship to distant space. Here, then, a human who is mainly or exclusively existing in the near-zone can be diagnosed as alienated from distance and spaciousness. However, there is a considerable tension between the supposedly dynamic space of nearness - in relation to distance that makes this dynamic possible in the first place - and the probable settling into one's own familiar near-zone. Seamon points to the "most intimate portion of one's own lifeworld," which tends to be experienced and lived unconsciously to the point of "lived obliviousness" (Seamon, 2018). In this context, it is interesting to hear James complain about habitual experience as *energy-less*: "as if we lived habitually with a sort of cloud weighing on us." And the author continues:

"*Compared with what we ought to be, we are only half- awake. Our fires are damped, our drafts are checked. We are making use of only a small part of our possible mental and physical resources. In some persons this sense of being cut off from their rightful resources is extreme, and we then get the formidable neurasthenic and psychasthenic conditions, with life grown into one tissue of impossibilities, that the medical books describe*" (James, 1907, p. 3)

This bio-energetic perspective may correspond to an increasing tendency for humans to live within the near-zone, a state that often goes unnoticed and unquestioned, thereby allowing the relatively diminished mode of near-existence to become a new habit and an unconscious norm of experience. To be detached or alienated from distance and spaciousness means, with James, to be cut off from space as our "rightful resource." This existential process of unnoticed loss of living experience, and thus of sustainable and sharable experience, resonates with a problem

[90] "An *alienated* relation is a *deficient* relation" p. 5.

known in environmental psychology as “Environmental [Generational] Amnesia” (Kahn, 2002) and in ecology as “Shifting Baseline Syndrome” (Pauly, 1995). Here, connections occur in terms of different modes and qualities of human experience where how something is experienced matters (e.g., *lived distance*), which also has an impact on its access to human memory, action, and responsibility with distant environments, human and non-human ecologies.

3.5 Necessity of Space for Movement of Life

With respect to the comfortable *near-zone* of the human being, we have identified a kind of necessary voluminosity of the body as relevant to the possibility of experience of distant space and spaciousness. Merleau-Ponty describes a spatiality of the body as part of the general structure of perceptual experience, which is realized against what he calls a double horizon of external space and bodily space (Merleau-Ponty, 2014). When the “spatiality of the body is an encrustation in the space of the world” (Merleau-Ponty, 2003, p. 278), this existing connection not only shows our body being situated in space, but also leads to the meaningfully affective dimension in spatial relations. In this context, it is not incidental that emotions show themselves in motion - *e-movere*-, which must also imply a level of energy that is in action and can manifest as emotion. Contemporary affective sciences brought differently charged emotional energies together with the concept of arousal: “arousal or activation are often interpreted as the amount of energy we feel we have available” (Colombetti and Harrison, 2018, p. 252). Remembering James here and his complaint about a rather energy-less, habitual state of living in which less energy is available or accessible to us. Accordingly, affective and emotional energies that arise in human-space relationships, which are interconnected and sharable, can also express the strength of and from communication with the environment, which can then be available as existential potential for further action such as “care for and attend to place” (Seamon, 2018, p.

105). Yet with the potential of moving energies of the human-space relationship, the need for space and openness is expressed in multiple ways. Activated emotions, co-constituted and lived in relation with space, emerge and are in motion and therefore require space also to distribute themselves in direction(s). In relation to the human body, these co-created energies with space can generally be conceived as directed inward and/or outward (Sheets-Johnstone, 2016). On the one hand, these movements of energies inside the body and in relation with the environment tend to occur unconsciously. On the other hand, there may be experiential contributions of these movements, which Colombetti and Harrison (2018) describe, for example, as "feeling aroused during an emotion often involves the experience of wanting to move one way or the other." However explicitly these mobile energies of the being-body-space connection are expressed in an individual, it requires *sufficient space*, and in this regard two interconnected characteristics of movement become apparent:

1) Movement (e.g., vision, emotion) needs space and thus distance and spaciousness to emerge and unfold/evolve
2) Movement (e.g., vision, emotion) simultaneously co-creates and generates bodily as well as external space

We have already seen how external space emerges in living distance, carried by the phenomenal body in its described affective and emotional extensibility into spaciousness. The required bodily space for and of movement, however, does not comprise the phenomenal body alone, but is in an open dialogue with the organic space. A substantial influence of the physical body space can be further illustrated by "Spacious Medicine," a field of body therapy, when it comes to concretely loosening and widening the human body in its spatiality (Liss et al., 2009). Practices on the physical body, such as the living tissue and fascia, can open the body and create more space for experiencing and feeling oneself as well as the world. This echoes James' quote about life withdrawing into the "tissue of impossibilities", whereas the point here is to literally awaken the tissue of the body to life and open and unlock its possibilities. For example, when

seeing and lively experiencing the spacious sky – phenomenal-organic body is in the opened *living mode* – this space can resonate as felt spaciousness (or living distance) within an open human body. The organic or biological as well as the phenomenal body are therefore differently equipped in their (never definite) capacities of and for movement, but nevertheless appear here as mutually nourished and widened with distance and spaciousness.

In addition, there is a tendency toward spatial narrowing, as urban intensification means that one encounters predominantly *grey space*, which is "largely made up of impermeable and hard surfaces such as concrete and tarmac" (Potter et al., 2023). Such built environments can be visually restrictive and therefore affect human health in terms of eye care and function, as evidenced by myopia. However, despite the abundant evidence of nature's positive contribution to human health (Sullivan and Kaplan, 2016; Jimenez et al., 2021), and the recognition of open green spaces in this context, the WHO report on green space and health (2016) acknowledges that the specific aspect of green space *size* remains insufficiently studied and poorly understood. From an eco-relational standpoint, environments are not merely viewed as isolated, objective properties existing independently of the perceiver. Rather, they are interconnected with the perceiver (e.g., through visual capability in the distance), with their affordances and possibilities enabling the act of reaching and being reached. One such perspective is the affordance approach, which suggests that the nature of an environment changes when its potential for action is considered. As noted by Meagher and Marsh (2016), "[r]esearch found spacious environments offer more affordances (opportunities for action), and conversely, narrower environments should offer fewer affordances from an ecological psychology perspective." This perspective helps illustrate how "human well-being and place [and space] well-being each afford the other" (Seamon, 2018, p. 108).

3.6 Living in a Non-Dynamic Near-Zone and a Change of Movement

Considering that humans are myopic and exist predominantly in the near-zone, it has been shown that access to visual and thus experiential, emotional and cognitive meaningful involvements and extensibilities with distant space and spaciousness tend to be absent, while nearness and near-being are much more emphasized in this process. The ontological structure of "human-being-in-place" mentioned at the beginning could then be modified for myopia as "being-in-near-place." Yet this "being-in-near-place," involving a deficient exchange up to alienation from distance, is not a sufficient description of myopic existence in terms of movement as change of place and space. The subsequent claim here is that nearsighted existence, which lives and relates predominantly in nearness, moves trough the world and environment without changing place, in the sense of remaining in its kind of closed near-zone. Human locomotion through space, in this case, is with and within this familiar near-zone, where the same "being-in-near-place" persists and is maintained, even if and where the near-zone existence "moves."

Again, the quality of experience can be stressed, because of course there is bodily contact and exchange with the external world also in the near-zone, where, for example, breathing and looking operate. But the question remains – see the difference between staring/looking and seeing - whether the distant world is perceived visually and to what extent one can speak of a living-lived and thus relational experience in this respect?

Important to emphasize that this everywhere near-zone being is not referred to here as rootedness in one's identity, or "self," or body center (e.g., *hara)*, although they can all contribute to a bodily and embodied experience. What is at issue here, however, is the existential and undifferentiated structure of a dominant living in nearness and being in the near-zone. For human movement in this context, it can be consequently stated that it only means to move with and within the own near-zone - detached from distance and spaciousness - to another

geographical point in space. Regardless of whether it is physical movement through space or a energised bodily feeling, one never gets out of the intimate and familiar, yet restrictive and deficient nearness.

3.7 Explosive Energies

Galvin and Todres' (2018) comprehensive concept of well-being includes, among others, the aspect of *mobility*, which not only stresses "a sense of moving into wider horizons," but the authors aiming here at "the essence of mobility." Which lies: *"in all the ways in which we are called into the existential possibilities of moving forward with time, space, others, mood and our bodies. We could say that it is a kind of Eros or energy that can give a feeling of flow, a sense of aliveness and vibrant movement*" (p. 324). This forward-moving energy seems to contradict the earlier description of a new structure of movement in near-sightedness and its being in relative persistence and closedness towards distance and "wider horizons," even in "moving" through the world. Life energy such as emotions and perception are inevitably tied to movement and, as we have seen, to the necessity of space. But the level of energy available to us varies, as seen above about emotional distance and activated emotions, where James spoke of feeling more or less alive.

For a human being experiencing and existing predominantly in the near-zone, the questions arise whether and how the existential calling is perceived (e.g., seen) in such a kind of closed near environment and whether a "incarnate sense of vitality" (p. 335) moves and to where? Or in other words: how may these energies and movement motivations alter in a near-zone existence? There is the reference that emotion "literally means an outward movement" (Thompson, 2007, p. 363) – which brings it back to the energetic perspective and the emotional energies discussed moving inward and outward in relation to the body. If emotions move outward, but that outward space tends to be closed off or simply absent in experience, then

emotions can linger inside and be directed within. Energies cannot dissolve into “nothingness,” but in this case might build up an internal pressure. For the necessary balance control of the body-environment system and its healthy range of function, the biological regulation processes of homeostasis (Billmann, 2020) and allostasis (Sterling, 2011) apparently are not sufficient here. Rather, they must be extended here to include the condition of space, such as distance and openness, for movement capacity. This refers back to the well-being and health of human vision, where space was shown essential for alternation between near and distant vision.

3.8 Conclusions and Outlook

This study uncovered, described, and critically questioned structures and components in human space experience and understanding under myopic conditions. The particular focus was on distance and spaciousness with the rationale of initiating a discussion of their current status in a supposedly narrowing world, culminating in their absence from human experiential life-space. During the study, the human *near-zone* was identified as a marker of *existential dysbalance* because it overemphasizes living and experiencing in nearness while detaching and alienating from distant space and spaciousness. When distant space falls literally out of human sight, it appeared that an affective and emotional as well as cognitive distance develops toward it, with demonstrated consequences for the interconnected health of humans and environment.

