



<https://doi.org/10.48417/technolang.2022.04.12>

Research article

Knowing and Controlling the World through Gardenworks and Biorobots: Discussion of Tamborini and Schwarz

Alfred Nordmann¹ (✉) , Astrid Schwarz², and Marco Tamborini¹ 

¹ Technical University of Darmstadt, Residenzschloss 1, 64283 Darmstadt, Germany

² Brandenburgische Technische Universität Cottbus – Senftenberg, Erich-Weinert-Str. 1
03046 Cottbus, Germany

nordmann@phil.tu-darmstadt.de

Abstract

The papers by Marco Tamborini „Philosophy of Biorobotics: Translating and Composing Biohybrid Forms“ and Astrid Schwarz „Composing and Combining: Opposing Constructive Principles?“ outline different positions on mimesis and composition as the fundamental practices of *homo faber*. A critical commentary seeks to highlight their differences. Tamborini specifies *homo faber* as *homo translator* who moves between different media of presentation and expression. Reproduction in another medium entails a back and forth which defines the work of the translator: a novel is reproduced by a film, the movement of a salamander is reproduced by a machine, an architectural design is reproduced by a physical building. Schwarz promotes *homo hortensis* who practices gardening, widely understood, in different ways – by composing and imposing a plan, or by combining and incorporating the dynamics of physical and biological processes. She foregrounds a creative and constructive act which is profoundly mundane in that it assimilates the world into the works of technology and art. Engineers, designers, architects, and planners are gardeners of sorts in that they are world-makers, tending to works and worlds. This resonates, of course, with ideas of the anthropocene and the epochal role of humans in planetary affairs. – The authors then respond constructively to the critical commentary, seeking common ground among the three positions.

Keywords: Composition; Combination; Translation; Gardening; Biomimesis

Citation: Nordmann, A., Schwarz, A., & Tamborini, M. (2022). Knowing and Controlling the World through Gardenworks and Biorobots: Discussion of Tamborini and Schwarz. *Technology and Language*, 3(4), 175-186. <https://doi.org/10.48417/technolang.2022.04.12>



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УДК 130.2:62

<https://doi.org/10.48417/technolang.2022.04.12>

Научная статья

Познание и управление миром с помощью садовых работ и биороботов: обсуждение Тамборини и Шварца

Альфред Нордманн¹ (✉) , Астрид Шварц² и Марко Тамборини¹ 

¹Дармштадтский технический университет, Резидентшлос, 5, Дармштадт, 64283, Германия

²Бранденбургский технический университет Котбуса – Зенфтенберг, Эрих-Вейнерт. 1,
03046 Котбус, Германия

nordmann@phil.tu-darmstadt.de

Аннотация

В данной статье я исследую, как можно создавать и комбинировать биогибридные формы, начиная с органических форм. Тезис, который я здесь выдвигаю, – эпистемологический: комбинаторная практика бионики, биомиметики, биоробототехники и всех стратегий дизайна, вдохновленных природой, основана не на биомиметическом вдохновении (т.е. на подражании природе), а на практике перевода. Чтобы развить этот тезис, я сосредоточусь на практиках современной биоробототехники. Я исследую практику перевода природных форм в технические артефакты, разработанную Раулем Генрихом Франсе в начале 20 века. Затем я анализирую создание роботов, способных воспроизводить сложные системы передвижения. В итоге я исследую взаимодействие между роботами и живыми организмами (рыбами). В заключительной части статьи я рассуждаю над философским значением и более широкими возможностями для этой практики перевода. Я обсуждаю, когда и до какой степени перевод биологических форм в биотехнические приемлем, и так же выделяю концепцию формы, лежащей в основе этой практики. Кроме того, я стремлюсь привлечь внимание к необходимости философского исследования происходящего между различными областями знаний – особенно между наукой и техникой. Таким образом, данная статья предлагает развитие философии в пробелах преумножения знаний.

