The Struggle for Recognition of Nature:

A Biomimetic Approach

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Abstract

In this paper I argue that "mimicking" entities of the natural world is an apt mode of recognizing nature in the sense that it satisfies the inherent ethical implications of environmental and ecological justice when performed adequately. The philosophical concept of biomimicry—i.e., the emulation of models, systems, and elements of nature—and the concept of recognition that I derive from social recognition theory, offer such adequate mode for recognizing nature when both concepts are taken together and give rise to what I claim to be a theory of *biomimetic-recognition*. I demonstrate that by uniting or amalgamating these freestanding philosophical concepts within the context of the non-human or natural world, their conceptual virtues and vices rule out discrepancy because they are complementary. The theory and insight that stems from their conjunction is initially an altered version of both concepts and constitute the rudiments of a biomimetic-recognition concept that has the ambition to give nature their due. I claim that the biomimetic-recognition approach is both a *mode for* recognizing nature and *kind of* recognizing nature; biomimicry offers a way to meet the demands of environmental and ecological justice, and corresponds with a kind of recognizing relevant features, namely based on a notion of *talent*. I develop the rudiments of the theory of biomimetic-recognition by first scrutinizing both concepts before I turn to my analysis of the conjunction that I present as a theoretical model.

Key words: biomimetic-recognition • biomimicry • recognition theory • recognition of nature • human-nature relationships • environmental and ecological justice • bio-inclusiveness • recognition of talent

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Introduction

Nature struggles for recognition. Instances where nature is unjustly treated by humans seem prima facie abundant, but where are those? And what should we do about it? A heated topic nowadays is global warming and the uneasy effects of climate change (see IPCC, 2018). The argument goes that human activities impact Earth's climate and ecosystems ever since the beginning of the Industrial Revolution that approximately marked the debut of the Anthropocene epoch. Scientists have estimated an increase in climate-related risks to health, livelihoods, habitats, food resources, water supply, and economic growth (IPCC, 2018). These risks are troublesome to humans, but also affect other beings and systems in nature (e.g., species extinction, occupying habitats, livability degradation). Climate change is but one example of a notion of injustice towards nature: consider overexploitation of nature, factory farming, animal abuse, killing, forest devastation, marine pollution, natural resource depletion, greenhouse gas air pollution and many more. On a positive note, it is not all death and decay between humans and nature. Think of the pets we treat as friends, the joy of roaming through forests and climbing mountains, the gardens we let flourish, and so on.

These real-world events invoke us to think of the underlying structures and relational mechanisms. Fundamental questions such as 'What is nature', 'What is humanity', and 'How ought humans relate to nature'—or vice versa—, or 'How should the vis-à-vis relationship be understood' illuminate ontological, epistemological, and ethical contents with normative implications. Whether or not humans wish to have and maintain a relationship with nature: denial of the human-nature relationship seems inevitable. Especially considering the view that humans are nature, or thus part of the larger community of life just as any other living being or system on Earth (Vogel, 2015, pp. 1-6). For as long as humans and nature are thought to be exclusively dual or dichotomous concepts that (do not) operate separately from each other, while although there is plenty evidence or proof to support the idea that is a perpetual or constant or unremitting causality and responsiveness between both parties; there is an inclination to ask ourselves what *we* owe *them*.

Prior to making any authoritive judgements about the ubiquitous human-nature relations comes the classification of those who comprise nature, accompanied by the varying attitudes and normative implications that determine their moral standing, and so postulate guidelines and norms for human conduct towards them. A conventional way to dissect the natural world is by reference of the *biotic community* and the *abiotic community*. The biotic

community includes living things or organisms such as the flora, fauna, and fungi—humans are members of the biotic community as well since we are associates of the animal kingdom—, and the abiotic community represents non-living things or innate nature such as mountains, forests, water, soil, the sun, the atmosphere, and such. An exception is the notion and residency of *ecosystems*. Since an ecosystem is comprised *by both* the biotic and abiotic community, they can be regarded as an inherent combination of both sides and hence may be seen as *living systems*.

A more sophisticated way of defining nature is by considering the impact of humans *to*, and the areas of intersection *with* the natural world. Many theorists take the environment as equal to human nature and approach the environment—or human nature—and non-human nature as two separate domains (Kortetmäki, 2019; Vogel 2015; 2016). As Vogel puts it, the environment is "the world that environs us" and seems to be a built or artificial environment (2015, p. 1). Especially in light of the Anthropocene, there may no longer be such thing as "non-human nature" or "wilderness", thus nature may no longer be in danger (p. 1). However, the distinction ultimately depends on "an unjustified metaphysical dualism that seems at the bottom of Cartesian [dualism] and anthropocentrism" (p. 1). The distinction thus adds a complication and does not resolve the semantic ambiguities of nature; though it might further intensify or diminish the problem depending on one's perception or metaphysical view of nature. In this paper I assume there is a natural world, whether or not some areas are "humanized", which I take to be the biotic community and living systems: for simplicity I plainly refer to them as *nature*.[1] Still, these characterizations of nature are important to keep in mind since each outlook embraces different normative implications.

How humans conceive nature, or parts of nature, and their human-nature relationship ultimately determines their value perspective and moral status, and how significant their values and interests are relative to human values and interests.[2] The discipline of environmental ethics is concerned with these challenges that exhibit a broad notion of environmental issues—e.g., climate change, animal abuse, rainforest conservation, resource depletion, ocean pollution, and so on. Environmental ethics instantly turns to discussing rights, duties, and responsibilities on the behalf of human agents relative to conservation, preservation, and protection of the integrity

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[1] According to Vogel, "we need to accept that the environment is nowadays built by us and decide to build it better (2015, pp. 129-166). My interpretation of nature also accepts his statement because I support the idea that at least some parts of nature are indeed "humanized" which might grant us justifiable reasons to interfere and improve the state of nature. Ultimately this fits the aim of this paper to "improve" nature, and not "worsen" it.

[2] Needless to say, most theories in environmental ethics are largely based on Western worldviews from Western societies whose beliefs and value systems are predominantly Western, Educated, Individualistic, Rich, and Democratic (WEIRD) (Henrich, 2010).

of the environment, or the biotic and abiotic community. However, there seems to be an integral challenge within environmental ethics regarding the plurality of outlooks. This pluralism resides in the notion of *moral standing* which is relative to all members of the natural world and includes outlooks of anthropocentrism (i.e., human interests first), zoocentrism (i.e., animal interests first), biocentrism (i.e., biosphere interests first), ecocentrism (i.e., ecosystem interests first) (Vilkka, 1997, p. 8). Deciding which outlook is most plausible or favorable fundamentally often depends one's interpretation of intrinsic value, instrumental value, and inherent worth (see Taylor, 2011, Chapter 2). Having intrinsic value is arguably thought of as the supreme condition for acquiring certain entitlements due to its higher-level moral standing (Vilkka, 1997, pp. 10-19). There is wide agreement that a person has intrinsic value as an end in itself, and its own right independent of its usefulness to others. Also, the possession of intrinsic value engenders a notion of moral agency and prima facie duties; this possession is exclusively for persons and not non-persons (Vilkka, 1997, pp. 17-19).

To illustrate the kind of theories that emerge from environmental ethics, I use Arne Naess his account of *deep* and *shallow* ecology. Naess argues that humans have moral obligations toward ecological wholes (e.g., species, communities, and ecosystems) and not merely individual constituents (1973, pp. 151-155). He claims that deep ecology should be endorsed as a universal ethic based on experiences of deep satisfaction we receive from our similarities and closeness with nature (P. 151). But deep ecology is a kind of *biospheric egalitarianism* which holds that the biotic community and living systems are valuable in their own unique way, independent of its usefulness to others e.g., to humans or human ends. Its weaker form, *shallow ecology*, takes shared ecological problems between humans and nature— e.g., global warming, pollution, and resource depletion—as the central objective, and prioritizes the well-being and interests of humans over the interests of non-human entities— which essentially makes it anthropocentric, whereas deep ecology is ecocentric. The idea of a shallow ecology resembles with a notion of *enlightened anthropocentrism*, which hold that moral duties towards the environment are direct duties to its human inhabitants. Despite the vast number of environmental theories and its integral pluralism, it should be noted that all revolve around *prioritizing interests* of the biotic and abiotic community based on value systems that ultimately provide evaluative reasons and action guidelines.

In this paper I intend to depart from this supposedly narrow and saturated fixation on values (such as intrinsic, inherent instrumental and non-instrumental values) and moral status that is mainly thought of as a necessary step in identifying the human-nature relationship and its corresponding implications in everyday life. Instead, I turn to identifying the human-nature

relationship by looking at notions of justice out of a solemn interest in "improving" the present-day human-nature relationship by taking it in the direction that does justice to both humans and nature. This sheds light on environmental justice and ecological justice as proposed by David Schlosberg (2007). *Environmental* justice is mainly concerned with the distribution of natural goods between people and has an apparent *social* justice appeal; whereas *ecological* justice goes beyond mere anthropocentric versions of environmental justice. Schlosberg aims to expand the scope of justice by embracing the notions of justice that exist in recognition theory, the capabilities approach, and political participation (p. 8). His goal is to develop an extended notion of justice that can be applied to both relations regarding "environmental risks in human populations and relations between communities and non-human nature" (p. 6).