In addition, a corresponding new movement tendency in human existence by inhabiting the *near-zone* was uncovered, one that increasingly closed off from distant space and the wider environment. The living-lived experience of space was conceptualized as *living distance*, which has the potential to bridge distance and, through the lived understanding of space or distance. In this context, open distance and spaciousness were shown to be a necessary complement to nearness in various ways. A potential area of future research is the study of dys/balance and the understanding of “sufficient” alternation between the interconnected realms of nearness and

distance, not only in visual experience but in relation to human bio-existence more broadly. This is where space-human planning becomes relevant, as the architecture of the living body intersects with architecture and design that consider and create human habitats, thus fostering healthy living conditions. Consequently, the fundamental and sensitive question arises: what do we mean by “sufficient space” for humans in terms of their future existence? This question is especially crucial when recalling the initial, orienting inquiry regarding the “sufficient determination of being healthy,” which extends beyond mere visual considerations.

4 Changing Nature and the Living Experience of Biodiversity Loss

"Die Objektivität des Objekts Natur bestimmt sich nach Art der Wißbarkeit die das erkennende Subjekt hinsichtlich seiner selbst besitzt."[91]
(Heidegger. Zollikoner Seminare)

4.1 Introduction

According to the United Nations Convention on Biological Diversity, biodiversity refers to "the variability among living organisms from all sources including, inter alia, terrestrial, marine and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species, between species and of ecosystems" (CBD, 1992). Acknowledging that there is no consensus on the definition of biodiversity among scientists, this definition orients the following thinking, that living organisms exist in interrelationship with each other and within dynamic and interrelated ecosystems. Today, any discussion of biodiversity is inseparable from its rapid loss with an unprecedented rate of species extinction that "is now as much as 100 times that of the 'normal rate' throughout geological time."[92] In contrast to background extinction prior to humans (Pimm et al., 1995), there are now numbers presented in literature with rates of extinction that are up to 1000 times and higher (Pimm et al., 2014). The evident biodiversity-crisis (Driscoll et al., 2018) indicates that the "planetary boundary" for biodiversity loss has globally been transgressed (Rockström et al., 2009, Mace et al., 2014), even if the rate of biodiversity loss varies across species groups and regions. In the following, the intercoupled existence of actual conditions, the process of change and loss through past, present, and future states of earth's biodiversity will be referred to as "Biodiv(loss)." The concept of Biodiv(loss) applies to Earth's biodiversity on macro- and microecological scales,

[91] English translation: „The objectivity of the object nature is determined by the kind of knowability that the recognising subject possesses with regard to itself." (p. 140).
[92] Gerardo Ceballos, Paul R. Ehrlich. 2018. The misunderstood sixth mass extinction. p. 1080.

which implies not only outer-biodiversity of natural ecosystems, but also inner-biodiversity of human ecosystems such as the human gut microbiome (Simpson et al., 2021).

First, this work presents some general scientific assessments and measurements of outer-biodiversity and its change and accompanying problems. By means of a selection of recent scientific studies, the view of Biodiv(loss) in science will be outlined. To avoid a geographical bias, studies from boreal, temperate, and tropical zones were reviewed. To avoid a possible bias in terms of the considered species groups, vertebrates, insects, plants as well as microbiota were incorporated.

4.2 Measurements and Assessments of Biodiversity

Due to its spatiotemporal variations and the inherent complexity of standardization, biodiversity measurements and assessments remain a central topic of discussion within the scientific community. Fundamentally, species diversity serves as a critical variable, focusing on the numbers of species observable within a given area. This can be quantified using selected indices, such as the Shannon Winer index, which measures species richness (Magurran and McGill, 2011). However, such general indices have limitations; for instance, when all species within a community decline at the same rate, the index remains stable despite significant biodiversity loss (Buckland et al., 2005). This highlights the importance of species evenness, another quantifiable aspect of biodiversity, which reflects the relative abundances of various species in a given area. To address the limitations of single measurements and the complexities inherent in assessing changes in biological diversity, composite indices and combinations of metrics have been proposed (e.g., Buckland et al., 2005). Another measurable aspect of biodiversity is abundance, which refers to the number or density of individuals of present species within an observed or collected sample of biodiversity data (Magurran and McGill, 2011). Additionally, biomass can be used as a quantitative metric across species, while

percentage ground cover is a relevant measure for terrestrial plants (Buckland et al., 2005). These measures are primarily restricted to species- and individual-level biodiversity, often neglecting the functional and interactional aspects of ecological systems.

Biodiversity also encompasses genetic and ecosystem dimensions, such as geodiversity, which are inherently linked to species diversity (Zurell, 2022). For instance, soil microbial diversity is both shaped by and contributes to species diversity, underpinning key ecological processes and system stability. These dimensions emphasize the need for integrative metrics that account for the multi-scale complexity of biodiversity, bridging gaps between structural, functional, and compositional assessments.

Despite efforts to quantify biodiversity using diversity indices, significant differences in detectability and assessability across species groups persist. These disparities may also reflect variations in patterns of biodiversity change. For instance, notable differences exist between insect biodiversity trends (Millard et al., 2021) and those of plants (Roux et al., 2019). The latter study, which analyzed comprehensive datasets of regional and global plant extinctions, revealed accelerated extinction rates in both biodiversity hotspots and coldspots since the Industrial Revolution. However, compared to extinction rates in other taxa, the authors concluded that "the march toward extinction is slow for plants."

Nonetheless, their findings strongly suggest the existence of an undetected "plant extinction crisis." This phenomenon arises partly because plants pose unique challenges for unequivocal extinction classification. Their often-inconspicuous presence in the environment, combined with incomplete data and limited historical records, complicates assessments and highlights the need for more targeted and systematic monitoring approaches to detect and address ongoing plant biodiversity loss. However, compared with other extinction rates they stated that "the march toward extinction is slow for plants", still, there is are strong indications for an undetected "plant extinction crisis" since plants "represent a particularly challenging taxon to unambiguously claim extinction, given their often-inconspicuous presence in the environment."

Even less observable is microbial diversity and its decline, particularly in soils. Factors such as human-induced pollution, climate change, and increasing aridity exert significant but poorly understood influences on microbial ecosystems (Maestre et al., 2015). Despite this limited understanding, the catastrophic decline of insects is now starkly evident.

In the recent "Scientists' Warning to humanity" (Cardosa et al., 2020), researchers emphasized the underestimation of global insect extinction rates. Referring to the ongoing "insect crisis", the authors highlighted that insect extinctions extend beyond the loss of individual species, profoundly disrupting entire ecological networks. They stated, "Insect extinctions not only reduce species diversity, but also simplify networks, and we may be losing interactions at a higher rate than species" (Cardoso et al., 2020). This underscores the cascading effects of insect declines on ecosystem functioning, with potential repercussions for pollination, nutrient cycling, and food web stability.

In contrast, the status of vertebrate biodiversity is more prominent and verifiable. Ceballos et al. (2015) reviewed modern vertebrate extinctions, emphasizing that vertebrate extinction assessments are supported by the most extensive and reliable fossil and modern data records. However, disparities remain among vertebrate groups; for instance, while mammals have been more extensively studied, many species of reptiles and fishes have yet to be fully evaluated (Ceballos et al., 2015).

Despite these differences, plant, insect, and vertebrate diversity share a unifying characteristic: the presence of rare species. Rare species, defined by their restricted geographic range, low population density, or narrow habitat requirements, are particularly susceptible to environmental change (Newbold et al., 2020). These vulnerabilities make rare species critical indicators of biodiversity loss, as they often serve as the first casualties of ecosystem disruption. Their decline not only signals the erosion of species diversity but also foreshadows broader ecological instability, given the functional roles many rare species play in maintaining ecosystem resilience and complexity.

4.3 Biodiversity Change and Extinction in Spatial and Temporal Dimensions

Assessing the extent of biodiversity change and extinction can be approached in spatial and temporal dimensions. Anthropogenic extinction rates are of particular interest here because they illustrate the occurrence of an unprecedented temporal dimension where "species extinctions at a global scale are occurring much faster than what is 'normal' in the fossil record" (Cardinale et al., 2018). This is especially concerning due to a general agreement under scientists about "underestimating the number of species that have gone extinct in the past few centuries" (Ceballos et al., 2015). Additionally, amidst the ongoing "extinction crisis" (Ceballos et al., 2015), the focus on species extinctions as "a core process that affects the diversity of life on Earth" (Sudakov et al., 2022) serves as a key example of the challenges involved in detecting and analyzing biodiversity change in the Anthropocene. Before a species is described as extinct, there must be a temporal certainty about its loss that relates to issues of detectability which also vary over time and space. Therefore, extinction rates and numbers have been criticized for their insensitivity to gradual changes in species richness, abundance, community composition, and species distribution (Mace et al., 2014). These subtle yet critical changes, such as those observed in plant extinction processes, are vital early indicators of biodiversity loss and provide opportunities for intervention to prevent further extinctions.

This highlights another significant limitation of extinction estimates; they predominantly focus on vertebrate species, which constitute less than 2% of all described species (Mace et al., 2014). For instance, in the context of plant extinction, a comprehensive study revealed that none of the 17 globally extinct plant taxa in California were listed as endangered or extinct on the IUCN's Red List (Le Roux et al., 2019). This discrepancy underscores the inadequacy of current assessment frameworks in capturing extinction risks for less-studied taxa, particularly plants, and emphasizes the urgent need to improve representation and monitoring efforts for non-vertebrate species.

Moreover, an analysis of tropical forests biodiversity estimated a 41 % reduction in species richness within disturbed habitats compared to the undisturbed forests, projecting as looming extinction crisis in tropical regions (Alroy, 2017). In summary, not only are there hotspots of biological diversity that remain incompletely explored and described, but this limitation extends to the vast majority of Earth's biodiversity (Pimm et al., 2014). Consequently, extinction measurements often fail to account for species that went extinct or are in the process of extinction before they were ever discovered. Addressing these gaps requires incorporating estimations of extinction risks for undiscovered, rare, or undescribed species.

The studies discussed here underscore that biodiversity loss is a dynamic process occurring across spatial and temporal scales—regional and global—that remains challenging to observe, monitor, and interpret comprehensively. To effectively assess and predict biodiversity changes, driven by both anthropogenic and natural factors, robust biodiversity baseline references are essential. Ideally, such baselines should be derived from intact reference sites, offering a standard against which biodiversity changes can be measured and understood.