Ключевые слова: Композиция; Комбинация; Перевод; Садоводство; Биомимезис

Для цитирования: Nordmann, A., Schwarz, A., & Tamborini, M. Knowing and Controlling the World through Gardenworks and Biorobots: Discussion of Tamborini and Schwarz // *Technology and Language*. 2022. № 3(4). P. 175-186. <https://doi.org/10.48417/technolang.2022.04.12>



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I. COMMENTARY (Alfred Nordmann)

How are natural forms produced, do they follow certain rules of composition? This is a long-standing question in biology and nowadays biotechnology. Marco Tamborini and other historians and philosophers of biology are interested in a related question: Does science discover these rules of composition and engineers then utilize some of them for their own compositional purposes – or do we learn to compose through our technological practice and then, through a process of translation back and forth, we understand nature as a kind of engineer and producer of forms and learn from nature's compositions for our own practices and purposes? Marco Tamborini adopts the second of these accounts and therefore gives center stage to *homo translator* (Tamborini, 2022b).

Astrid Schwarz doesn't begin with a question that is traditionally associated with science but with the practice of creating works of technology and art, including flowerbeds, fields, parks, landscapes. It makes a difference to her whether this practice implements a blue-print or plan by imposing principles of composition on the elements that make up a work – or whether it responds to the recalcitrance and internal dynamics of things, combining them so as to stimulate a kind of co-production. Accordingly, combining things is not just part of compositional practice but a distinct, complementary activity – if classical music, mechanical engineering, and certain forms of landscaping proceed compositionally, it is also important to acknowledge combinatorial practices in the art of gardening that prompt a reflective way of tending to the world and taking a gardening-attitude towards the interplay of people and things, as does *homo hortensis* (Schwarz, 2022).

Though they differ in terms of emphasis, choice of example, and the need to categorically differentiate ‚composition‘ and ‚combination,‘ both help us understand our engineering ways of working with biological processes and forms. What does it mean to live not only in but with „nature,“ to tune technologies to the conditions and processes of life? This is a question of mimesis, imitation, attunement, or repetition, of working together or being in step. How do routines and patterns get established? On some conceptions of mimesis, it involves the production of likeness, inviting judgements of representational accuracy, with biomimetics yielding a technical copy of a biological original. Both, *homo translator* and *homo hortensis* stand for different approaches that differ also among each other.

On Marco Tamborini's „Philosophy of biorobotics: translating and composing biohybrid forms“

Homo translator coordinates words in one language with words in another language. This does not yield mirroring – the two languages remain quite distinct, each has its own requirements, melody, idioms, and yet within the medium of one language one can reproduce claims, associations, feelings from the other language. Reproduction in another medium entails a back and forth which defines the work of the translator: a novel is reproduced by a film, the movement of a salamander is reproduced by a machine, an architectural design is reproduced by a physical building. The main criterion for a successful reproduction is whether it is a good composition here as it is there, that is, whether and how well it works. The successful construction of an analogue or counterpart



cannot be reduced to mere rendering, that is, producing a representation that is more or less „faithful,“ or „true“ to the original (Nordmann, 2021). As one can tell from the famously biomimetic Lotus-effect or Velcro-fastener, it does not even matter whether the well-composed technical reproduction does the same kind of work as does the biological original: While the leaves of the Lotus plant repel water as do their technical counterparts, their function is to pool and collect water on the surface; and while cockleburs effectively attach or fasten themselves to dog’s hair, they are not about fastening as such but about travelling with the dog and spreading their seed. And yet, Marco Tamborini (2022b) adds a requirements or criterion for what makes a better translation by quoting Leibniz: „Those are the same of which one could take the place of the other, with truth unharmed (*salva veritate*), such as triangle and three-sided figure, quadrangle and four-sided figure” (p. 151). In other words, it is not mimetic practice itself which determines what is preserved and what not. There is a something which needs to be preserved and there are better translations and worse depending on how well they preserve „the truth“ of the original. According to Tamborini, the test of this would be a reverse translation that yields back the original. Now, even his very nice literary example does not pass this test, nor do water and dirt-repellant surfaces, the Velcro-fastener, and the mechanical model of a salamander. Is it really the aim of bio-robotics to produce an artificial fish that will blend in with „real“ fish, or is it the aim to produce machines which can move better by integrating mechanical ideas that are derived from a technical scrutiny of fish? And comparing translations of Shakespeare’s plays through the ages, we judge them not by literalness but by effectiveness: A most conscientious translation from the 18th century is no longer able to reproduce dramatic effects in the medium of contemporary German or Italian, whereas a quick and dirty translation from the 21st century may well be able to move us.