I wish to proceed Schlosberg's ambition by scrutinizing the concept and theory of biomimicry as conceptualized and developed by Henry Dicks (2017; 2016; also in Dicks & Blok, 2019) and others. Through this, I intend to explore whether a conception of biomimicry is apt as a mode of recognizing nature in the way Schlosberg would approve of, namely on the condition that it meets the normative demands of both environmental and ecological justice in a way that is arguably fair.

I proceed as follows. First, I scrutinize the concept of biomimicry in Chapter 1. This enables me to understand and layout the core principles that lie at the heart of biomimicry. These principles are utilized and recontextualized by Henry Dicks to formulate what he terms "biomimetic ethics"; that is, an ethic takes nature as the *source* of ethics and opposes environmental ethics who mistakenly take nature as the *object* of ethics. Then I scrutinize the second key concept, namely the concept of recognition that I derive from social critical theory in Chapter 2. Although I primarily use the concept of recognition as an analytical framework for assessing the potency of biomimicry to be judged as a mode of recognition nature, both concepts turn out complementary. It follows in Chapter 3 at last that I analyze both concepts by contrasting them first before I demonstrate that a combination of both concepts gives rise to a theory of its own kind. I claim that this theoretical model, what I refer to as the *biomimetic-recognition model*, offers a unique way of serving justice. It offers a solution to overcoming prominent environmental and ecological challenges and aids nature in their struggle for recognition.

1. Biomimicry: A Philosophical Concept

In this chapter I present the concept of biomimicry and demonstrate how biomimicry undergoes a conceptual expansion as merely a technological discipline to a philosophical one. Some theorists have argued that biomimicry can take shape as an ethic that provides a moral framework for interpreting the human relationship with nature, in addition and contrary to traditional environmental ethics. My representation of biomimicry serves as a foundation for the normative discussions that follow in the succeeding chapters about its eligibility for being set forth as an adequate mode of recognizing nature. Hence, I contribute to the philosophical discourse about biomimicry by revealing its inherent virtue of serving justice, making it a more sophisticated version.

1.1 The Principles of Biomimicry

The concept of biomimicry is popularized by Janine Benyus with her book *Biomimicry: Innovation Inspired by Nature* (2002). Benyus claims that imitating nature (nature *mimesis*) offers solutions to reaching a sustainable future. She classifies biomimicry in three types, namely 'nature as model', 'nature as measure'[3], and 'nature as mentor'. Nature as model suggests that biomimicry is "a new science that studies nature's models and then imitates or takes inspiration from these designs and processes to solve human problems, e.g., a solar cell inspired by a leaf" (2002, p. xi). The logic behind nature as measure runs like this: other than human lifeforms inhabited the Earth for billions of years—approximately 3.8 billion years— and throughout that time they worked out the basic techniques, strategies, principles, and laws of sustainable existence; in other words, they learned what humans need to do in avoiding ecological catastrophes (p. 8). It follows that biomimicry uses this knowledge as a measure or ecological standard to judge the rightness of innovations. These basic sustainable techniques include "generating renewable energy from the sun, recycling wastes in endless cycles, life-friendly chemistry, allowing biodiversity to flourish, and so on" (Dicks & Blok, 2019, p. 519). Here, technological innovations (e.g., a solar cell) imitate specific models abstracted from nature (e.g., a leaf—or photosynthesis), and are advantageous for generating renewable energy. Furthermore, Benyus claims that biomimicry introduces an era based not on what we can

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[3] Note that it was not Benyus who coined the expression 'nature as measure', but Wes Jackson in his earlier essays (2011). However, Benyus popularized the expression and merged the nature as measure with the other two directions to constitute her conception of biomimicry.

extract from the natural world, but on what we can *learn* from it (Benyus, 2002, p. xi). This thought characterizes 'nature as mentor' which, according to Benyus, offers a "new way of viewing and valuing nature" (p. 8). Thus, by imitating nature, or by drawing inspiration from natural 'beings and systems', humans stand a good chance against global ecological challenges.[4]

After the publication of Benyus' groundwork, biomimicry gained momentum in philosophical discourse. Some theorists have set out the differences between 'biomimicry', 'biomimetics', 'bionics', and 'bio-inspiration' (Iougina et al. 2014; Speck et al, 2017); others argued that biomimicry includes the imitation of ecological phenomena without establishing a separate category of 'ecomimicry' (Marshall & Loveza, 2009). Biomimicry is not only brought into dialogue within the philosophy of science and technology, but is also concerned with questions regarding ontology, epistemology, and ethics (Dicks & Blok, 2019).

According to Benyus, certain canon of laws (i.e., a standard of excellence), strategies and principles are characteristic to nature in the sense that "Nature runs on sunlight; uses only the energy it needs; fits form to function; recycles everything; rewards cooperation; banks on diversity; demands local expertise; curbs excesses from within; [and] taps the power of limits" (Benyus, 2002: 7). On the other hand, mimicry might be read as imitating original nature in the sense that it works towards the ecological reintegration of humanity into Earth's community of life by following synergistic patterns set out by non-human species. This approach is sensible not only towards sustaining human civilization but also sustaining all life on Earth. The latter approach is intended by Benyus with her understanding of biomimicry.

Biomimicry mainly aims to serve the needs of humans and is therefore human-centered in its rudimental form. However, Mathew thinks that "in order for biomimicry to avoid being understood in such a purely human-focused sense, it needs to be supplemented with a further explicitly ethical principle of *bio-inclusiveness*—a principle that urges protection for *all* species" (2019, p. 574).[5] Biomimicry as an ethically neutral principle does not entail, nor necessarily motivate, bio-inclusiveness. In addition, Mathews demonstrates how biomimicry intersects with the project of eco-modernism, declared by the Breakthrough Institute via their 'Ecomodernist Manifesto'. One of the main aims of eco-modernists is "to 'decouple' human

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[4] Although Benyus offers the view of depicting nature as mentor, as a new way of viewing and valuing nature, she focuses merely on the natural sciences character of biomimicry and its technological potency rather than any philosophical understanding.
[5] Mathew favors the term 'human-focused' over the traditional term 'anthropocentric' to indicate the moral standing and significance of humans in comparison to non-humans, because biomimicry has the tendency to focus on humans, but not necessarily to place them at the center of moral concern. Also, she abstains from using rigorous terminology such as *biocentrism* and *ecocentrism* that is commonly used in environmental ethics discourse: they can easily be misunderstood as the privileging of non-human over human life (2019, pp. 574-575).

production systems from wider life systems which resonates with biomimicry in the human-focused sense" (p. 575). Furthermore, Mathews is concerned with the acceptance of bio-inclusiveness. She thinks "[i]f people habitually live in a state of radical dissociation from nature […] then a bio-inclusive stance can never be expected to gain real traction. Any such stance must grow out of practice" (p. 578).

Also, Mathews suggests that biomimicry in many ways can serve as a design template for ecological civilization (p. 573). Ecological civilization can be characterized as mainly 'cyclical' (p. 573). She claims that we must redesign current modes of praxis, otherwise the value orientation fostered by the new order would remain anthropocentric (p. 573). Interestingly, she writes that we should neither adhere to any non-anthropocentric attitude but cherish a human-focused view that without the exclusion of non-human interests. Strong anthropocentrism ultimately results in an eco-modernist type of scenario in which society is 'decoupled' from nature. Mathews explores ways in which "modern industrial systems could include participatory modes of praxis that would emanate in genuinely bio-inclusive forms of consciousness and hence lay the ethical foundations for an ecological civilization" (p. 573).

In further developing the concept of biomimicry, Dicks & Blok (2019) set out key research questions for philosophical discussions of biomimicry based on the key publications from the last decade.

1.2 Three Philosophical Topics in Biomimicry

Now that I have laid out some fundamental principles of biomimicry, I set out few key topics and questions relevant for biomimicry in the philosophical discourse. For this, I mainly draw on Dicks & Blok their critical analysis (2019).

The first key philosophical topic they lay out is the idea of technology as a mode of imitating nature. Dicks & Blok claim that science and engineering literature neglect the origins of this idea which dates to ancient philosophers such as Aristotle, Plato and Democritus. While scientists and engineers nowadays base their inventions on natural models as a source of inspiration (Vogel 1998; Ball 2001), they rarely consider the ancient *idea* of nature imitation (Dicks & Blok, 2019, p. 520). Hans Blumenberg (2000) demonstrates how the ancient idea of 'man as imitator of nature' was replaced in the modern period by the idea of 'man as creator of nature'. Dicks & Blok (2019, p. 520) wonder whether the first half of the 21st century brings a so-called 'biomimicry revolution' where historical norms return, or that contemporary

biomimicry is substantially different from the ancient view on imitation of nature. An unresolved concern is how the process of imitation ought to be theorized and conceptualized. Consider the ethical dimensions regarding the abstraction of natural models: which types of models *may* we abstract (e.g., forms, materials, process, systems, strategies, functions), and is it sufficient to 'merely imitate' to count as biomimetic, or must a deeper logic be involved. Blok (2016) raises the question whether we should aim to imitate not only the 'products of nature', but also—perhaps more outstandingly—the 'generative processes' by which nature brings things into being. Another concern here is that imitation might involve a kind of submission to nature, hence a denial or abandonment of cultural human values of autonomy and creativity (Kaplinsky, 2006). Conversely, others denote the possibility of imitation such that it is understood as allowing for or enhancing our creative freedom.