4.4 Biodiversity Baselines and Shifting Baseline Syndrome

Unimpacted biodiversity conditions have become increasingly rare, largely due to the dominant drivers of biodiversity decline, particularly land-use change (IPBES, 2019). As noted by Ingram et al. (2021), "(n)inety-five percent of the Earth's land surface is now modified to some degree by humans, which is likely to increase given the projected growth in human populations." This pervasive alteration of landscapes further complicates the establishment of reliable biodiversity baselines.

Bueno and Peres (2020) examined the suitability of baselines, understood as intactness of reference sites, in relation to the effects of land-use change on biodiversity. Their analysis concluded that land-use changes "almost inevitably result in species losses (i.e. decreases in

species richness).” For instance, the tropical regions, recognized as the most biodiverse on earth, experience severe biodiversity declines, where “habitat loss and land-use change had the largest impact on species richness” (Murphy et al., 2014). These changes underscore the challenge of defining baseline conditions for biodiversity, especially when historical data or intact reference sites are increasingly scarce.

Furthermore, Le Roux et al. (2019) stated that Madagascar –one of the “hottest plant biodiversity hotspots”– has a “crucial lack of data related to species extinction”. Moreover, there are critical uncertainties of additive effects on biodiversity such as interactive and combined pressures, for example, anthropogenic land-use and climate change (Newbold et al., 2018). Species richness also decrease with increasing climatic stress (e.g., Whittaker et al., 2001). This means that even if intact reference sites still exist, it is likely that their baselines are shifting. Therefore, Bueno and Peres (2020) prioritized biodiversity surveys “in the last remaining undisturbed areas of any biome to establish solid baselines prior to anthropogenic disturbance.”

In addition to the general problem of lacking unimpacted reference data, there is a fundamental gap of historical, particularly pre-industrial, data on biodiversity. This absence of pre-industrial data is compounded by the broader need for more long-term data in biodiversity research (Magurran et al., 2010). For example, the long-term study by Hallmann et al. (2017) investigated insect diversity in protected areas (PA) in Germany over a span of 27 years. The results showed a significant decline in insect biomass, with a seasonal decrease of 76% and a mid-summer decline of 82%. Despite the fact that these data originate from already protected areas, long-term time-series data are crucial for establishing (historical) baselines. Such baselines are essential for defining thresholds and values of biodiversity, enabling comparison with ongoing changes in biodiversity (i.e., Cardinale et al., 2018).

Another example of long-term studies on plant species richness comes from Denmark. Nielsen at al. (2019) documented a dramatic shift in species composition, accompanied by strong biotic

homogenization over the last 140 years. The complex phenomenon of homogenization over time (McKinney and Lockwood, 1999; Cardinale et al., 2018) can often accompany the decline of natural diversity. It has been shown to be a ubiquitous consequence of human disturbance, underscoring the underscoring the widespread impact of anthropogenic activities on species diversity across various ecosystems (Clavel and Devictor, 2011). A critical issue for misinterpreting biodiversity data in view of homogenization may occur when the problem of invasive species equals or exceeds occurring extinctions and thus species richness remains constant or even increases (Cardinale et al., 2018). Along with homogenization, an increase in dominance can also be an ecological response to anthropogenically altered environments. This phenomenon occurs because only a subset of species is capable of coping with the new conditions (Buckland et al., 2005). In such cases, although many individuals may still be present, the community may appear deceptively rich, as the dominance of a few species masks the underlying loss of biodiversity. This shift towards a few dominant species can undermine ecosystem functioning, as it often leads to a reduction in ecological complexity and the loss of important interactions among species.

The challenge of identifying suitable reference baselines for biodiversity–not only those preceding the significant impacts of agricultural industrialization, pollution, and climate change–becomes even more pronounced due to the phenomenon in ecology known as "Shifting Baseline Syndrome" (SBS) (Pauly, 1995). First drawing attention in fisheries science, SBS has been generally described as "gradual change in the accepted norms for the condition of the natural environment due to a lack of experience, memory, and/or knowledge of its past condition" (Soga and Gaston, 2018). Such a phenomenon has the potential to significantly lower the standards for biodiversity and ecosystem assessments. Degraded habitat baselines can obscure the severe impacts of biodiversity loss drivers, such as land-use change.

Bueno and Peres (2020) highlighted the shifting baseline problem at the *La Selva Biological Station* in Costa Rica, a tropical forest reserve. Only after decades of research did shifts in

community structure become apparent. This delayed recognition of ecological change has led to ongoing debates about whether *La Selva* can still be considered an "intact" tropical forest baseline. Such controversies emphasize the challenges in defining and maintaining baseline conditions in ecosystems that have been subject to long-term human influence, even in protected areas. The shifting baseline syndrome complicates the identification of reference points for ecological restoration and conservation efforts, as the perception of what constitutes a "pristine" state is altered by gradual changes over time.

However, in the presence of SBS actual ecological changes, like the decline of biological diversity, have not been perceived and experienced either in its gradual preludes or actual extent. Changes in biotic composition in a region are often accompanied or preceded by abiotic alterations in the broader environment, including shifts in weather patterns (IPCC, 2016), air quality (CBD, 2015) atmospheric conditions (Maciver, 1998), and soil quality. These abiotic changes are sometimes influenced by human activities and are partially detectable through direct human perception and experience. In contrast, phenomena like SBS reflect as lack of perceptiveness to environmental changes and the patterns or appearances of these changes over time. Lozano-Montes at al. (2008) collected local knowledge from fishing communities in the upper Gulf of California, Mexico, and linked the observed environmental shifts in baselines to a corresponding "cognitive shift" in humans. This cognitive shift refers to the way in which people's perceptions of their environment adapt over time, often resulting in an underestimation of the extent of ecological degradation. In this perspective, altered ecological states are mentally considered as "normal" by humans and continue to be normalized with subsequent changes. This normalization of degraded and homogenized ecological states challenges the ability to accurately measure and assess biodiversity changes in the Anthropocene, as well as to establish suitable baselines for biodiversity conservation or restoration, as questioned by recent research (Milhoub et al., 2017).

4.5 Environmental Amnesia and the Experience of Change in Nature

Biodiversity loss, as described through the lens of SBS and its associated challenges, is intrinsically linked to human perception, experience, and eco-relational capabilities. Soga and Gaston (2018) name three major causes of SBS: (1) lack of data on the natural environment, (2) loss of interaction with the natural environment, and (3) lack of familiarity with the natural environment. In general, all three causes stem from insufficient or divergent human experiences with nature and its diversity. This limited capacity or directedness of human experience concerning contemporary changes in nature can be described through the psychological concept of "Environmental Amnesia" (EA), identified by the environmental psychologist Peter H. Kahn as one of the most pressing and underrecognized problems of our time.

EA refers to the phenomenon where ecological changes—such as the decline of biodiversity in one's immediate environment—are not perceived or experienced in any way. Kahn's extensive research, particularly studies involving children and their interactions with nature, highlights the concerning implications of this disconnect. He concluded that successive generations are increasingly disconnected from the natural world, leading to what he terms "generational environmental amnesia." He writes:

"I think we all take the natural environment we encounter during childhood as the norm against which we measure environmental degradation later in our lives. With each ensuing generation, the amount of environmental degradation increases, but each generation in its youth takes that degraded condition as the nondegraded condition—as the normal experience. I have called this psychological phenomenon *environmental generational amnesia*" (Kahn, 2002).

The implications of EA are profound: without intentional efforts to reconnect people, particularly younger generations, to nature, humanity risks perpetuating a dangerous cycle of ecological neglect and diminished biodiversity standards.

In addition to “generational environmental amnesia,” it can be argued that, given the unprecedented pace of global changes in the accessibility and condition of nature, the initial “norm of experience” established during childhood—as far as it can be established at all—may shift multiple times within a single human lifetime. Indeed, these shifts can occur repeatedly over several decades. From this perspective, anthropogenically or naturally altered states of nature are continuously perceived as “normal” and undergo progressive normalization even within a single generation. This phenomenon could be described as *intragenerational environmental amnesia,* where the reference baseline of nature experienced in childhood gradually fades and is replaced, unnoticed, by progressively impoverished ecological states throughout an individual’s life. As a result, the ongoing degradation of ecosystems and biodiversity may become normalized, further obscuring the urgency of ecological decline and diminishing the capacity for individuals to perceive or respond to these changes.

Of particular interest is that the current changes in nature are unprecedented in their spatial and temporal dimensions, continuing to unfold within a single human lifetime. This raises critical questions about human responses to these changes, particularly in the context of phenomena like SBS and EA. It can be assumed that changes in the surrounding environment—such as gradual biotic shifts in species composition, abundance, and appearance—precede more pronounced ecological disruptions like species extinction and loss. Moreover, such gradual changes in biotic composition are often accompanied by abiotic changes, including air quality, sky appearance, soil composition and appearance, temperature, and/or climatic conditions in general, all of which can be sensorially perceptible to an observer familiar with the region. All these features of the environment, both biotic and abiotic, can partially constitute the content for human experience of nature. Therefore, we must ask how and in what ways these changes in nature’s diversity are perceived and/or hidden from human experience, as seen in phenomena like SBS and EA. In addressing this question, it is important to note that we are concerned with lived understanding, which emerges from direct living-lived experience, distinct from

knowledge gained through intellectual or cognitive actions. While we can learn abstractly from the media that biodiversity is declining, this is fundamentally different from directly experiencing the growing absence of biodiversity. The latter understanding arises from lived relationality over time.