Literary translator Anne Weber provided a story to of reproductive translation which radically questions any fixed criterion of faith- and truthfulness: „A European tourist once ordered a Coke in India and was served a Sprite. After drawing attention to the mistake, this was the reply to appease him: Same, same. Same – but different!“ (Weber, 2017)

There is a reason, of course, why Tamborini does not settle for such a liberal conception of translation and seeks to tie it back in with standards of truth. He is still committed to science and the underlying question „how are biological forms produced?“ In contrast to other philosophers of science, however, he does not consider the search for an answer a primarily intellectual exercise but believes that human and natural engineering is productive of many things while being, at the same time, a fruitful detour for science (Tamborini and Datteri, 2023). About the efforts of 18th century mechanical artisans to build machines that imitate organisms, such as a „biorobotic“ defecating duck, he notes: „However, this practice and the implicit knowledge it entailed were not codified until the early years of the 20th century“ (Tamborini, 2022b, p. 148). To be sure, the attempt to reproduce biological functions in the medium of clockwork mechanisms expanded and advanced working knowledge, that is, knowledge of how cogwheels, levers, springs can be composed (put together) to produce an effect (Nordmann, 2020). And indeed, this expansion and advance of working knowledge owes to the idea that



organisms are also technical works which produce effects by way of their very own principles of composition. But this does not allow us to conclude, as Tamborini appears to do, that the working knowledge of mechanical artisans somehow elucidates biological principles of composition. There is no such immediacy of transference, and this is, precisely, why Tamborini's notion of the translator is so productive and important: The working knowledge of mechanical artisans offers biologists a material vocabulary for translating biological principles of composition into a mechanical idiom. And indeed, we thus arrive at Tamborini's conclusion: „The compositional practice of biorobotics is thus not biomimicry (i.e. a mere mimetic copying of the forms of nature), but a translation practice based on the general metaphysical paradigm of an inscription of the mechanical onto the organic“ (Tamborini, 2022b, p. 154).

On Astrid Schwarz's „Composing and Combining: Opposing Constructive Principles?“

Homo hortensis creates gardenworks which are works neither of nature nor of technology or art. These gardenworks are paradigmatic of technological agency since the entire planet is a place where we make our home by working the land, securing food and shelter, positioning ourselves in a built environment, in landscapes and timescapes, organizing a temporal and working order of people and things. To the extent that in the continuum of technical or gardening practices we can distinguish between composition and combination, different garden designs and gardening practices induce the self-reflexivity of the human gardening engineer.

It does not matter much whether the categorical distinction between composition and combination can be secured or whether we speak of different kinds of composition, as one does in music which serves as an example also for Astrid Schwarz: To be sure, the traditional view of composition posits an author who controls homogenized and modularized material and arranges it willfully according to some principles of composition. But in the case of John Cage and Robert Rauschenberg on the one hand, of Jazz on the other hand, there is a composed openness to the surprising qualities of everyday noise and spontaneous expression. So, the difference between the compositional master-mind behind a Baroque French garden and the combinatorial openness in the design of a Romantic English garden becomes important only when we reflect our own position in the creation of works.