The second key philosophical topic asserts to how biomimicry perceives and understands nature. In science and engineering, nature is often perceived as a source and collection of design solutions (Benyus, 2002). With what Bensaude-Vincent (2011) calls 'reciprocal mimesis', he refers to technology itself that provides the model for how we understand nature and as the model for technological development. This does not imply that biomimicry reduces nature to a collection of imitable technologies. Instead, this raises another fundamental question namely "whether it is possible to put forward a concept of nature that is compatible with, and perhaps even conducive to biomimicry, but which also accords to nature some sort of independent or autonomous being and existence" (Dicks & Blok, 2019, p. 521). Another point of interest is the traditional epistemological view that conceives the human relation to nature as an 'object of knowledge' (i.e., what we learn *about* nature). However, the principles of biomimicry suggest that it relates to nature as a 'source of knowledge' (i.e., what we learn *from* nature) (Dicks, 2017; 2016). Perceiving nature as a source of knowledge moves away from the idea of 'domination and exploitation' of nature towards an approach characterized by 'learning and exploration' from nature (Blok & Gremmen, 2016, p. 204). In addition to this shift, Benyus remarks that this new epistemological relation to nature potentially allows us to overcome our ontological separation from nature, and that "… we might fit in, at last and for good, on the Earth from which we sprang" (Benyus, 2002, p. 9). Thus, Dicks & Blok (2019, p. 521) question whether biomimicry "holds the key to a radical shift away from the traditional Cartesian [Culture/Nature] dualism"; and instead, one day we might learn how to overcome this dualism and see ourselves as but "a species among species" (Benyus, 2002, p. 8).

The third key topic for philosophical inquiry is biomimicry's relationship to questions of sustainability and ethics. It has been widely acknowledged that a mere imitation of nature is insufficient to achieve sustainability (Kennedy et al., 2015). Others, like Mathews (2011), wrote that imitating nature might make human civilization sustainable, but at the expense of other inhabitants on Earth. Here, questions regarding anthropocentrism enter the discussion. Mathews' concern suggests that a non-anthropocentric ethics is necessary to constrain technological imitation of nature. At least two responses are relevant here. First, the view that non-anthropocentric ethics must be worked out independently, by means of ratiocination, before it is applied as an ethical principle by which biomimetic technologies could be assessed. Second, the principle of 'nature as measure' (Benyus, 2002; Jackson, 2011) holds that nature provides ethical standards or prescriptions for judging the rightness of actions. This perspective is what Blok & Gremmen (2016, pp. 205-210) call the 'strong concept' of biomimicry; it holds that nature not only teaches us how to do things, but also what we *ought* to do.

Additional Challenges

Hub Zwart discusses the paradox of biomimicry in his introduction to various key issues of the philosophy of biomimicry and argues that biomimicry is both an ancient and modern concept (2019). Ancient biomimicry, according to his arguments, is mainly attentive to imitation of the outward form (*morph)*, while contemporary biomimicry also focuses on the inward form, which is the logic (*logos)* of living systems. This gives rise to the practice of imitating not only the *morph* but also the *logic* of living beings and systems, for example by artificially recreating them, and covers both biology and ecology. Imitation of nature regarding the *logos* of living systems plays a substantial role in at least the following four mainstream fields of research: (1) synthetic biology[6], (2) (bio)chemistry, and (3) soft robotics; and (4) nanotechnology. Zwart's paradox is interesting because ancient philosophical views took inspiration from nature but predominantly based their inspiration on the outward form of living beings and systems, while nowadays, science can comprehend the inward form, too. Moreover: modern science is even capable of recreating the inward form for reasons that suit human purposes.

Another challenge revolves around the application of biomimicry and the kind of outcomes it must achieve. Mathews posits that there lies a fatal ambiguity at the core of

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[6] Synthetic biology aims to synthesizing living systems in an artificial manner. Think here of genetic engineering by means of CRISPR/Cas9 (Doudna & Sternberg, 2018).

biomimicry, one that concerns the focus of whose interests it must consider. Despite Mathews' optimism about the potency of biomimicry to underlie a global ecological civilization, she argues that biomimicry could lead to either (a) a radical decoupling from nature, or (b) to a bio-synergistic scenario in which human agents cooperate with other life forms (Mathews, 2019, p. 574). The latter requires a 'bio-inclusive' ethos and approach that extends the moral circle to including non-human living beings and systems. This kind of tolerance and shift, Mathew argues, could not simply emerge by ratiocination, but would need to emerge through practice (p. 578).

Dicks argues that norms as 'appropriateness' and 'sustainability' give the principle of nature as measure a distinctive ethical dimension (2016, pp. 229-230). To elaborate, Dicks & Blok (2019, p. 524) write that "[t]o take nature as measure would thus be to measure our own way of being against the standard set by Gaia". They go even further by saying that 'being like Gaia' allows humanity to resolve three fundamental problems in environmental ethics: (i) deficiencies associated with biocentrism and ecocentrism, (ii) to reconcile, into a single ethical framework, goals of 'preservation and restoration', and (iii) theoretical and practical difficulties of obligations to future generations.

I present further challenges and implications in Chapter 3 based on the conjunction of biomimicry and recognition theory. The challenge that emerges from this conjunction offers some solutions to the three challenges set out by Dick and Blok, but also provide an additional challenge. Now I turn to a notion of biomimetic ethics and its implicit criticism of environmental ethics.

1.3 Biomimetic Ethics versus Environmental Ethics

The contemporary biomimicry movement is associated with taking nature as *model* for technological innovation—especially in science and engineering practices. The implicit ethical principle of biomimicry as nature as *measure* is mistakenly under-represented. In his effort to explore the relation between 'nature as measure' and environmental ethics, Dicks argues that:

> Mainstream formulations of environmental ethics share the common trait of seeing our ethical relation to Nature as primarily involving duties to protect, preserve, or conserve various value in nature, and that, in doing so, [environmental ethicists] problematically either overlook or dismiss as anthropocentric the possibility that Nature may provide measures, understood in terms of ecological

standards, against which our practices, or at least some of them, may be judged—
a way of thinking I call "biomimetic ethics". (2017, p. 255)

Quite generally, mainstream environmental ethics discourse is centered around wilderness preservation, natural resource management, habitat protection, protecting endangered species, animal rights and welfare, and other related objectives; whereas biomimetic ethics is concerned with questions of *how* natural entities are produced, used, and consumed, which may potentially provide a basic ethical framework to underpin the transition to a circular, bio-based, solar economy (p. 256). Also, fundamental questions in environmental ethics are concerned with whether only humans have intrinsic value or whether (specific parts of) non-human nature has intrinsic value, but biomimetic ethics is concerned with whether only humans provide measures for action or whether nature also provides measures (p. 263). The relation between biomimicry and sustainability is, according to Dicks, "encapsulated in a principle not present in other variants of nature-inspired innovation (i.e., biomimetics, bionics, and bio-inspiration)" (p. 256). In his article, Dicks considers the relation between the principle of nature as *measure* and mainstream theories and outlooks of environmental ethics in more detail than possible here. He argues that environmental ethicists typically view nature as the *object* of ethics, which discusses preservation, conservation, and protection on the part of humans; while the principle of nature as *measure* views nature as the *source* of ethics. A complication might arise depending on one's interpretation of *who* constitutes nature. If humans are part of nature, then humans are also the *source* of ethics and then the methodology collapses back to an ethics based on reason (i.e., Kantian ethics), consequences (i.e., consequentialism), and virtues (i.e., virtue ethics). But as intended here, when referring to nature I typically mean non-human nature, as goes for the relevant literature.

Moving back to Benyus, note that her canon of laws is merely descriptive although it is clearly implied—in the logic of taking nature as *measure*—that these statements may be translated into prescriptions of what one *ought* to do. In this way, nature as *measure* differs from nature as *model* by the following line of reasoning: the fact that living beings and systems possess some feature or behave in a certain way, or having a particular good of its own, does not mean we *should* imitate it in a relevant sense (p. 258). To clarify, as Dicks points out, the fact that sea sponges have advanced fiber optics does not mean that we *should* imitate this, although we may choose to do so (p. 258). In a footnote, he admits that it is hard to see how this kind of imitation implies ethical obligations to reproduce a particular natural law or strategy; it leads to the question of *what* in nature belongs to 'strategies' and to the domain of

'laws or principles'. There seems to be no token of proof of an endeavor to derive standard principles directly from nature for inter-human ethics (p. 258). According to Benyus, what it means to take nature as *measure* is "the abstraction of laws and principles from nature and their subsequent *translation* into laws and principles applicable to certain fields of human action" (as cited in Dicks, 2017, p. 259). Here, human action does not insinuate inter-human ethics, but actions towards the natural world.