4.6 Evolutionary Perspectives on Human Experience of Change in Nature

Taking on the evolutionary perspective for understanding fundamental human ways of interaction with a dynamic nature and environment may indicate that the sense of neglect displayed by SBS and EA is perhaps an adaptive response to cope with its change.[93] Besides, even if there is a kind of behavioural trait like "neglect," humans would still have to perceive and recognize the situation before they could respond to it, e.g., with ignorance. Human adaptation is a multifaceted as well as selective phenomenon that can be physiological (biological) and/or behavioral in the broadest sense.[94] Adaptive responses to environmental changes are often linked with (physiological, behavioural) plasticity (Church, 2010, p. 38) and display a certain (thus limited) grade of human flexibility towards the environment. Due to a "biocultural nature," SBS and EA can be interpreted as expressions of the human ability to deal with new environments. An evolutionary mismatch perspective (Li et al., 2017) says something similar, where such unawareness or inattentiveness – conscious or unconscious – to the rapid changes in nature would represent a so-called "adaptive lag". With adaptive lag humans do not anticipate the changes in their environment, instead, they seem to follow a kind of inbuilt reliance on nature, trusting its way of dynamic steadiness. An inbuilt reliance in nature and its natural rhythms like night and day or seasonal patterns that are in a way left behind from the

[93] Adaptation here in general as "process of adjustment to actual or expected" environmental changes (IPCC, 2022, p. 2898). See also *Chapter 2.1.4* on "Eco-logical Balance".
[94] See „Adaptations options" defined as „The array of strategies and measures that are available and appropriate for addressing adaptation. They include a wide range of actions that can be categorised as structural, institutional, ecological or behavioural" (IPCC, 2022, p. 2898).

passing Holocene (Rockström, 2022). This kind of trust in nature, which was as a fundamental aspect of the human-nature relationship during the Holocene, no longer functions in the Anthropocene. A closer look at evolutionary history suggests that the habitats occupied by humans have rarely provided reliable resources over extended periods; mobility, rather than stability, was the rule (Orians, 2007). However, focusing solely on such dynamics addresses only local variability. Beyond this, human can still rely on a sense of global natural steadiness, trusting in recurring environmental patterns. This trust in nature can be understood not only as a co-evolved reliance on nature's fundamental rhythms but also as a recurrent provision of "clean" air, water, and nutritious food–much like the resources provided to ancestral organisms. Therefore, the "seeds for present-day evolutionary mismatch were sewn roughly 10, 000 years ago" (Li et al., 2017). The authors argue that "human[s] evolved to consume local resources without concern when pollutant output was relatively low, populations were small, and to new locations was feasible." If such evolved psychological mechanisms and behavioral traits continue to partially drive contemporary unsustainable behaviours (De Medeiros et al., 2018), as well as phenomena like SBS and EA, it is insufficient to merely view them as adaptive failures or processes of evolutionary mismatch. These phenomena can offer valuable insights into human eco-relational capabilities through lived experience, which now shifts the focus to the human body as the origin of these bio-experiential capacities.

4.7 Ecological Health and the "Anthropocene Syndrome"

The loss of experience regarding past and current environmental conditions, coupled with the normalization of declining biological diversity–as illustrated by EA and SBS–could lead to the assumption that anthropogenically altered environmental information (i.e., artificial light, biodiversity losses, pollution) is still, in some way, appropriate or sufficient for humans. A major argument against this assumption, and against the continued efficacy of human-nature

communication (information exchange), is provided by the current state of the human health, as evidenced by the ongoing Western chronic disease epidemic (e.g., O'Malley 2020; CBD, 2015). Moreover, Prescott and Logan (2019) discuss a "non-communicable disease (NCD) crisis", which they describe as part of the "Anthropocene Syndrome". They state that "it is now clear that the origins of complex NCDs are to be found in disturbed ecosystems at both micro and macro scales." The microscale of human health, such as the "microbiota-gut-brain axis" (Simpson et al., 2021), has become prominent in what is now referred to as the "microbiome revolution," where the diversity of the human ecosystem and its biomes–and, consequently, human health–are directly related to the condition and diversity of the surrounding world (CBD, 2015). An entire report from the Convention on Biological Diversity (CBD) titled *Connecting Global Priorities: Biodiversity and Human Health* is dedicated to exploring the interlinkages and dual challenges between biodiversity and human health (CBD, 2015). Especially important is the role of soil ecosystems and their microbial diversity, which is described as "the most biodiverse habitat on Earth" (Zhu et al., 2019), representing a fundamental bi-directional pathway that connects human and natural ecosystems. An ongoing anthropogenic depletion of the soils correlates with less nutritious food leading to negative consequences for human health (Bertola et al., 2021; CBD, 2015). Additionally, declined microbial-diverse natural environments lead consequently to degraded exchange with this altered outer world where the consequences of reduced direct and indirect contact are not yet been investigated sufficiently. However, with the current increasing scientific attention to microbial worlds and their vulnerable diversity in both human and natural systems, as well as their complex and critical interactions (e.g., Geisen et al., 2018), can be drawn "a direct line from planetary to personal ecological health" (Prescot and Logan, 2019).

4.8 The Concept of Living-Lived Biodiv[loss]

The ecologist Robert Pyle warned of the "extinction of experience" (Pyle, 1993). The approach of direct or living-lived experience as a way of accessing and engaging with diverse nature, as discussed below, contrasts with ecology's more objective and quantitative approach. It also differs from ecology as a science, which originated from the observation of natural phenomena. Unlike the observations of an ecologist, living experience is not intentionally guided by predetermined objectives. While scientific measurements, like those described earlier, seek to approach *objective biodiversity*, in the realm of lived and living experience–thus of a *lived and living biodiversity*–there are initially no predefined concepts such as "biodiversity" that are closely tied to the experience. Moreover, without the scientifically distanced third-person perspective and without tools other than the human body, natural phenomena are experienced as they appear in a situation at hand. Being a bodily existence allows for living relations with the world and nature to occur and *be* – in contrast to doing anything – and this possibility is embedded in daily life. In this perspective, the human body is considered the medium of living experience and relationality with the world, and thus with nature's diversity and change. Drawing on the science of experience, particularly phenomenology, the human body is recognized in its inseparably objective as well as in its living aspects. The objective body refers to the biochemical-physical body, which includes, for example, the heart, brain, muscles, DNA, the nervous system connecting the brain and body, hormones[95], and sensory receptors both within and outside of the body that report about the environment. According to today's progress of knowledge, one must include to the physical human body also its world of microorganisms and their communities, the so-called microbiomes, and can therefore also refer to the human as

[95] The hormone of darkness, melatonin, for example, has attracted considerable interest in humans but also as ubiquitous molecule in all living organisms. For example, in plants: Zeng et al. 2022. Melatonin-Mediated Abiotic Stress Tolerance in Plants.

multi-species entity. This points above all to the importance of the vital connection between human and natural systems.

Being aware of this biological domain and its complex interrelations of internal and external environments, there is also the living/feeling or phenomenal body, which is equally in interaction with the inside and outside, and which transcends the physical body. For example, our emotions, moods, and other affective processes are fundamentally connected with the external world. They can open and direct us toward the things that matter, or conversely, close us off and shut out the world. Similarly, the perception and experience of the outside world, such as the disappearance of a particular species, can evoke emotional responses and feelings of loss. Affective states, thus invoked, are processes of the body (including the brain) interacting with the external world, simultaneously attesting to a form of body knowledge.

It is important to note that, from an evolutionary point of view, "bodies *were* there first" (Hoffmeyer, 2008)–whether as a cell-body, a plant-body, or a human-body. This suggests that *bodies know first* and possess an innate and primordial knowledge. Bodily being, then, is a way of knowing, preceding more conscious and cognitively driven processes that may later take over. However, this is not a hierarchical assertion that places the body first and the mind second. Instead, it challenges us to question: Where does the beginning lie? Rather than a linear sequence, it concerns perception within a flow of experience, within the continuum of existence, where both aspects of life condition, integrate, and differentiate continuously, shaping the future.

However, bodies can provide knowledge often overlooked due to their relationality and openness to nature's biological diversity and ongoing change. Knowing through the body can be understood in two ways, following the complementarity and interactivity of the biochemical-physiological body and the phenomenal, feeling body. The physiological body receives and responds to information from the external world, such as through signs of illness or disease. Modern studies of the human microbiome highlight the connection between our internal

microbiomes and nature's external biomes, formed through contact with, breathing, eating, and feeling nature.

Following the inside-outside complementarities described by body-philosopher Sheets-Johnstone (2016), one can understand the continuous inward and outward movements of life—like breathing or eating nature's diversity—as direct experience. In the case of the physical body, one may or may not be aware of this movement. Sheets-Johnstone, referencing Husserl, described this as a "primal sensibility of one's own body," a passive receptivity to the world. Beyond mere physical movement, an active feeling and being in one's own body is crucial for a living, direct experience that unites internal and external situations.

Thus, the phenomenal body transcends the physical body and provides the foundation for a lived and living biodiversity. In addressing the global challenge of halting biodiversity loss, a body-based approach can offer new questions and insights. The concept of "living-lived biodiv(loss)" highlights aspects of the human-nature encounter that have not yet been considered in the context of biodiversity decline. The second way of knowing the world is through this living body that I am, which is essential to our eco-relational capability, especially in the context of biodiversity loss.

4.9 Human Experience of Biodiversity and Related Challenges

Building on this line of thought, questions arise regarding the possibility of directly perceiving and experiencing something like "biodiversity." Scientists, who focus solely on objective facts, or philosophers who aim to separate biodiversity from "ordinary experience," may be skeptical. As Maier (2012) argues, "There is no sensible entity or even simple collection of entities that any person encounters in the world that *is* biodiversity or that in any straightforward way stands in for it."

It is important to clarify that this approach here does not suggest a direct or singular encounter with “conceptual biodiversity” as an object. Rather, “lived biodiversity” is understood here as a dynamic, spatial-temporal process of changes in nature’s richness, accompanied by experienceable changes in biotic and abiotic conditions over time. The key question, then, is how biodiversity and its loss can be experienced or more specifically: how can one experience nature’s richness at a pre-reflective level without any immediate concept of “biodiversity” in mind?

4.10 Phenomenological Investigation of a Particular Experience of Nature

The lived experience and first-person perspective as described here (see *Appendix 1*), encompassed several decades that build up a horizon of lived experience with nature. Based on this background, a change of natural conditions can be experienced, forming a present, total experience composed of interactive bodily –as described here in its double nature – and mental or intellectual components, all in relation with the environment. For the purposes of this investigation, the bodily emergence of experience with nature is of primary focus. Therefore, special consideration must be given to time as it is lived with and through the body, in contrast to objective time, and in participation with nature. This aligns with Merleau-Ponty’s concept of “lived time.” In contrast, objective time is abstract and countable like clock time or numbers of years, while lived time incorporates a relationality and, moreover, it is “born of my relation with things.” The experience of nature considered here as an example can be understood as lived time, which arises in the lived relation with the natural phenomena. I am lived time in the sense that I embody past time with nature. I am lived time with the nature just as I am body, as discussed above. For example, the experience of a concrete (robust) butterfly in the present recalls the lived experience of a past, bringing butterflies from a past experience into the present. In the present relational moment, past relations are called for and make it possible to experience

the change, for example, in the altered abundance of butterflies. Therefore, the actual experience becomes enmeshed with an already lived past and together, past and present, form the local situation which I experience and feel in the moment. With this significant and valuable moment, I immediately feel a loss - a loss which, after the immediate felt recognition, can subsequently be rationally understood as the recognized loss of relations with nature. This lived and felt loss arises from the experience of change in nature. It is not the result of a reflectively constituted difference between past counts of organisms and current assessments. Instead, it emerges because the lived past becomes an immediate and bodily present, felt as a form of bodily knowledge. This lived understanding may eventually lead to intellectual recognition, but it does not necessarily have to. The present horizon of lived experience of nature provides a felt sense of change out of the implied knowledge of the lived past of nature that are now part of the present. Moreover, bodily based thus lived experiencing from past and present simultaneously involves knowledge of multisensory and synesthetic awareness of the surrounding world. For example, the sounds of a lawn mower, car(s), bee(s), but also the absences of sounds of birds or insects, the burning sun and the heat, the felt calm, the smell of the air, and so on. All this complex information of and about the environment exchanging and becoming part of the flow of living and lived experience and thus of *living-lived biodiv(loss)*. That being said, the process of lived experience, as lived time with nature's changing richness, does not merely contain a past within the present, it also flows into the future. In this sense, the experience of lived nature is both retrospective and forward-looking. The lived experience of nature's change over a lifetime unfolds in the present as a manifestation of the past, while simultaneously anticipating the future. As Merleau-Ponty suggests, "prospection is anticipated retrospection." The past-present experience of lost organisms, species, and relationships with nature transcends itself into the future through lived experience.