It will be most fruitful to further pursue Schwarz's proposal since her juxtaposition of composition and combination invites reflections about the conditions and limits of technical control. What kind of work goes into achievements of control? When artists and engineers control their material or the production of specific effects, they adopt a one-sided mode of composition. It belongs to „those activities used by philosophers to claim that structures and processes are fundamentally posited anew, that this is a one-sided process, and that the condition for it to occur is a homogeneously formed material – musical notes, for example – which, when a rational set of rules are applied to it (the theory of harmony) – lead to a work that is complete in itself according to certain criteria“ (Schwarz, 2022, p. 164). The conditions for the controlled creation of radical novelty thus include a strong conception of authorship, a homogeneous substrate of inert and



modularized material, and the formal principle of a closed or bounded work as a limited whole. Whether these conditions are satisfied or not is by no means a given – artists and technicians work to homogenize, stabilize, discretize the material world. They do so conceptually and by way of theory, they also do so practically and by way of ritual or experiment. And they do so with the aim to achieve a form of control that ideally establishes their authorship of our conditions of life. And of course, this is only one mode of compositional practice. Preponderant perhaps are technical works which admit heterogeneity, spontaneity, unpredictability – that are willing to exercise only partial control or surrender it entirely.

Homo hortensis is engaged in the reflection of these different modalities which are present equally in the spheres of art and engineering – no translation is required to move between these spheres because they can be treated in their original unity. To make this productive for contemporary discourse is part of Schwarz’s achievement.

Mutual Delimitation

Marco Tamborini works with an advanced conception of translation and thereby provides a rich description of the production of mimetic relations and of the production of knowledge in the back and forth between biological and technical idioms. He shows how we learn as technical and biological productions of forms become attuned to one another like two languages that become coordinated through the process of translation. His account is haunted, however, by the elusive idea of an original which is subject to mimicry and translation and which is to be understood.

Astrid Schwarz provides a rich description as well, one which foregrounds a creative and constructive act which is profoundly mundane in that it assimilates the world into the works of technology and art: „Gardenworks, then, are a product of people’s activities and ideas, a well-defined artifact that must constantly be tended and simultaneously re-interpreted time and again. Gardens, like technology, testify to migration, domestication, colonization, to settlement models and economic systems. Yet gardens are also products of nature; their visible structures are, as a rule, overwhelmingly plant-based, but they are also visited, used and even constituted – usually invisibly – by animals, fungi and microorganisms“ (Schwarz, 2022, p. 169). Accordingly, Schwarz foregrounds the expressive qualities of composition and combination. Taking the „gardenwork“ as her paradigm, she does not need to distinguish biological and technical processes of rendering form, and yet, her approach may well serve to elucidate biorobotic artefacts as well. Engineers, designers, architects, and planners are gardeners of sorts in that they are world-makers, tending to works and worlds that mirror each other. This resonates, of course, with ideas of the anthropocene and the epochal role of humans in planetary affairs. At the same time, and despite Schwarz’s careful attempt to limit the reach of ‚composition‘ as opposed to ‚combination,‘ her focus on works of technology and art is haunted by the idea of authorship.

If Tamborini is interested primarily in how we learn to know the world through biorobotics, Schwarz is interested primarily in how we exercise technical control of the world through gardenworks. If Tamborini therefore assigns too much importance, perhaps, to an original order of things and a given wealth of forms, Schwarz counters this



by overemphasizing creative authorship – and while the translator and mediator inhabits the modest role of scientist and engineer who seeks attunement to the world in which we find ourselves, the gardenwork forges a unity of biology, technology, and political culture, tending, of course, to the recalcitrance of things, but internalizing all externalities. Drawn to both positions, I have now exaggerated the differences between Tamborini and Schwarz because they limit, qualify, constrain each other in important ways – limiting and constraining also the ambitions of a philosophy of technoscience which valorizes the felicitous interplay and attunement of people and things in a working order.