      Dicks posits two objections to his account of biomimetic ethics. The first objection is that biomimetic ethics lacks proper theoretical grounds (pp. 267-268). Since biomimetic ethics is a new and thus far conceptually underdeveloped and thinly theorized, the objection is obvious yet authoritative. *Why* should we mimic nature? *What* give us reason to learn from nature? Dicks responds to these kinds of questions that challenges biomimetic ethics by denoting our anthropocentric and ecocentric reasons, namely that we could take nature as measure either *for ourselves*, or *for nature* that, in this context, includes both non-human and human nature. But first some source of *value* or *value system* has to be in place for giving us reason to opt for the latter, or the former, otherwise none of them can be taken as measure. The second objection revolves around the idea that environmental ethicists largely ignored the concept of biomimicry due its noticeable anthropocentric character, and its misplaced ambition to be a sort of environmental ethic (p. 268). He responds by saying that "there is no logical connection between taking nature as measure and anthropocentrism" (pp. 268-269) because whether nature as measure benefits humans or nature depends on the agent and the outcome.

2. Social Recognition Theory: Toward Inclusion of the Natural World

Now that the conceptual space of biomimicry (i.e., the concept of biomimicry) is outlined and comprehensible or conceivable, including the normative position that nature as *measure* gives rise to a biomimetic ethical field (i.e., a theory of biomimicry), I turn now to questioning whether the concept and theory of biomimicry can be interpreted as a *mode* of recognition which I derive both from the social roots of recognition theory and its recent discussions regarding the inclusion of nature within the sphere of recognition and its corresponding attitudes and behaviors. In this chapter I start by introducing recognition theory based on an overview of invariable and variable key elements. These include but are not limited to why

there is a demand of recognition in the first place, who struggles for recognition, who deserves recognition, who should receive recognition, and to which extends, supplemented by various normative implications that demonstrate the legitimacy of an ethical extension to considering nature. These aspects form the basis for the normative discussion that follows in Chapter 3 where I analyze the position of (parts of) nature within the scope of justice. This offers a starting point or foundation for the more sophisticated discussion on how the concept and theory of biomimicry meet the standards for adequate recognition. Here I also explore the role of nature in critical theory to see whether and on what grounds they did or failed.

2.1 A Representation of Social Recognition Theory

Recognition theory essentially revolves around several key questions such as *why should be recognized,* w*hat should be recognized, by whom, how much,* and *on what justifiable grounds.* In its rudimentary form, recognition is the identification or acknowledgment of a certain feature, or a set of features, that has as its normative implication to bring about an action with respect to those features, and often occurs between subjects of recognition (i.e., recognition *givers*) and objects of recognition (i.e., recognition *receivers*), or even the identification of features in oneself i.e., self-recognition (Honneth, 2008, pp. 63-74; 1995; Ricoeur, 2007, Ch. 2). But what is the relevant meaning of 'recognition', and how is it different from 'identification' or 'acknowledgement'? The term 'acknowledgement' in particular causes ambiguities since some theorists use 'acknowledgement' and 'recognition' as synonyms; while others use the term to denote the validity of particular insights, values and norms (Ikaheimo & Laitinen, 2007, p. 34-37). Paul Ricoeur shows that recognition can denote many things as he discusses more than 20 variants of what it means to recognize (2007, pp. 5-16), which he grouped into three categories: (i) 'recognition as identification', (ii) 'self-recognition', and (iii) 'mutual recognition'.

Recognition has two clear dimensions: normative and psychological (Iser, 2013). When, for example, the subject recognizes the object as an autonomous agent, or as having a specific normative status (e.g., as a free and equal person), the subject not only admits that the object has this feature, but the subject embraces a positive attitude towards the object for having this feature (Iser, 2013). But how should we interpret such a positive attitude? And, if present, how does it relate to notions of justice? This normative aspect of recognition implies that the subject bears certain obligations to treat the object appropriately. Hence, recognition implies a

notion of victimhood. On the other hand, the psychological aspect is concerned with the idea that persons fundamentally depend on the feedback of subjects and of society as a whole in order to develop a practical identity (Iser, 2013). Those who fail to experience "enough" recognition ultimately struggle in embracing themselves and their praxis as valuable. Such experience occurs when the object of recognition is misrecognized, not recognized, or negatively and wrongly recognized by surrounding others or societal norms, values, and structures. For instance, a misrecognized person finds struggle in establishing a successful relationship with the self, and hence fails to develop a practical identity. There are numerous examples of "struggles for recognition", amongst which victims of racism, colonialism, xenophobia, sexism, ableism, speciesism, and other related categories[7], who suffer psychological harms by being demeaned as inferior, or misrecognized for their inherent qualitative features and moral status (Iser, 2013). Misrecognition thus violate the genuine identity of subjects and objects of recognition. These events helped popularize the notion of "identity politics".

It follows that many accounts of recognition theory aim to assign a more fundamental role to the concept of recognition: one that covers the ethical content of human relationships in its entirety. Whether these endeavors are limited to human-human relationships, or as full-fledged as considering human-nature relationships, will be discussed in Chapter 3. One of the main themes regarding the ethical content of recognition theory is the notion of justice. The notion of justice is at least twofold. None of the aforementioned social groups or movements struggle for the distribution of goods primarily; they fight for a particular affirmation of their particular features or identity. For instance, Young (1990) argues that "justice is not primarily concerned with how many goods a person should have, but rather with what kind of standing vis-à-vis other persons she deserves". Likewise, Laitinen & Kortetmaki (2019, p. 253) argue that when we want recognition "[it] is not merely [about] being noticed, but [to have] our relevant features being adequately responded to". Both views have in common that recognition implies a notion of justice. Others discussed circumstances where (re)distribution of certain goods is, however, intertwined with recognitional approaches to justice (Fraser & Honneth, 2003). Despite a common conceptual foundation, there are varying, and sometimes contradicting, conceptions of recognition amongst different theorists of which distributive justice is but one example of disagreement. Such positions have been fundamentally challenged

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[7] Since the 1990s, theories of recognition illuminated uprising social movements. For example, struggles for recognition by ethnic, religious, homosexual—or the LGBTQ+ community more broadly—and physical and mentally impaired minority groups.

by the idea that a need for receiving recognition renders persons utterly dependent on dominating societal norms. Hence, struggles for recognition might lead to conformism and a sort of strengthening of ideological formations (Iser, 2013).

As I have shown, many theorists claim that 'recognition' transcends mere 'identification' or 'acknowledgement'. They claim that the concept of recognition requires a disposition of a *passive* approach to recognition, and take an *active* approach to recognition, i.e., going beyond merely acknowledging relevant features or values of a subject or object, or the legitimacy of principles (Laitinen & Kortetmäki, 2019, p. 252; Laitinen, 2010). It turns out that mere identification or acknowledgement of relevant features lacks both effort and intention to serve the full ethical content of recognition with regards to justice for when it is normatively relevant.

Here I distinguish between the *passive* and *active* form of recognition, namely by setting *two criteria (C)* and its *premise (P)* for recognition that, if approached correctly, precede each other and are both satisfied:

C1   The identification or acknowledgement of relevant features.

C2   An adequate response to relevant features.

P   C1 is a necessary condition for C2, thus C1 always precedes C2.

These two criteria, whilst being reductionistic, are based on the representation of recognition theory given here and ultimately lie at the heart of recognition theory.

2.2 Subjects and Objects of Recognition

Now let us consider the potential or entitled candidates for being or becoming subjects and objects of recognition.

Notwithstanding the diverse applications of recognition theory, most theories revolve around notions of mutual recognition.[8] For many, the notion of mutuality serves as a precondition for appointing subjects and objects of recognition. Many argued that recognition implies mutual recognition and claim that recognition is intersubjective and occurs between persons. One of the pillars of mutual recognition is the idea that only subjects can experience

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[8] The embedment of 'mutuality' that is part of the normative core of recognition theory stems from Hegel's *Phenomenology of Spirit* where he writes that "we become conscious of our own autonomy by being challenged [or "called upon"] by the actions of another subject". In this sense recognition is something that is mutual or shared between two or more persons.

"getting recognition" (Laitinen & Kortetmäki, 2019, p. 252). Another argument in support of mutuality is the idea that the experience of being recognized by a subject is a vital need since it affects the object's self-relation or practical identity (p. 252), which is essential for a person's development (Honneth, 2008, p. 41). The central idea is that we gain self-consciousness as autonomous agents, namely only by interaction with other autonomous subjects. In other words, only by understanding the intentionality of someone's actions can we grasp our own actions and utterances as expressions of an intentional self (Iser, 2013).[9]

Mutual recognition holds that only *objects* of recognition cannot be recognized due their incapability of giving recognition. On this view, nature, animals, ecosystems, and inanimate objects cannot be recognized because they cannot *give* recognition. Only when natural entities are granted a legitimate attribution of personhood they might qualify as subjects of recognition, but whether they genuinely *give* recognition is arduous to prove.