Therefore, the lived experience of biodiversity encompasses the knowledge gained from over 30 years of direct experience, which can be seen as analogous to the long-term studies necessary

for assessing the status of biodiversity. The concept of *Living-Lived Biodiv*[*loss*], as introduced here, aims to highlight the limited perceptual and experiential nature-engagement of humans and the resulting reduction in our relational connection to the natural environment. Living-lived biodiversity challenges our experiential and eco-relational competencies by reconnecting us with our bodies as the source of relationality. In this context, a loss of biodiversity–both in the external world and within our own experiential world–is inked to a sense of isolation and enclosure within the body.[96] Therefore, the message is clear: use it or lose it.

[96] There are many body practices in therapy which start exactly here and try to re-open the body. E.g., Spatial Medicine.

5 The Loss of Sky-Blue: Changes in the Sky-Environment

5.1 Introduction

This manuscript aims to initiate a discussion on the observable changes in the sky-environment, from the possibility of increasing haziness to the persistent blurring of sky-blue that deviates from historical and seasonal dynamics. Due to the scope of the work, the concern about the loss of sky-blue to be raised here cannot encompass the pressing issues of rapid urban growth and the built environment in terms of an increasingly obstructed view of the sky. Rather, the starting place is that we still have the opportunity to perceive and experience current developments in the sky. However, an aesthetic assessment of deviation from natural environmental variability is still particularly difficult, as it must be addressed against the background of a new, human-made epoch. The beginning of the Anthropocene is unprecedented in its phenomena for which there are no aesthetic and experiential references yet. In view of a transition, it seems urgent to identify and anchor aesthetic experiences with the sky-blue environment as a baseline. The natural sciences, by contrast, have defined comparable references on the basis of the Holocene epoch, in which the Earth system was considered relatively stable and resilient and in which we humans were able to settle. This reference range of the last ~10,000 years enables the assessment of current changes of the "post-Holocene Earth," which appears to be in transition to more instability and unpredictability (Richardson et al., 2023). What this includes is the sky-environment and, in addition to the necessary measurements and objectified assessments of it through the natural sciences, attention should be drawn here to the necessary but missing integration of living knowledge through aesthetic experience with the sky-environment. This is not about placing these different approaches and knowledge systems into competition or a hierarchy, but to promote integration and constructive dialogue for the benefit of the sky-blue itself and for human's possibility of experiencing it. The statement of an *increasing loss of sky-blue* is therefore given as motivation for the needed discourse in aesthetics and beyond.

An initial question that arises is why aestheticians, who are regarded as being both practically and theoretically sensible not only to art but also to their environment, have not yet addressed the profound change of the sky-environment as claimed here. In the context of this claim, a possible lack of aesthetic and "atmospheric sensibility" (Thibaud, 2021) towards this post-Holocene environment could basically be thought of in two basic ways.

(1) Either the sky is part of aesthetic life and is experienced, but no significant changes are observed that deviate from the "familiar" and are considered worthy of discussion.

(2) Or the sky is not observed and experienced, and deviant phenomena can therefore not be recognized and discussed.

The latter case poses the more obvious initial situation that there is no necessary experiential knowledge base about the actual sky for a critical discussion, even though it is an environment shared by all. Although it may be a controversial topic, the prerequisite for an aesthetic debate is missing as long as some past and recent states of the sky have not been perceived and can hence not be considered as known or updated. So, if I want to question the current visibility of sky-blue, there must first be given actualized experiences of sky-blue and/or the absence of sky-blue. This basic but seemingly difficult prerequisite of human environmental knowledge appears to be often unfulfilled in so-called everyday life.

The first case, is the even more difficult starting point for the debate because it is obscured by supposed sky viewers. When the sky is visible to humans, experiences of change that differ from past perceptions and recognize deviating change seem possible. But assumptions about supposed "familiarity" with this environment may get in the way of really experiencing change, as well as forms of silent adaption to or acceptance of any change that are already captured in important concepts such as "shifting baseline syndrome" (hereafter SBS; Pauly, 1995) and "environmental amnesia" (hereafter EA; Kahn, 2002). SBS, for example, used particularly in ecology, is generally described as a "gradual change in the accepted norms for the condition of the natural environment due to a lack of experience, memory, and/or knowledge of its past

conditions" (Soga and Gaston, 2018). In terms of human responses to environmental changes like SBS and EA, an obvious reason for the supposed sky viewer not perceiving and experiencing deviant changes may be related to essential differences in the qualities of human experience and what can be considered living aesthetic experience. Either way, both versions indicate a lack of aesthetic knowledge of the sky-environment, and in this respect the human capacity for a living aesthetic experience is called into question here. This highlights the need to re-examine what and how a living aesthetic experience is constituted, especially in the context of a changing sky-environment that exceeds natural variation.

Nonetheless, aesthetics as an account of aesthetic life serves here as an opening into this complex topic by enabling the conception of a "*living*[97] *sky-blue beauty*" presented here as a means of better grasping and discussing contemporary changes in the sky-environment. Moreover, the philosophical questioning of the concept of "familiarity" in connection with supposed knowledge of the everyday sky can also, according to one possible argument, be seen as a reason for a non-actualized and thus unreliable experience of it. Against this background, some essential differences between a shared sky-environment as an everyday "by-product" and an aesthetic experience of the same will be identified. On the basis of the "*living sky-blue beauty,*" the experienced existence and appearance of the sky-blue can demonstrate the overcoming of the separation between the notions of "ordinary" and "extraordinary". More importantly, the "*living sky-blue beauty*" that is intrinsically connected with its lived knowledge can help to address and communicate its changes and the possible increasing absence of sky-blue, for instance, due to problems of anthropogenic sensory pollution.[98]

[97] 'Living' is chosen here instead of 'lived' because it implies both the past [lived] and the future and emphasizes the temporal continuum of this experience in its continuing activity.

[98] There are human impacts of sensory pollution across modalities such as light, noise, and chemical pollutions. E.g., Dominoni et al. (2020).

5.2 Lost Reliability of a Sky-Blue Environment and the Problem of Familiarity

"I don't have to have Faith. I have Experience."[99]

The recognition of everyday aesthetics and the aesthetic uncovering of once rather hidden and withdrawn entities and processes, from lichens and mushrooms to designed objects of the built environment such as wind turbines[100] or shopping malls, could suggest an expansion of aesthetic sensibility and awareness. In the context of the environment, aesthetics can be understood with Arnold Berleant as a "theory of sensibility" that he described as a "perceptual awareness that is developed, focused, and informed" (Berleant, 2012, p. 55).

The awareness and appreciation of celestial events, however, seems to be ancient, and still today the sky can be understood as our closest environmental reference or involvement (Heidegger, 1962/2006, p. 413). In this sense, the sky tends to be seen as one of the last natural spaces. Its naturalness originates, for example, from the fundamental sun-dependent rhythms of darkness and light, whose complex meaning for humans, non-humans and ecological processes has only recently awakened new scientific interest in the light of precarious planetary health (Haines, 2021). On closer observation, however, the sky-environment is more than a self-evident naturalness anymore, as revealed, for example, by the increasingly dense air traffic and various perceivable "signs," be they indistinct clouds, stripes, strange light formations and persistent haziness (Larson et al, 2019; Baroutaji et al, 2019). In relation with air and atmospheric pollution, which ultimately affect the integrity of the biosphere, the increase in anthropogenic aerosol loading should be taken into consideration, which is defined as one of the nine planetary boundaries (Rockström et al., 2009) that is very likely to be exceeded in some regions (Richardson et al., 2023).

[99] Campbell (1988).
[100] E.g., Saito, Y. (2004) Machines in the Ocean: The Aesthetics of Wind Farms; Gray, T-L. (2012) "Beauty or Bane: Advancing an Aesthetic Appreciation of Wind Turbine Farms.

Drawing attention to the loss of a sky-blue environment is a particular challenge since the sky is a shared everyday presence and yet it is ever-changing. The concept of "familiarity" in everyday aesthetics appears paradigmatic here for such an everyday event that *was*, *is* and probably always *will* be above our heads. However, the assumption or belief that the sky will continue its "familiar" range of appearances, including sky-blue, in the future is now questionable. The relatively reliable Holocene can refer to the natural reliability in certain patterns, dynamics and appearances of natural phenomena, which we are beginning to leave behind us. In other words, if *natural reliability* is an important precondition for what might be called "familiar" experience, it seems worth asking whether one can still "rely" on a blue sky-environment in the approaching Anthropocene. Already Soga and Gaston (2018), in the context of the above-mentioned SBS, name the "lack of familiarity with the natural environment" as a major cause of SBS. Can the human-sky relationship then still be considered a "kind of experience that is all-too-familiar to most of us" (Saito, 2007, p. 51)? Part of the aim of everyday aesthetics, according to Saito, is to "illuminate the ordinary neglected, but gemlike aesthetic potentials hidden behind trivial, mundane, and commonplace facades" (p. 51). Furthermore, she says, it is important to "nurturing this awareness of the neglected, but familiar" (p. 51). Consequently, she presents sky art as a seemingly necessary means for the possibility of an experience of the sky with a subsequent or accompanying appreciation (Saito, 2011). But when the everyday, like the sky-environment, is measured by what "stands out" and what is not "normal," it suggests that the everyday needs protection or elicitation, for example by first being classified and then experienced as *gems*. If this is meant as a legitimate critique of our neglected aesthetic awareness of the everyday it does not change the fact that the everyday realm becomes devalued because it is still measured with the attention towards the arts or the so-called "extraordinary." The sky discovered as "gem," also intending to equate it with art and thus integrating it into its sphere, nevertheless treats this realm as "superior." According to such an approach of everyday aesthetics, the extraordinary is conceived as the antithesis of the ordinary,

and as a result the two cannot exist together. More importantly, one does not do justice to the experience of the so-called everyday – like the sky-environment – because one also denies the possibility of (experientially) transgressing and leaving behind cultural products. We will see below that this is possible and that an aesthetic experience of the sky-blue beauty allows us to overcome the limiting alternative of natural *and/or* cultural aesthetic experience.