II. REPLY (Marco Tamborini)

In my response to these comments, I do not want to point out the mutual limitations, but rather the possibilities that arise from merging the approaches of Astrid Schwarz and my own. To do so, allow me first a brief excursus. In 1940, the Baltic German biologist Jakob Johann von Uexküll published his book *Bedeutungslehre*. One chapter in this book was titled “Compositional Theory of Nature” [*Kompositionslehre der Natur*]. By this, Uexküll meant an epistemological standpoint towards nature, but at the same time his notion of a “compositional theory of nature” contained a strong ontological component. He wrote that “the form formation of living beings will be brought closer to our understanding only when we have succeeded in deriving from it a *composition theory of nature*” (Uexküll, 1940, p. 130). The basic idea of a possible composition¹ was to study how the subject and the world enter into relations of mutual correspondence and organicity, in the same way that two notes tune for a melody. For example, since a subject is always in its surrounding-world [*Umwelt*], the harmonious relations between the subject and the objects that are considered as carriers of meaning must be carefully analyzed. Uexküll explains that these two factors come together, in effect creating meaning beyond their individuality. Through this process, they become a composition of nature. Another quick biological example. Let us consider the octopus as a subject in relation to the object “sea water” as a bearer of meaning. The incompressibility of water constitutes the prerequisite for the construction of a muscular swimming bag. The pumping movements of the swimming bag mechanically act on the incompressible water and push the animal backward: “The rule of meaning connecting point and counterpoint is provided by swimming” (Uexküll, 1940, p. 132). According to Uexküll, the swimming of the octopus is generated by the composition that attunes anatomical structure and the properties of water. In turn, the meaning created in the interaction changes the embryological structure of the octopus. Therefore, concludes the Baltic German biologist, the task of nature’s theory of composition is to indicate the rules that emerge from this process and how new meaning is created from this coming together.

Yet, and this is my first point, if we accept this remark as a starting point for a response to Alfred Nordmann, the question to ask is what elements can be included in a theory of nature’s composition and how do these elements interact to create new meanings (i.e., new compositions)? The approach thus formulated makes one of Nordmann’s

¹ Given the binary structure of the relation conceived by Uexküll it might be more correct to speak of a combination of nature.



criticisms of my approach less effective, namely that I have given “too much importance, perhaps, to an original order of things and a given wealth of forms.” Yet an order of things and forms must be always given to understand the rules by which a composition can emerge.² What is the starting point of *homo hortensis*’ practice if not the forms given by nature? The technical composition of forms in both gardening and bio-robotic practice starts only from the given forms of nature – what we called “facts.”

Second, let us put aside for a second the different purposes of the two practices and whether *homo hortensis* and *homo translator* want to understand or dominate phenomena, whether their enterprise can be named “science”, “technoscience”, etc. Instead, let us focus on the objects (or Uexküll’s meanings) that are composed by bringing together different parts – in this case, bioinspired robots and variously designed gardens. What are the compositional rules in this process? On the one hand, as Schwarz notes, there is a difference in compositional and combinatorial practices. This accompanies a change in the mimetic principle and reflects a diverse role of objects and their properties. On the other hand, I observe that this is an exercise in translation since by translating we transport something unfamiliar (what Darwin called the mystery of mysteries) into a language that we can master. Moreover, in translating, we as subjects recognize the various interwoven semantic and synthetic layers of the world and its domains, i.e., what Nordmann called the “cacophonous multilingual environment” (Nordmann, 2020, p. 88). In fact, what Schwarz and myself have exposed is a classic example of multilingualism. The various rules of composition that we have pointed out can in fact be seen as practices that do not compete with each other, but rather mutually inform each other in order to make sense of our being a subject in the midst of a cacophonous environment. Moreover, if we develop Uexküll’s idea further, the question that arises is about the properties of what is actually created. What kind of object is produced, and what greater meaning has it acquired for the subject during this composition?