The notion of mutuality as a precondition for recognition is contested by Laitinen (2010) through his proposal of *adequate regard*, which is based on experiences of misrecognition. He argued that the condition of mutuality disproportionately limits the scope of recognition (Laitinen, 2010). Therefore, we should distinguish between a *narrow* conception of recognition based on the *feature of mutuality*, and a *wide* conception grounded in the idea of *adequate regard* (Laitinen, 2010). By affirming *a valuable feature* of an entity (i.e., persons, animals, and even inanimate nature) we properly recognize the valuable feature of the entity *regardless* of whether the recipient of recognition realizes this transaction or is even able to *give* recognition. Hence, the wide conception is receptive to increasing the pool of recipients of recognition, namely by including those entities that arguably cannot be subjects of recognition themselves. Note that even though the pool of recipients may be larger in size than the number of subjects of recognition, the eventual objects that struggle or deserve recognition may be of course smaller than the factual number of recipients. Later, in a paper with Teaa Kortetmäki, they describe the adequate regard account by saying that "[i]t is not merely that [people] want to be noticed or identified or classified as persons, or persons of this or that type, but they want that they are taken and treated *adequately* in light of what they are" (Laitinen & Kortetmäki, 2019, p. 252). On this view, adequate recognition depends on the responsiveness of subjects to relevant features; not only of persons, but also non-persons. Non-persons or

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[9] In one of Georg Wilhelm Friedrich Hegel's stories about the state of nature, he describes social relationships as follows: "A person who attacks your property does not primarily want to gain material goods. Rather, she wishes to remind you, the first possessor, that she is a person with moral standing as well who has been neglected by the act of 'first acquisition'" (Honneth, 1995, pp. 44-45). This illustrates that by fighting against the other, the subject wants to affirm its freedom by proving that its normative status is of more importance to the subject than any of its desires, including—at an extreme—the desire to live. However, such a struggle would fail to achieve *mutual* recognition and therefore result in an impasse.

inanimate objects can have relevant features in comparable regards as persons. By this line of argumentation, valuing nature as "non-instrumental" is a recognitional mode of adequate regard towards nature.

Besides the qualification of *individuals* to be subjects and objects of recognition, a further challenge in recognition theory asserts to questions whether an in what regard *collectives* can qualify as such. It is debatable whether groups or collective entities can be full-fledged *givers* and *recipients* of recognition, especially on a berth of mutual recognition. To explore the different implications of collective subjects and objects, I separate them in three levels: (i) group-level, (ii) state-level, and (iii) institution-level. First, most theorists think that groups of persons can be both subjects and objects of (mis)recognition on grounds that group members can share a *collective intention* as well as certain features relevant for (mis)recognition.

Second, it has been famously argued by Rawls that states can be subjects and objects of recognition in the proper sense to the extent that they can have a legal personality (1999, pp. 34-35). Though, this view has been contested based on the idea that states as a collective entity are merely an aggregation of individual intentions (Pettit, 2007, p. 180), nor is it clear whether states exhibit collective intentions. To illustrate, when citizens of one state 'feel disrespected' by the particular events of another state, it is doubtful whether this is due insults to the state, a public official, or themselves as citizens and members of the state.

Third and last, the institution-level is promising but dependent on one's definition of institutions. In principle, an institution can roughly be described as everything that is the product of what humans bring about. Institutions can arguably disrespect persons (or non-humans) because institutions always express, as well as reinforce, underlying attitudes of those who designed or uphold them (Iser, 2013). These include formal institutions such as states, constitutions, economic markets and so on; and informal institutions such as cultural norms, values and traditions. On the one hand, institutions can be subjects of recognition based on its ability to disrespect. For example, when factory farming industries and capitalism more broadly exploit natural goods and resources for profit, one could argue that this is a clear form of disrespect. Whether institutions can be disrespected on the other hand is not just as self-evident. Institutions can be disregarded, but whether they can be (mis)recognized depends on the involvement of persons that comprise the institution since they can be (mis)recognized. In a more indirect sense, persons who have institutionalized certain practices or norms, could arguably be disregarded when their intentions are (mis)recognized, for example sustainable solutions or technologies could be disrespected.

2.3 Antecedental Recognition

While mutual recognition thus grants others the status of an epistemic authority that allows the construction of a normative space of reasons, antecedental recognition does not seem to depend on norms and values, but an elementary form of recognition (Honneth, 2008, pp. 40-52). This elementary or antecedental form of recognition is rather a source of norms and values, then the object of such. Jürgen Habermas claimed that communication or language presuppose a form of recognition where all other communicators (primarily rationality-based language) are equally authoritative (Honneth, 2008, p. 8). This outlook holds that humans never create their world or sphere of reasons from scratch but are embedded in holistic webs of meaning which they reproduce altogether.

Honneth argued that only through empathetic engagement with other persons allows for taking over another's perspective (2008, p. 27). Taking over another's perspective seems to be a prerequisite for sharing their evaluative reasons, or in Honneth's terminology, "recognition precedes cognition" (pp. 40-44). Contrary to Habermas, Honneth grounds his theory of recognition on psychological insights to develop a more sophisticated version of recognition theory instead of one based on communication or language. Honneth argues that a child's brain can only develop cognitively through emotional attachment of attachment figures such as (psychological) parents or primary caregivers. These positions draw on the relationship between parent and child and are inspired by psychoanalytical object relations to describe these relational mechanisms. As Michael Tomasello points out, "[o]nly by being interested in sharing experiences with other autonomous beings does the child gain access to the 'world of meaning'" (as cited from Iser, 2013). On this view, humans recognize others as *persons* early on in life. Already, offspring learn to recognize attachment figures as intelligible beings, or as meaning-conferring or autonomous (Honneth, 2008, p. 42). The line of reasoning goes that a child later perceives all other humans as humans. However, while this may seem theoretically cogent, reality proves that subjects at some point become blind or insensitive to antecedental recognition (Honneth, 2008, p. 58), presumably through reifying social practices.

Reifying social practices discard relevant qualitative characteristics of a person who is then perceived through quantitative measurements and as thing-like.[10] This phenomenon is what

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[10] Honneth's notion of 'reifying social practices' stems from the Hungarian philosopher György Lukács who first conceptualized 'reification' (*Verdinglichung)* in his highly influential treatise *Reification and the Consciousness of the Proletariat* published in 1925. Lukács derived the

Honneth also refers to as the *forgetfulness of recognition.* It prompts individuals to perceive subjects merely as objects, or as non-human or sub-human (Honneth, 2008, pp. 59-60), and is something inhabited and conditioned in development from birth in early stages of life. A more sophisticated characterization of reifying social practices, or the forgetfulness of recognition goes as follows:

> […] the exchanging partners and finally one's own personal talents may only be appraised in accordance with how their quantitative characteristics might make them useful for the pursuit of profit. This kind of attitude becomes "second nature" when through corresponding processes of socialization, it develops into such a fixed habit that it comes to determine individual behavior across the entire spectrum of everyday life […] Lukács consequently understands "reification" to be a habit of mere contemplation and observation, in which one's natural surroundings, social environment, and personal characteristics come to be apprehended in a detached and emotionless manner—in short, as things". (Honneth, 2008, pp. 24-25).

The forgetfulness of recognition thus becomes a fixed habit. Honneth responds to this social phenomenon by arguing that we ought to exhibit recognition in order to "dereify" or "mitigate" such habitual modes. To do so, Honneth brings forth three influential accounts of recognition: love, respect, and esteem (1995). Love relates to special bonds and affections in the intimate sphere of family and friendship. Recognition based on respect entails universal respect for human autonomy and equal dignity. Negative experiences of disrespect are obvious when humiliation takes place, or when humans are treated like mere things. Esteem denotes the recognition of particular traits or achievements—not necessarily whole identities—by those who value those traits, for example individuals, communities, or tribes. It is sufficient for individuals to be respected by all and esteemed by few. Furthermore, all three accounts are essential for self-realization.

Remarkably, natural entities are profoundly ignored in philosophical discussion about recognition, however, nature can also be object or victim of reifying practices since it is widely known that humans exploit natural goods and resources for their purposes. At least some philosophers incorporated the notion of reification of the environment in their work (Kortetmäki, 2019; Vogel, 2015; 2016; Hailwood, 2015). Kortetmäki (2019, pp. 503-504) examines the aptness of the concept of reification in environmental philosophy and argues that the reification of the 'environment', 'non-human animals' and 'non-human nature' each has

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concept of reification from capitalist economic exchange whereby others were seen and treated as instrumental to commodity exchange. Honneth has expanded Lukács version of reification from the capitalist domain to every other area in social life.

different implications. For instance, Hailwood (2015) argues that non-human nature can be recognized, but not reified. While on the other hand the reification of human-environment relations is arguably akin to the reification of persons because both deny the human choice and agency in building the world (Kortetmäki, 2019, p. 495).