But first the question remains whether something like the sky-blue can be neglected and still be familiar, as Saito suggests. As discussed, the notion of "familiarity" has been scrutinized concerning the problem of a nowadays questionable *natural reliability* within *natural variability* such as of the sky-environment. Yet what can elucidate a supposed "neglect" of the sky? Time seems to be essential here for the experiential context, because whatever the proposition “the sky is blue” is based on, whether it was learned or experienced, it probably comes from a past. How far back this experienced past goes seems crucial for a dynamic environment like the sky. Especially if the everyday sky is assumed to be “neglected,” which is why familiarity with its appearance can easily be deemed outdated.

Nevertheless, colour philosopher John Campbell says that we can share aesthetic experiences of colour, which for him in the case of blue would describe a relationship to an external blue in which we stand, in such a way that colour is understood as “an indispensable element in our imaginative understanding of one another” (Campbell, 2021, p. 410). Importantly, such a *shared blueness* still means that your “imaginative understanding” of it “depends on your knowledge of the shared environment,” so it still requires first knowing a colour in the environment, like sky-blue (p. 418). This does not answer the question of how up-to-date the experience of such a dynamic environment must be in order to "know" it, for example, in terms of its colour or anthropogenic changes. More easily this might be the case with cultural artifacts such as human-made colours, for example, the famous *International Klein Blue* (IKB). The aim of the creation of IKB was to make the properties of a blue stable and obtain an unchanging color value and intensity (Gopnik, 2010). Of course, the perception of this IKB can also change due to external

conditions such as various light exposures and other contexts. Decay and aging are also real processes to which human artifacts are subject, although they might occur more slowly than natural decay and change. The sky, in other words, is special in that it is a very everyday environment, suggesting that humans are familiar with it while it is constantly changing, making it even more difficult to recognize any changes beyond the natural variability. However, in order to be able to further discuss a changing sky and the possible loss of sky-blue, the necessary prerequisite of an aesthetic experience and thus a lived and actualized knowledge with the sky must be given.

5.3 The Missing Central Link of the Everyday Body

"*If the Doors of Perception were cleansed [and open] then everything would be seen as it is*"[101]
Although in Campbell's philosophy of colour, as we have seen, there was the precondition that one must first know one's environment, there was no distinction of the quality or mode of such experience, but he understood experience generally as a relationship in which one stands (Campbell, 2021). For example, the sky can be co-experienced as a kind of by-product when unpacking the car, perhaps even felt in its vastness above our heads. Here it is not clear whether for Campbell this would already mean "standing in a relationship," but in our context it is not considered an aesthetic experience. By no means does this mean that aesthetic experiences cannot be made every day, on the contrary, aesthetic being is not only an essential part of life, aesthetics is life, or like Katya Mandoki discusses that "beauty is not the cause but the consequence of evolution" (Mandoki, 2015, p. 32).

Nevertheless, a living aesthetic experience of sky-blue requires the participation of the human body, which will now be examined as the *missing central link*. The participation of the body disputed here concerns an imbalance in the interplay between the activity and openness of the

[101] Jarman (2019).

organic-biological body and the *Leib*[102] with its affective dimension. The latter, he also referred to as phenomenal body, can transgress the physical boundaries towards the sky. Phenomenological research introduced this analytical separation of the human body for scientific observation and description, not to create a new artificial separation within the human being and thus establish a body-body problem (Thompson, 2007, p. 235). An attempt can instead be made to approach the complexity of the human body, which is in biochemical exchange with an environment as well as in a living and feeling exchange with the world. In respect to the *Leib,* Heidegger reminds us, for example, in his last seminars and conversations with the psychiatrist Medard Boss, that the *Leib*-dimension is the most difficult[103] and *Leib*-phenomenology is still outstanding (Heidegger, 1987/2021, p. 292). In this sense, it should be noted that the integrative consideration of the *Leib* goes beyond the mere mention of the first-person perspective and should be elaborated in more detail in the course of this work. Later, Varela et al. understandably criticized the fact that also body philosophers get stuck in theory and wrote, relevant to this work, that "one needs to be embodied to attain realization" (1991/2016, p. 233). The living aesthetic experience as the possible embodiment of a sky-blue beauty then also means the participation of both interacting and codependent bodily dimensions and not the neglect of the organic-biological aspects that phenomenology often advocates. To the best of my knowledge, this bodily encompassing cooperation has not yet been seriously considered from a phenomenological point of view and could enlighten us about so far missed body-knowledge of the human being itself as well as with the [sky-]environment. For example, material seeing, such as the sky-blue spaciousness, can co-influence *leibliche* experience, create feelings, affective processes and even actions. Here, the possibility of aesthetic experience can unfold as boundlessness in the deep and wide, spotless sky-blue, all the way to contemplation

[102] The old German term *Leib*, for which "lived body" is often used, is avoided here as temporally insufficient. As stated in the note on "living" blue-beauty, the temporal continuum of past, present and future shall be emphasized [see FN1]. As an alternative to *Leib*, "phenomenal body" is used.
[103] „das Leibliche das Schwierigste ist"

in *sensual metaphysics*. Goethe famously wrote in his '*Theory of Colours'* (1810/1948) that "we love to contemplate blue, not because it advances to us, but because it draws us after it,"[104] what also alludes to the penetrating and "almost inexpressible effect" (779) of the expansive sky-blue. The blue of the sky can draw us into its spaciousness, appear limitless and expand us on a bodily, mental and spiritual level. Moreover, the sky-blue is then also experienceable and thus understandable as "an energy" (779)[105] that corresponds to the dynamics of a natural element that can transmit its power to the experiencer. As a result, this living experience of a changing power and effect of nature, which accompanies the living and thus bodily understanding of the sky-environment, enables us to grasp the changing sky-environment in its vulnerability. Ideally, it could help to promote the preservation of this beauty for the future. Due to the scope of the article, it is not possible here to expand on related discourses on empathy and intersubjectivity (e.g., Zahavi, 2009) that would assist in better conceptualizing such *lived vulnerability* of the [sky-] environment.

Another possible bodily-active and thus living experience, by contrast, would be the aesthetic disappearance of the wide blue sky-environment, which can carry feelings of loss, such as the loss of freedom. Concerning freedom in relation to the concept of the "everyday" discussed earlier, Varela et al. have written something very essential that is worth quoting in full:

"*Freedom is not the same as living in the everyday world conditioned by ignorance and confusion; it is living and acting in the everyday world with realization. Freedom does not mean escape from the world; it means transformation of our entire way of being, our mode of embodiment, within the lived world itself*" (p. 234).

[104] „so sehen wir das Blaue gern an, nicht weil es auf uns dringt, sondern weil es uns nach sich zieht." (Goethe, 1810/1948, 781).
[105] „Sie[blau] ist als Farbe eine Energie" (779).

To further pursue the living aesthetic experience of the sky-environment as a prerequisite for the intended discussion, including the missing central link of the interplay of the human body, the focus will now be on *sky-blue beauty* and some related requirements.

5.4 Atmospheric Life and Sky-Blue Beauty

"Blue transcends the solemn geography of human limits"[106]

Starting with the sky as a by-product in the flow of everyday experience–such as when unpacking the car parked under the sky–the bodily sense organs, like the eyes, are at work. The eyes may briefly glimpse the sky, but a true aesthetic experience of it does not seem to be constituted in such goal-oriented scene. In such everyday situation, it is generally assumed that the time required for an attentive gaze and the body's engagement to experience the world, such as the sky, would be too long compared to the more reflexive reactions and information reception from the close environment (Deisseroth, 2021, p. 67). If experiencing the sky requires awareness,[107] aesthetic attention,[108] or mindfulness, it may appear to be a time investment, aligning with the common argument of having too little time in everyday life. However, this should not be viewed as a measurable investment driven by the excess of counting, but rather as a mode or quality of living that is always present in the potentiality of being. I deliberately avoid suggesting that one must first choose this present way of being and consciously engage with it, as this would again imply distinct steps that require time. It does not need to be chosen initially, but simply lived.

It brings us back to the missing central link in the aesthetic experience of the sky-blue-beauty and the multi-layered bodily openness that resonates with it. Maxine Sheets-Johnstone provides an interesting comparison of the child's whole-body experience to that of an adult, asking: "how

[106] Jarman, p. 86.
[107] E.g., See Berleant debatable degrees of intensity up to „fully acute awareness" (2015) p. 5.
[108] E.g., See Bence's (2016) claim on the centrality of aesthetic attention for understanding aesthetic experience.

is it that adult humans commonly lose not sight but the *felt bodily sense* of their full-body affectivity?" (Sheets-Johnstone, 2016, p. 77) It is important to capture this bodily felt sense here as a whole-body experience that might be missing in adulthood. It also means that a missing felt sense of the body or body awareness is more than the absence of individual or different emotions, but refers to the possible bodily distribution range of affects and emotions. According to Eugene Gendlin, emotions tend to be clearer than the more encompassing *felt sense* he focuses on, which is larger than emotions but include them (Gendlin, 1981/2007, p. 40). A missing felt sense of the body thus prevents the whole-body experience, which partly coincides with the missing link argued here. A prevented, blocked, or insufficient experience of the sky, to call it "aesthetic," concerns the body in its wholeness. For example, due to a lack of concrete *organic openness,* the sky-blue carried by the *Leib*, like a *sky-blue feeling,* cannot enter and spread. Also, a felt sense of a living experience never arises in the first place. In this regard, there is a striking connection to "spatial medicine" that can help to demonstrate this entangled connection and inevitable interplay between phenomenal body and biological body that are part of "full-body affectivity." Spatial medicine, a branch of body therapy, focuses on concretely creating more space in the human body itself, for example, by treating living tissue and fasciae (Marfin-Martin et al, 2015). By expanding the interior body space and opening up the physical body, restrictive tensions that could be dominant today due to chronic stress are released. Now, the physical body is more open and attentive to interaction and especially to communication with the phenomenal body in an environment. It is this co-openness of body that is manifested in a co-dependent relationship with the world and the environment. We find here a living synthesis of phenomenology and biology in aesthetic experience, in which openness becomes a multifaceted bodily prerequisite for a living aesthetic access and experience of sky-blue as an *felt beauty.* If this state of the body in its multidimensional openness is not given, it is possible that there are *inner-bodily imbalances* and compressions that rather do not allow an open interaction with the world and the environment while nourishing the assumption of a missing

bodily link for living aesthetic experience. This is in allusion to so-called "attentional imbalances" identified by contemplative science, which shows attention as so scattered and distracted that there is little to no (bodily) space for aesthetic attention (Wallace, 2007, p. 7). However, the phenomenal body, which Merleau-Ponty called the "vehicle of being in the world" (2012, p. 537), can nevertheless exceed the organic body and extend to the sky. For example, the body can move in emotions (*e-movere*).[109] Merleau-Ponty writes concerning the experience of the sky-blue:

„*If I wish to enclose myself entirely into my eyes and abandon myself to the blue of the sky, soon I am no longer aware of gazing and, at just the moment I wanted to give myself over to vision entirely, the sky ceases to be a 'visual perception' in order to become my current world*."