2.4 Recognition of Nature: Environmental and Ecological Justice

As pointed out, there is good reason to think that parts of nature, and nature as a whole can be the object of reification. Particular features of nature are not recognized or misrecognized and this practice leads us to the following discussion about how philosophers in the debate think that nature ought to be recognized, including the different dimensions, perspectives and arguments.

Schlosberg (2007) conceptualized notions of environmental justice and ecological justice. Ecological justice moves beyond anthropocentric versions of environmental justice that are concerned with the distribution of natural goods between people. Instead, he aims to expand the scope of justice by embracing notions of justice based in the recognition of nature relating its multifaceted identities, (the protection of) capabilities and participation (in political decision-making). His goal is to develop an extended notion of justice that can be applied to both relations regarding "environmental risks in human populations and relations between communities and non-human nature" (p. 6). Rather than developing a singular universal theory of ecological justice, he defends a pluralist position that allows interpretations of various discourses and concepts in the ethical extension to including individual organisms, collectives, and natural systems (p. 9). According to Schlosberg (2007), both paradigms—environmental justice and ecological justice—isolate themselves in a conceptual sense since environmental justice typically excludes the interests of the natural world beyond human impact, and ecological justice blatantly ignores the concerns raised by environmental justice movements (p. 6). Interestingly he attempts to mediate and connect both paradigms by introducing notions of recognition, capabilities, and participation that put them on equal footing and equally worth of consideration, while maintaining a pluralist perspective.

Prior Accounts of Recognition of Nature

Schlosberg analyzes three main views that each provide normative grounds for the claim that, first and foremost, nature *can* and also *ought* to be recognized since it can be an object of recognition, and secondly, *what* we ought to recognize in nature—or a how-question—drawing on the kind of features that entitle them to moral consideration:

> R1   Recognition based on *similarity* (e.g., sentience, consciousness, interests, dignity and authenticity, agency, subjects).
>
> R2   Recognition based on *integrity* (e.g., autonomy, resilience, autopoiesis).
>
> R3   Recognition based on *status injury*.

Each offers manifold perceptions of *what* justifies recognition of nature. In what follow I represent the integration of recognition theory in Schlosberg's analysis.

First, nature can be recognized in terms of the similarities between us and them. Persons who are sentient, yet not morally capable persons are extended inclusion in the scheme of justice. Sentient persons are granted the status of subjects even if their full agency is limited. So those who can suffer should be included. Again, the attempts are to extend inclusion in the moral community by breaking down theoretical barriers—and by recognizing some key similarities—between humans and nonhuman nature. The similarity approach does not depend on extending what is human to nature, but offers a way to understand and recognize what is natural and not necessarily unique to humans. This idea extends the community of justice by basing community on a type of quality that we *share* with nature. In other words: this kind of recognition holds that we are *like* nature and not as *separate* or *unique* as we would like to think. So, we should recognize the distinctiveness of nature, but also the commonalities.

Second, the integrity account is based on nature's status of being able to have its integrity insulted. He starts with saying that we could base this account on nature's bodily integrity, the recognition of (i) the potential in nature, (ii) its autonomy, (iii) resilience, or (iv) respect for autopoiesis. That we should not use nature as a means to our ends, what Rodman also says. Rodman also defends (a form of) recognition of autopoiesis "… having their own characteristic structures and potentialities to unfold, and that it is as easy to see this in them as it is in humans, if we will but look". But recognition of nature can come out of a human-centered concern for integrity. This is what Haywayd (1998) argues: respect for nature can come directly out of respect for our own selves and each other. If we respect the integrity in ourselves and other people, we do not have a good reason to withhold that respect from the rest of nature. We are part of nature, he says, and it is part of our human interest to integrate

ecological concerns. Clearly, we can expand the notion of the recognition of physical integrity to nature, so that an abuse of that integrity, or a harm to the 'body' of nature, is an element of disrespect and malrecognition. We can also refer to this as respect for dignity.

Then a third form of recognition is the account of 'status injuries'. Fraser's insistence on the status of a group or victim makes the application of recognition as an element of ecological justice much easier. It is not aimed at valorizing individual or group identity, or at recognizing psychological plight of individual victims, but at overcoming subordination. By this, we can dismiss the criticisms that recognition of 'agency' or 'integrity' necessitates an anthropomorphizing or psychological need for recognition in nonhumans. However, we can see nature injured, its interests ignored, autonomy dismissed, or its integrity damages without resorting to such psychological language or conceptions (Schlosberg, 2007, p. 139). Furthermore, Rodman's critique of moral extensionism was ultimately based on the argument that extending existing notions of human-based ethics simply do not recognize nature or itself: "…. Degraded rather by our failure to respect them for having their own existence, their own character and potentialities, their own forms of excellence, their own integrity, their own grandeur" (Rodman, 1977, p. 94).

3. Biomimicry as a Mode of Recognizing Nature: A Conjunction

In this chapter I bring the concept of biomimicry and the concept of recognition together and show that the conjunction of both concepts gives rise to a mode of recognizing nature that is satisfactory in its attempts to approach themes related to notions of justice. I term this the theory of biomimetic-recognition. First, I contrast the two concepts as formulated in the preceding chapters by illuminating their virtues and vices—primarily when placed in the context of justice in relation to nature—and show that in this novel setting both concepts are complementary and give rise to a new perspective—the new perspective is different from the original concepts, yet more inspired by them. As a second step, I set out the conceptual space for the ethical model by analyzing six components that make up the founding principles of biomimetic-recognition altogether. Not only does the ethical model provide guiding principles, but it also offers a backdrop against which practitioners can assess the legitimacy of their mimesis praxis. Note that the formulation and development of the conceptual conjunction, thus the emergence of

biomimetic-recognition, is situated in the rudimentary stage, and requires further deepening and substantiation to cover the whole conceptual space and application prescriptions. I, however, aim to first explore this uncharted territory in the pursuit of these ambitions.

3.1 Complementarities and Conflicts

At first glance, the following lessons are afforded by each concept in turn. A point of departure for the more sophisticated analysis that follows hereafter in §3.2. It should be noted that biomimicry learns respectively more from recognition theory rather than the other way around. This is due to the primordial theoretical and conceptual roots of recognition theory that stem from the social domain, and not the natural or Earth sciences domain. Thus, the lessons and perspectives the concept of biomimicry affords to the concept of recognition are initially aimed at making the already extended version towards recognition of nature more sophisticated, while detaching from social recognition. In other words, biomimicry does not offer clear and relevant lessons for social recognition. Moreover, the main focus of the conjunction is on what the convergence of both concepts hold and propose in normative sense, rather than simply outlining what the virtues and vices of one concept contribute to the old form of the other concept. Thus, the conjunction gives rise to a whole new concept that takes inspiration from both concepts but is a concept of its own in the novel form. The potency and triumph of the conjunction bestows justice towards nature through biomimicry.

Recognition: Lessons from Biomimicry

First and foremost, biomimicry suggests that non-human nature has relevant features of sufficient value considering the entry requirements for becoming an object of recognition. Instead of accepting the precondition of mutuality I adhere to the contrary precondition of adequate regard as introduced by Laitinen (2010). According to the principles of biomimicry, non-human nature disposes of features that are capable of, one, mitigating ecological disruptions, or to adapt to abruptly changing ecosystems and the atmosphere; and two, having a good of its own that is worth moral consideration. I claim that both these qualities are good reasons to identify (non-human) natural entities as capable candidates for joining the pool of recipients of recognition. To circumvent the problem of prioritization between humans and non-humans, at least for now, I propose that both parties should be dichotomized to having

their own pool of recipients. This way it avoids the reasonable inclination to favor and prioritize the interests of the human species over non-humans in all relevant events when contrasted against one another.

Secondly, mimicry in human-human relation could give rise to a new method of understanding and recognizing others. In a similar vein as taking the perspective of the other, mimicry in a social sense, as a kind of sociomimicry, might succeed where ordinary semantic communication fails. Effort implies the attempt to mimic, which suggests that the effort to mimic is in itself a method of trying to understand and take the perspective of the other. From a sociological point of view, the effort put in mimicking a member of marginal groups would mean trying to understand their situation and how the situation came about in terms of the social structures that made that the group is a marginal one.

Third and last, improve human-human relations because biomimicry might unite former antagonists to collaborate to care for the planet together. A shift of focus to solving environmental issues—including all kinds of wrongs towards the non-human natural world—rather than mere socio-political issues as a joined objective might provoke better understanding between parties in their attempt to reach common goals e.g., a healthy and global life-support system.

Also, biomimicry suggests that quantitative features such as weight, bone structure and other biological features can be recognized, in an adequate sense whereas social recognition does not allow such recognition; at least not significantly.

Biomimicry: Lessons from Recognition

I regard its strengths as being a valid and intriguing philosophical concept and ingenious regarding it prospective innovations to take inspiration from the biotic and abiotic community in an appreciative manner, especially since many technological innovations are or have been inspired by direct human invention due reasoning and rationality et cetera. A weakness is its philosophical infancy and its occurring focus on human purposes.