Here we are also reminded again of the above-mentioned adjustment of the eyes, which must first reach the sky and are also consciously adjusted to it until we reach a unified[110] moment of experience over time as essential part of the process of aesthetic experience of the sky. Here, in synch with the sky-blue, human beings can experience a *primordial balance* or coherence between inner and outer states in contrast to the preventing "attentional imbalances." Moreover, feelings of unbounded interiority in a continuum with sky-blue can emerge and the blue sky can become "my current world." It is important to emphasize, that perceiving, experiencing, and understanding happen in such moments simultaneously, which is where the experience of beauty of the sky can happen. To experience the sky-blue in the present moment as beauty means to experience oneself integrated in this beauty, in a living aesthetic experience with beauty. It is a synchronized experience with the sky-blue through an openness to [natural] beauty by being in beauty. Fortunately, it is "as easy as breathing" to feel and embody the beauty of the sky-blue when one is in the living body and being the body. In this living way of

[109] E.g., See Sheets-Johnston extensive inquiry on movement.
[110] The feeling of unity is something different from a theoretical discussion about unity that happens "within this metaphysical point that is the thinking subject." (Merleau-Ponty, 2012, p. 242).

experiencing, we can feel the sky-blue beauty and realize the sky-environment as *vulnerable* in a bodily way by understanding it as *atmospheric life*. It is essential to the living and the conceptualizing of a holistic moment in a continuum or process of aesthetic experience that despite its stimulated complex interplay of the human body we are momentary present in its unity. This alludes to what Merleau-Ponty discussed as temporality of the body – where "body takes possession of time and makes a past and a future exist for a present" (2012, p. 249). By being in the body, we are here and present, and this includes freedom from stress and "rumination" (Whitmer and Gotlib, 2013), the distraction through the daily talk of the mind that rather inhibits such moments of human-world balance in beauty.

However, *living sky-blue beauty* happens before rational attribution and is therefore not yet determined and expressed in the linguistic term "beauty," which I leave to the discussion of aesthetic judgements of taste. The point is rather to re-evoke a *living beauty with the sky,* from which the necessary aesthetic attention and deep sensing can emanate, initiating concerns regarding its changeability and vulnerability. Living blue-beauty requires even more significance as *lived knowledge* which is not reached by thinking, but by seeing and experiencing. In this context, Ted Toadvine's *ecological aesthetics* should be cited: "The aesthetic significance of a part of nature depends on the elements revealed" by the perceiver "but these elements are still features of nature not subjective projections" (Toadvine, 2010, p. 89). Today, this can also affect features of nature that have been altered by anthropogenic sensory pollutants. Here it becomes a particular challenge for aesthetic skills and environmental sensibility to distinguish between natural and anthropogenic changes of the sky. Significant here is Berleant's concept of environmental sensibility as "educated sensation." Moreover, particularly relevant in this context is his assertion thar "[I]t requires the perceptual knowledge and skills that we are continually enhancing in and through our encounters and activities" (Berleant, 2012, p. 55).

Just to mention that the embodied mind and the cognitive as well as intellectual capacities are understood as originating from the human body, and that they are not excluded in the process of aesthetic experience and in the processing of *living sky-blue beauty* and the *lived knowledge* contained in it.

Nevertheless, lived beauty as well as other forms of lived knowledge with the sky include relevant insight about this environment that can contribute to Dryzak's call for the cultivation of "*ecological reflexivity*." When he writes to "listening more effectively to an active Earth System, capacity to […] receive and respond to early warnings about potential ecological state shifts" (Dryzek 2016), this must also include the sky-environment and its anthropogenic changes. Furthermore, *beauty*, understood here as lived aesthetic capability of the human being, challenges the aesthetic, and therefore also the bodily, condition of the human being and asks: How open are you to your environment above you? What do you know about it (from your experience with it)?

5.5 Summary and Future Considerations

Still, one might respond here, why is this concern about the sky-environment necessary at all, everything is changing and we are living in a human-made era where almost nothing is "natural" anymore. But then again, we have already shown how we nevertheless presuppose naturalness when we rely on the sky in its blueness and existence as described above.

The predominant theme of this study was to draw attention on the changes within the sky-environment and the tendency towards the loss of sky-blue. Familiarity with the assumption that the sky is blue has proven to be untenable in the Anthropocene. The aim was not to offer pre-determined aesthetic descriptions of new phenomena and appearances, but rather to encourage aesthetes and aestheticians to engage in their own living experiences and to look up to the sky again.

The concept of *living blue-beauty* was introduced as countermeasure that allows the close sky-environment to be perceived and experienced in an intimate way and to reawaken aesthetic awareness and atmospheric sensibility. Through the bodily experience, the potential vulnerability of atmospheric life could be understood. Based on the accompanying lived understanding of the sky-environment transformative discussions and actions in the context of the constellation of change of a new epoch are initiated. Focusing on such a sensitive subject, however, did not allow the *living blue-beauty* to be grasped as thoroughly as possible. One direction that has only been touched here in relation to the human body is how such living understanding of the sky-environment differs from merely hearing or reading *sky-news* (such as weather reports etc.). Other issues that could not be sufficiently discussed are clouds in general and in particular in relation to the monochrome blue, as well as a new indistinctness of cloud formations. Another undiscussed and understudied problem is the indirect impact on the visible sky. It would be important here to consider the increasing traffic in [outer]space, which is filling up with space debris and is known as the Kessler syndrome (Mark and Kamath, 2019). Furthermore, the cultivation of deep and atmospheric sensing in respect to borderless dimension of the blue sky-environment can be investigated together with the important concept of mindfulness that correlates with attention or its absence. Here affective sciences come in, where other cultures should be involved, asking how people experience, perceive, and understand the sky-environment? The objective could be a global aesthetic picture of the post-Holocene sky-environment allowing prediction and prevention of uncontrollable consequences of the change of this, as demonstrated, particularly fragile environment.

Finally, aesthetes and aestheticians should therefore intensify the investigation of anthropogenic sensory pollution, as an increasing main issue of our time, and address it more radically. Aesthetics can therefore play a role of a central ‘change agent’ of necessary societal transformation, in which aesthetic capabilities are required to access, perceive, experience, alternatively understand and possibly prevent changing environments. Especially, for a clean

sky-environment itself and for the prevention of a continuously blurred and diminished experience of the natural beauty of the blue sky.

6 CONCLUSION

"For all flesh is as grass,
and all the glory of human
as the flower of grass.
The grass withereth, and the flower thereof falleth away."[111].

In 1987, the World Commission on Environment and Development introduced *Our Common Future* as "A Global Agenda for Change" with the goal of achieving sustainable development by the year 2000 and beyond. Yet, 37 years later, sustainability remains a rather distant goal. Nevertheless, the global vision persists: to transform the human-nature relationship and "ensure that, by 2050, the shared vision of living in harmony with nature is fulfilled" (CBD, 2022, p. 4). While calls for a (re-)connection with nature, as advocated by sustainable science (Ives et al., 2018), have grown louder, a critical question remains: how we can achieve what has eluded us for decades in meeting sustainability requirements? Moreover, in light of these ongoing challenges, what specific contributions can this work make toward advancing the shared vision of living in harmony with nature?

This thesis began with the premise that an unaddressed bio-experiential human crisis is integral to the condition of human existence. This crisis was examined within the context of the [dis-]connection between humans and nature and the interconnected ecological crises affecting both human and natural systems. The argument presented was that insufficient attention to the bio-experiential dimension of human existence impedes sustainable transformations, as it limits lived understanding with nature and constrains eco-relational capabilities. By addressing this gap, this thesis expanded scientific knowledge, uncovering new aspects and pathways in the complex interdependencies of human-nature relationships. The thesis highlighted the reciprocal relationship between humans and their environment, emphasizing that while humans fundamentally impact and alter nature, they are simultaneously and profoundly–indeed

[111] Original in German: *Denn alles Fleisch ist wie Gras/und alle Herrlichkeit des Menschen/wie des Grases Blumen/Das Gras ist verdorret und die Blume abgefallen*. J. Brahms, Ein deutsches Requiem op. 45.

existentially–affected by these changes. These complex feedback loops influence eco-relational capabilities, among others, encompassing relationalities with humans, non-humans, and natural phenomena.

Furthermore, the research revealed negative, interconnected impacts on both natural and human systems, demonstrating their shared health within the overarching thought of the *One Health* perspective, which embraces a holistic understanding of life. This work endeavoured to integrate both the functional and existential dimensions of health, with each contributing equally or non-hierarchically to human bio-existence. In this context, a potential unity, as well as the vulnerability, of life was presented as a sharable and lived understanding. This approach contrasts with a purely abstract or cognitive comprehension of the world.

The bio-existential dimension was elaborated and applied across the three manuscripts of this dissertation, each investigating human bio-experience within different real-world contexts:

- Manuscript 1: Investigated human visual health, with a particular focus on the bio-existential implications of nearsightedness/ myopia. One area of focus was the contrast between open space, distance, and spaciousness versus nearness. Additionally, human movements–physical, mental, and affective–were also considered.
- Manuscript 2: Examined the unprecedented change and loss of biodiversity, specifically focusing on humans' capability to experience and perceive (or not perceive) environmental changes and the loss of nature's diversity over time.
- Manuscript 3: Addressed the vulnerable sky-environment, questioning the commonly assumed blueness of the sky. It also drew attention to human capabilities for experiencing potential changes in the sky, beyond natural variability.