To start with, recognition theory suggests that biomimicry should consider and be receptive to notions of justice. Practitioners of nature-inspired technological innovations or other institutionalized forms of biomimicry might unconsciously meet some demands of justice. It seems worthwhile to know. And to learn how biomimicry could contribute to justice.

Thus, recognition theory unravels an inherent opportunity in the concept of biomimicry. Biomimicry is a concealed mode of recognition when adequately 'performed'.

Finally, humans can be perceived as a source of knowledge, too—as well as by humans but also nature. Humans have plenty faculties, extraordinary considering the evolution of the human brain and its cognitive functions, that on a hypothetical and imaginary note, likewise, non-humans would be willing to have (some of) our faculties for whatever their motive. For example, we can act altruistic or empathetic towards others and step away from self-interest et cetera.

3.2 Biomimetic-Recognition Theory: Six Components

When both concepts are taken together, the area where they overlap is where the biomimetic model of adequate recognition of nature emerges.

Six components	Underlying questions
Mode and Kind	*How and what does the model mimic?*
Objects and Recipients	*Who should be mimicked?*
Relevant features	*What should we mimic?*
Adequacy	*How much should be recognized?*
Focus	*Why should we mimic, in whose interests?*
Subjects	*Who should recognize / who mimicks?*

Table 1. The basic constituents of the *biomimetic-recognition model* (BRM).

3.2 Mode and Kind

The biomimetic approach to recognizing nature is both a *mode* of recognizing nature, as well as a *kind* of recognizing nature. Consider the prior accounts of recognition of nature as outlined in §2.3: most of these accounts that focus on a particular feature, or a set of features, can be portrayed as objects of mimicry. For example, sentient creatures have a feature that arguably gives them moral consideration and thus admission to the pool of recipients of recognition. Whereas conventional modes of recognizing nature continuously struggle with meeting the demands of environmental and ecological justice when approached or propagated or fulfilled

by means of constitutional rights. Biomimicry offers a *mode* of recognizing nature in a way that satisfies notions of justice commanded by the principles of recognition theory with regards to the positive attitude of the subject of recognition (i.e., going beyond mere identification of relevant features).

Consider now the *kind* of recognition that the biomimetic approach inclines to reveal. If a performance of biomimicry in the recognitional sense is efficacious, the subject of recognition recognizes in the object of recognition a kind of talent. I term and refer to this *kind* of recognition as the 'recognition of talent'. Here I interpret 'talent' as a particular feature close to 'having a skill' that meets or succeeds the goal of any given task. In a strict sense, the notion of talent in the context developed in this paper comes close to a notion of a particular feature or set of features in nature, in relation to nature as a *source* of knowledge, that triumph at any given task or area of practice that—as far as we could possibly know—can be comprehended by humans (only). For example, a leaf has the talent to convert sunlight into energy. Based on this reasoning, the 'recognition of talent' is a *kind* of feature that is recognized in nature, while 'biomimicry as recognition' is a *mode* of recognizing nature. If, and only if, "it can be mimicked" in a way that satisfies the prerequisites of adequate recognition, it is talent. Both seems prima facie intertwined.

The efficacy of a biomimetic performance in the context illustrated here depends on the intention of the performer, and the outcome of the performance. If, and only if, the performer's intention satisfies C1, and/or the performance' outcome satisfies C2; then the biomimetic performance is an adequate *mode* of recognizing nature, hence, simultaneously a *kind* of recognition, namely the recognition of talent. In other words, the biotic and abiotic community possesses talent when they have a relevant feature, or a set of relevant features, that can be legitimate objects of mimicry because their feature can theoretically and pragmatically contribute to improving or stabilizing the health of life-support systems, ecosystems more broadly, and/or the direct circumstances of the object of recognition itself.

R4   Recognition based on *talent* (e.g., R1, R2, R3, X).

3.3 Objects and Recipients

The sphere of recipients is comprised by those natural objects of recognition who are victimized by *humans* in any conceivable way, or otherwise eligible for justice such as

endangered species. I emphasize humans as wrongdoers or assaulters here because the biomimetic-recognition model does not suggest, nor disapproves, to mediate in a dispute between two or more non-human species. In other words, biomimetic-recognition is not concerned with nature-nature relationships.

Since recognition implies justice, not all natural entities are recipients. Even though roughly all natural entities can be *objects* of recognition, not all natural entities are necessarily *recipients* of recognition. A pet or a garden may be taken good care of by its caregiver. So, in general, there are many other cases where natural entities do not (evidently) struggle for recognition—if they could even *know* they can; at least we might think so. There is a fundamental difference between the pool of *eligible* recipients of justice and the *actual* recipients of justice where the former pool comprises of *all* objects of recognition and is hence larger in size than the latter pool which comprises those who *struggle*. It is plausible to suggest that endangered species and victimized entities make up the pool of *actual* recipients, but I wish not to limit the scope of recipients to only these cases.

Further, the objects of recognition are individual entities, groups or species (including an inter-species level), and ecosystems. There is a normatively relevant difference between objects and recipients of recognition. Those who have *talent* based on the interpretation intended here, can equally be thought of as potential objects of mimicry in equal regard to the recipients of recognition. Important to note is that, based on the implicit notion of justice in recognition theory, the biomimetic-recognition approach tends to favor the *recipients* over the *objects* of recognition because they struggle arguably more than those who struggle less or not. But those who choose (i.e., the biomimetical performers) the object of mimicry for design solutions or technological innovations are not bound to selecting the object from the pool of recipients of recognition; rather they cherry-pick based on favorable features.

3.4 Relevant features

Features for biomimetical performance are possessed by objects of mimicry when those are relevant if the feature or trait is a *talent* that can be recognized. This way, biomimetic-recognition is not necessarily limited to the features or traits *themselves* that should be responded to in *adequate regard*—by drawing once again on Laitinen's argument (2010). Instead, the biomimetic-recognition theory allows for mimicking features or traits that are 'held', 'possessed', or 'carried' by the object of recognition on the basis of talent (analogously

also 'object of mimicry') as part of its identity or identity as a whole. One might argue that this takes the spirit of recognition out of context, since this view allows for, or consents to, mimicking features and traits that are unrelated to the features and traits that *should be adequately responded to* because those are what stir up their *struggle* in the first place when forgotten or misrecognized. My response is that the theory of biomimetic-recognition as developed here resides in a context of its own, namely one that considers nature alongside humans in the sphere of recognition by appraising the relevant feature of talent. Consequently, the theory of biomimetic-recognition is tolerant to a wider notion of features and traits that can be adequately responded to. This notion goes beyond what features and traits are forgotten or misrecognized (rather, it regards it a 'secondary concern'), but is receptive to recognizing features that can be judged as talents, and correspondingly, that this talent contributes to recognizing *others* in adequate regard thus in indirect fashion (although it takes notion of forgetting to recognize and misrecognition into account but additional to or indirectly to others). Whether talent should always contribute to a notion of justice what must not be forgotten or misrecognized but adequately recognized depends. The notion of talent can thus mean two things: (1) the talent of a feature to able to be mimicked and (2) superlatively, that this talent *also* constitutes or aims at recognizing natural entities in adequate regard namely what they require in light of their struggle to 'not to be forgotten' or 'not to be misrecognized'.

To illustrate: the beak of the kingfisher bird species is taken as the object of biomimicry by so-called "biomimetical performers" as a source of inspiration for designing the Shinkansen 500, a Japanese bullet train, to improve the aerodynamics. Here, the beak is the relevant feature, or talent, and is but one part of the kingfisher's identity. I regard the kingfisher's beak here as 'a talent' based on the ability of the beak 'to be mimicked', or in other terms 'to be the object of a "biomimetical performance"'.

A conceptual problem here derives from Honneth understanding of relevant features based on his notion of 'recognition precedes cognition'. What Honneth means by 'recognition precedes cognition' is that there are *some* features that Someone may already be familiar with in The Other, without being aware of the features in The Other. Thus, the relevant feature in this regard is some feature that the Someone likewise or in parallel manner already possesses from childhood and development. Think of similar features such as being an autonomous being or having consciousness; or even biological outer or inner form features such as a beating heart, a brain, flesh, and bones. Honneth's notion of 'recognition precedes cognition' is problematic when translated or embedded into the context of human-nature relationships. The problem resides in the features in nature that humans can identify with, which trades on an epistemic

category. (Note that similarities are not necessarily 'shared' or 'shared similarities' because it is humans that identify or conceive of similar features in nature, whereas nature at large or some natural entities might not (be able to) conceive of the similarities they identify in humans). Plausible but contested examples of shared or similar features reside in notions of 'sentience', 'consciousness', and 'intelligence', but also more obvious similarities between humans and nature such as the need for, and/or interest in, subsistence, survival, and life-support systems. Ultimately when the conceivable identification of decent similar features reaches the epistemic ceiling, they likewise reach the stage of discrepancy. From the point of discrepancy, we could consider a reversed approach to 'recognition precedes cognition' based on the notion of "cognition precedes 're'cognition" when existing features of the natural world are not *yet* or *ever* epistemically or ontologically possible to identify in the antecedental sense. However, through social life and the experience of a "second nature" we could arguably claim that when we cannot identify primordially with nature, we can nevertheless 'acknowledge' their relevant features through practice.[11] This way, the relevant features are not 're'cognized in the antecedental sense but merely cognized. It flows from here that through the practice of cognizing relevant features in nature we at some point "know" them and correspondingly also could "forget" them, though for the *first* time. This view renders the antecedental inconspicuous features at some point cognizable (e.g., through practice or the experience of "third nature" or similarly "objective nature"), which means that such features can be forgotten, misrecognized, or recognized, therefore should be adequately responded to. This allows entities with relevant features to be taken by humans as full-fledged *objects* of recognition and thereby obtain the authority to progress from C1 to C2.