In the following section, the key contributions of this dissertation to the human-environment/nature relationality discussed herein are further delineated, both in theoretical and practical terms

6.1 Contributions of the Research

The thesis is focuses on relationalities between humans and the environment, especially changes of natural phenomena. as and its changes as well as nature in its encountered phenomena. The existential project presented explores whether, to what extent, and in what ways–along with the associated implications–human beings actively engage in direct contact with the environment and other living beings through the presence and openness of the body.

6.1.1 Overall Theoretical

- Gained a lived understanding of life through the experience of the living body and demonstrated a shared vulnerability of life.
- Demonstrated that a bodily, living-lived understanding of phenomena (illustrated through space, spaciousness, nearness, the sky-environment, nature's biotic and abiotic diversity) can be experienced as a shared body-experience that extends beyond the human body to other entities (space, the sky, nature's life).
- All manuscripts contributed to expanding the understanding of previously under-explored interrelated influences of functional health and existential well-being in humans, in to and with natural systems.
- Promoted an understanding of the important interplay and interdependencies between health (living physiology) and existence as living well-being.
- Consistently challenges dualistic epistemic assumptions and advanced non-dualistic alternative thinking, offering new ways of engaging with the world and its implied knowledge
- As a result, proposed a non-dualistic alternative for researching and thinking about the relationships between humans, nature/environment, and life in general.

6.1.2 Theoretical and Practical

The thesis introduces three bio-existential-ecological concepts that capture previously unexplored relationalities and dynamics between humans, environmental changes, and natural phenomena. These concepts offer both theoretical insights and practical implications.

Manuscript 1: "Near-Zone Existence"

- In focusing on the human-space relationship, an increasing absence of distance and expanse, alongside an overemphasis on nearness, was observed. The concept of "near-zone" was introduced to capture, describe, and analyse this bio-experiential and, thus, relational process of human existence.
- The functional health and existential well-being of humans were shown to be interconnected not only with human-made *place* but also with natural *space.*
- The importance of natural light and its rhythmic patterns, as opposed to artificial light, for visual health was highlighted.
- Vision was elucidated as a fundamental aspect human existence, both biologically and existentially.
- Human relational existence is shown to be fundamentally influenced by the quality of experience, as well as the absence of visual experience at a distance.
- Distant nature and others were found to literally fall out of human sight, meaning that distance (>1 meter) is beyond human experience, attention, and care.

This work demonstrates the interconnected dimensions of our functional and existential being in relation to human visual quality. The absence of visual distance and spaciousness, as seen in the rise of myopia, is revealed as a bio-existential change of human being and relational living, with various implications.

Manuscript 2: “Living-Lived Biodiversity[loss]”

- The new environmental concept “Living-Lived Biodiversity[loss]” contributes both practically and theoretically to expanding the action program for the protection of biological diversity by incorporating the human bio-experiential existence.
- The focus is on the living human experience with natural biodiversity over time, particularly in relations to its changes, leading to the issue of loss.
- This includes studying the possibility of experiencing biodiversity itself as well as its loss and change over time.
- Ecological awareness was shown to be significant in addressing phenomena such as shifting experiential baselines.
- The issue of unnoticed acceptance of new, diminished norms in nature experience and natural phenomena is emphasized.

Manuscript 3: “Living Blue-Sky Beauty”

- The experiential concept of "familiarity", primarily used in aesthetics to describe the everyday, was shown to be increasingly inappropriate for the Anthropocene.
- The human mode and capability of experiencing the changing sky-environment, particularly in relation to deviations from natural variability, has been critically questioned.
- The new concept of “Living-Lived Blue-Sky Beauty” was introduced to propose an alternative mode of bio-experience with the sky, opening new insights into its appearances and environmental change in general.

6.1.3 Methodological & Practical

This thesis has advanced critical and interdisciplinary research on human relationality with the dynamic environment and the presence and/or absence of nature by investigating human bio-

experiential existence. It employs the body as a living method, from which integral and embodied understanding, and ultimately lived knowledge, emerge *with* lived experience.

- The living body is understood as a primary way of relating with the world, actively engaging with the environment through the bio-existential proposition: *I am the* body (in difference to the objectified perspective of *I have a body*).
- The body is employed as a living-lived method, emphasizing its experiential (rather than purely cognitive) way of relating with the environment through a continuum of time.
- A central tenet in this respect is the unique temporality of bodily existence, expressed in the affirmation: *I am the body. This* highlights the living body as the anchor of presence.
- The particular temporality of the body is integral in the way that the body exists in the present while simultaneously embodying the past and connecting with the future.
- The thesis extensively utilizes phenomenological conceptualizations and analyses of space and time from the standpoint of the body.
- The body, as a living source of knowledge, enables shared understanding, inter-bodily resonance, and empathy.
- This bio-existential approach highlights the importance of self-knowledge, particularly in respect to the own body within the world and the kind that develops through the body's active engagements with the environment.

The thesis also acknowledges the fragile nature of the non-dual mode of living-lived experience, among others. Additionally, integrates the co-evolution and interplay of cognitive and spontaneous intellectual moments, recognizing their convergence within the continuum and flow of human experience.

Finally, the research engages with cognitive and objective processes of understanding, reflecting on integrative philosophical practices of thinking. These practices aim to synthesize

insights through a comprehensive philosophical perspective, exercising sense-making across all stages of analysis and in every manuscript produced.

6.2 Research Limitations and Challenges

A key challenge lay in achieving a precise separation of individual investment stages or levels, which are partially interwoven and often blur the possibility to draw clear-cut analytical boundaries between living-lived experience and a distanced reflective perspective –responding to the very characteristic of a living and emergent process. A specific difficulty in this context was the development of new terminology to support a more life-oriented approach. This occasionally resulted in complex and overdetermined language, which was at times unavoidable to distinguish the new perspective from the established objective-scientific perspective. The latter's terms are already pre-assigned and connotated in ways inconsistent with the intentions of the bio-existential approach. This challenge was particularly pronounced at the analytical level, where the absence of clear subject-object distinctions made it difficult to think or reflect without relying on inherently biased terminology. The use of such biased terminologies, which inherently implies specific perspectives, methods and interpretations, would therefore also lead to different findings and questions.

Another challenge was to handle the necessary openness, uncertainty and contingency of life and to do justice to it in the way of thinking. It seems easier to assert certainty than to remain open minded. It was also important to develop tolerance towards vagueness, such as with regard to the ambiguity of the body and being in the world, and to throw old views and fears overboard in this respect. This also included the challenging abandonment of ideological or familiar western dualistic thinking. This proved to be the opposite of supposed certainty in thinking, but in accordance or coherence with life.

6.3 Recommendations for Future Research

This research has provided relevant and novel direction for future inquiry:

- Sustainability sciences and related fields: These disciplines were shown to inadequately address the preservation of open spaces and spaciousness, not only for biological conservation and ecological protection but also for human existential well-being. This represents an urgent area for future research.
- Spatial research: A more nuanced analysis is required to explore what fundamentally characterizes the acts of perceiving distance and expanse, and how these acts differ from other cognitive processes, such as imagining or remembering distance.
- Ecological crises**:** How can we focus on preventing or addressing ecological crises at their source, rather than merely managing their consequences? This question requires further exploration.
- Bio-existential guidance for political decision-making: There is a pressing need to develop bio-existentially integrated frameworks for guiding political decisions, particularly concerning the fundamental question: What future do humans want—with or without nature?

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APPENDIX 1 - Excerpt of Experiential Results of a Particular Altering Nature

Due to limited space, unfortunately, no detailed description of the living and direct experience of nature through time can be given here. Instead, there will be a condensed excerpt gained from the detailed descriptive account over several decades from birth to adulthood. The resulting lived data from my first-person perspective and experience with nature was gained primarily in a huge garden surrounded by agricultural fields and a mixed forest. These are some extracted experiential results: there are fewer butterfly-individuals in general, including the once abundant brimstone and cabbage butterflies. The butterfly species swallowtail completely disappeared over ten years ago. There are fewer flying insects in general. Fewer earthworms and red worms. Fewer ladybirds and more and more different invasive ladybirds over years. For the last couple years, there have been almost no ladybirds at all. No maybugs, no dung-beetles – and these are only the big beetles which are of course more easily perceived. Nevertheless, there have also been fewer little green ones. Some flame bugs have remained. Less and less diversity of birds (e.g., no chaffinches, no wrens anymore, much less swallows/barn swallows). No owls anymore–only know them from my grandmother's stories where there was one under the roof of the house. Many more crows. Hedgehogs are becoming rare, meaning one no longer sees one in the garden every year. For many years now the sight of a rabbit has been a miracle. The same is beginning to apply to deer. The first and last badger I saw was dead and that was in my childhood. Now, there are not even badger setts to be found in the forests anymore. Another experience over the last years is the perception of much more litter, which does not rot anymore and simply remains on the top of soil. This leads to a challenging form of experience that follows from those perceived leaves on the top soil; less microorganism in the soil. This way of knowing is not reflectively constituted and concluded in the first place, rather it is an embodied knowing in the same way like "plant bodies" do – described in the beginning. Before reflecting about a decrease of decomposing organisms, I

experienced the same appearance of leaves over a long time and knew from being within the experience and its flow over time, that something had changed and that life in the soil is missing. Additionally, the experienced change in the presence of the sky and cloud formation over years enriched the feeling that the air is changing and could contribute, but this is not the focus on this study. The feeling of "something is missing" or some diversity is lost is likely nourished from the described experiences and thus implied is the already felt loss of other natural phenomena, individuals up to entire species. It is a bodily knowing about and with the soil and the environment that not even has the direct visual contact with the microorganism, but still involves them. One human response is the feeling of loss. Moreover, part of this whole horizon of experience are the sensed and felt change of seasons that is the earlier blooming of spring plants, the loss of slowly or more steadily rising temperatures from spring to summer, instead there is a very rapid leap into heat accompanied by droughts. Through the damaging effects of the droughts from the recent summers, one can see and feel in all almost every tree ensemble, where branches are lying on the ground or are in danger of breaking off. The soils are hard and compressed and often cannot take water in, which remains on the top and forms puddles.

These experienced data are not meant to be exhaustive and to "*fully* describe a region's biodiversity would be impossible."[112]

[112] Johanna Burch-Brown, Alfred Archer. In defence of biodiversity. P. 971.