Correspondingly, most 'prior accounts for recognition of nature' focus overly on similarities between humans and non-humans. [I could still only focus on "the similarit approach to recognition of nature"].

But how much features are relevant: merely one, a set of features, or one's identity as a whole? The quantity is but one aspect of what it means for biomimetic-recognition to be adequate.

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[11] Odin Lysaker argued for a supposedly "third nature" in which humans depart from their "second nature" experience of the world determined by social life, to experiencing life (again) in a more antecedental manner, yet different from the antecedental position of "first nature" (2019, 208). In his paper, he also argues that Honneth's critical theory contains a promising ecological insight or sensibility that gradually vanished in Honneth's later works.

3.5 Adequacy

As I hinted earlier in §2.2, the adequacy of recognition essentially depends on whether and to what extent the two criteria, C1 and C2, are satisfied. The premise of the two criteria (P), and similarly also the premise or principles of recognition as a kind of justice, is that recipients of recognition should not only have their relevant features or traits merely identified or acknowledged, but adequately responded to. An adequate response can mean a variety of things depending on one's interpretation of adequate response, or whatever response is a justified one. For example, those persons or institutions who face the legacy of colonialism not only want this relevant feature merely identified or acknowledged by colonizers of the past, but their relative struggles adequately responded to by means of (re)distributive justice or capabilities such as treaties. In like manner, natural entities require transcendence of mere identification or acknowledgement to having their relevant needs or interests met, or at least a significant part of it. Despite the lack of rationality-based language or otherwise communicative means between humans and natural entities, it is plausible to adopt the view that 'not being harmed' denotes that it is in their interest 'not to be harmed'. The harm-based approach to the interests of the natural world is a more obvious example of what it means 'to have interests'. Other sort of interests, on a more positive note, may arguably revolve around non-interference and flourishing. Non-interference entails that, instead of bringing about harms in human-nature relationships, we should refrain from doing harm and thus refrain from interfering with their pursuit of goods and interests in their own unique ways (Taylor, 2011). Flourishing, on the other hand, is in my opinion the strongest sense of what it means to meet the interests of the natural world. It implies that humans should aid natural entities in reaching a state of flourishing. Depending on one's notion of flourishing, I claim that the capabilities approach tends to realize states of flourishing in individuals by focusing on a notion of "doings and beings" (Nussbaum, 2003; Robeyns, 2006)—similarly, Schlosberg also adheres to the capabilities approach as a mode of doing justice to the natural world (2007). In brief, the capabilities approach holds that justice is served when individual beings (arguably also groups or institutions) are made capable of achieving their full potential by means of their "doings and beings" (Robeyns, 2006). For example, kingfisher birds may flourish primarily through feeding on minnows and sticklebacks, that in their turn feed on a particular flower or plant; a sudden absence of such flowers or plants endangers minnows and sticklebacks, which in their sudden absence disables the kingfisher's capability to flourish. What it means, then, to adequately

respond to interests in the *strongest* sense, through a notion of flourishing, is the provision of goods and methods that aim to improving the circumstantial conditions in the interests of natural entities that enable them to flourish according to their own unique doings and beings.

An adequate response is not only limited to *direct* or *strong relational* outcomes of biomimetic-recognition, but also *indirect* or *relational* in a *weak* sense. The former suggests that a biomimetic performance relative to specific features of natural objects of recognition have to correspond with the outcomes it tends to achieve. For example, recognition of the whole identity of an endangered species may have a strong relational or direct inclination to respond directly to (all) the relevant features of its being, which implies that a biomimetic performance should aim to improve *just* this, regarding the ethical implications of relevant features altogether, that is to prevent the particular endangered species from extinction. Thus, on the account of biomimetic-recognition theory, the endangered species should be saved from extinction *through* a biomimetic mode of recognition—thus a biomimetical performance. The direct notion of biomimetic-recognition resembles with the principles of recognition from the social realm; *only those* relevant features that invoke the object of recognition to struggle, because they are forgotten or misrecognized, should be responded to in adequate regard. Hence, there is a *strong* relation between the relevant features (C1) and to the corresponding attitude or response in the pursuit of *corresponding* outcomes (C2).

In case of the later, the indirect form of biomimetic-recognition suggests that there is little or no causality between the relevant features (C1) and the corresponding outcomes (C2). Rather than being a mere *exception*, the receptiveness for weak relationism is the *spirit* of this theory; and quite an authoritive and appealing one. It substantively alters the meaning of what it implies 'to respond in adequate regard' because it takes relevant features of *one* object of recognition and provides outcomes for *another* object of recognition, or *also* for *another* object of recognition. This may seem prima facie wrong or counter-intuitive, but it creates space and opportunity for not only respecting the common interests of environmental and ecological justice but realizes favorable outcomes. It resonates with utilitarian principles to align conduct with achieving the greatest good for the greatest number; climate change mitigation and adaptation is a prime example because it is in the interests of many beings and systems, both humans and non-human.

Furthermore, besides the *relational* aspect there should be another aspect that determines the adequacy of biomimetic-recognition, or the *level* of adequacy, namely a *quantity* aspect. The quantity aspect concerns the *number* of features relative to the *total number* of features that were taken into consideration for biomimetic performances. This

invokes both an epistemic category as well as a pragmatic category of biomimetic-recognition theory.

To illustrate: one could conclude that the designers of the Shinkansen 500 did not utilize or exhibit the *full potential*. The Shinkansen 500 mimicked one of many potential features of the kingfisher. The biomimetic performers mimicked the characteristics of its beak and ignored other relevant features, such as its color composition, its habitats, or other unique traits such as 'the talent of being a "king in fishing"'. Though, one might object by saying that utilizing *full potential* leads towards unnecessary extremes. For instance, the bullet train does not run-on minnows or sticklebacks. There are of course limits to the extent of adequate mimicry potential. After all, we could take into question the adequacy of the Shinkansen 500's biomimetic performance in terms of its merit or achievements regarding outcomes. Although the performance improves the aerodynamics which alludes to energy-efficiency it may be adequate in the *indirect* or *weak* relational sense (e.g., efficient use of energy is good on itself), but not in the *direct* or *strong* relational sense (e.g., the performance outcome is not aimed at improving some living condition of the kingfisher).

A final important note is that the biomimetic-recognition theory disapproves of *post hoc reasoning.* Thus, if a biomimetic performance improves the living condition of an object of recognition *accidentally,* the relevant features (C1) of 'the' or 'some other' object of recognition were not *intentionally* considered legitimately: C1 must always precede C2 otherwise it lacks to serve the full-fledged implications and ethical content of environmental and ecological justice.

3.6 Focus

3.7 Subjects

The final dimension of the biomimetic-recognition theory concerns the subjects of recognition. By 'subjects of recognition' I refer to those who *give* recognition by using the term "biomimetic performers", or "subjects of (bio)mimicry"—these fit to the context of this paper at best.

Biomimetic performers can primarily be thought of as those who built, design, or initiate a biomimetic performance, or those who otherwise have a defined relationship with them. For example, a contractual relationship. When biomimetic performers mimic (a feature of) a leaf as a measure for designing solar panels, they approve of recognition in adequate

regard because solar energy is commonly thought of as contributive to a well-balanced or "better" ecosystem. A complication emerges from the idea that biomimetic performers *delegate* morality *to* a technological artefact or system such as solar panels. From the outset of delegation, the human performer or performers might no longer sustain or exhibit the performance, although biomimetic-recognition further processes due the "efforts" of a technological artefact or system.

To make clear, biomimetic-recognition is mainly situated within the domain of market institutions in the field of technology, innovation, engineering, and sciences. The reason for this is obvious. Since biomimicry corresponds to 'practice'—it asserts mainly on technological innovations thus far—these domains pose adequate solutions on a much larger scale and efficacious prospective than what mere individuals are capable of; especially when individuals do not delegate a biomimetic performance to institutions which renders both the duration and desirable effect or outcome insufficient. However, the act may evaluatively be according to the premise of adequate recognition, but also supererogatory.

Other complications and challenges, that I will not discuss in detail due limitations of space, reside in questions regarding the respective 'pool of biomimetic performers' and 'the demand for exhibiting a biomimetic performance'.

Final Conclusion

I laid out the rudiments (for further conceptualizing) of a *theory of biomimietic-recognition*.

Acknowledgements

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