Here lies a common opportunity opened up by the two approaches. In the practice of connecting parts, hybrid objects are created that take on new meanings. For example, *homo hortensis* creates gardens that are neither natural nor technological nor purely artistic, but all of the above. Through a process of translation, *homo translator* designs hybrid versions of natural forms that are both natural and technological. Through these hybrids, *homo translator* is able to re-read nature, in effect composing a new meaning (see also Tamborini, 2022a).

The point I want to make here is about our possible shared focus on the epistemology and ontology of hybridity as a category that emerges from the various practices of merging, assembling, combining, and translating elements. The common question that then arises starts from the rules and practices of composition, but it concerns the status of the composed object itself. In other words, the question that connects Schwarz’s and my approach, despite some essential differences, concerns the analysis of the overarching meaning that the composed object has taken on, and the possible effects this has on the subject who composed it. Since we have given up the idea of categorizing

² This was precisely the starting point of the Kantian meta-analysis, bracketing off possible metaphysical speculation in the account of knowledge composition.



the world into separate domains and live in a multilingual environment, what can the composed hybrid objects do and what meaning do they have for us as subjects?

III. REPLY (Astrid Schwarz)

I take this conversation about the three characters *homo translator*, *homo hortensis*, and the socio-technical multilingual *homo faber* (Nordmann, 2020) as an opportunity to engage further in a philosophy of technoscience which devotes special attention to the relational practices and potentials among humans, artificial and non-artificial living entities and things. First of all I want to thank Alfred Nordmann and Marco Tamborini for this exchange when pursuing the following questions: How and in what sense do these encounters between humans, living entities, and things work or fail to work, and what is the consequence of this on the epistemic, ontological and ethical level? Assembling people and things, thus incorporating the environment in an effective context is not simply an artful way of interacting or even a “felicitous interplay and attunement of people and things in a working order” – be it the machines to produce Christmas balls for millions of households, the working area and crew of a lignite mine, or the salamander living in its amphibious habitat. The notion of „success“ in these formations is biased and even political and most often refers only to their continuation and given structure. In order to foreground this normative aspect, a number of concepts have been proposed to decenter the interactions between human and thing and also to more strongly emphasize the common ground of materiality. Donna Haraway (1995), for example, has stressed the importance of not relying on a logic of appropriation and taxonomic identification, but rather to learn how to craft a likewise poetic and political unity that is able to persist the rigors of everyday life. Jane Bennett (2010) developed the concept of a shared materiality of all things – she calls this a „positive ontology“ – that in her opinion should also enable a fundamental political transformation, including a new environmental sensibility and a restructuring of economic relations. *Homo hortensis* encounters hybrid forms in the garden, be it a domesticated tree, or, conceiving the gardening human in a wider sense, be it a power grid infrastructure in the landscape or urban water management systems. These encounters invite us to engage not so much in the representational patterns and orders but rather in the material and political power of hybrid things. In this sense, the baroque garden and the romantic garden can be considered as crafted entities that have a political dimension on the one hand, and on the other stand more generally for the investigation of hybrid forms and their combinational and compositional genesis and preservation.

This is what Marco Tamborini and myself share. We are both interested in the design of hybrid forms and to better understand their appearances, modes of expression and their potential of re-ordering nature and re-designing built structures in the technosphere. One of the central concerns is how subjects of interest are related to their environment and to question the reciprocal character of this relation. Tamborini refers to Jakob von Uexküll when he explains his translational concept of composition and how an organism and its environment are mutually related to one another, which is to be understood in terms of fitting functions, which in turn makes for a meaningful apparatus.



The upshot is that this adjustment is interpreted as a permanent process of mutual customizing from which novelty can emerge. Understood in this way, compositions in nature and the underlying rules of formations and processes, afford novelty just as technological compositions do. In this context, Tamborini's remark that Uexküll's theory of composition is based on a "binary structure of the relation" and therefore might be understood as a combinatory play of nature, is an invitation for a conversation between the *homo translator* and the *homo hortensis* (Tamborini, 2022b, p. 154). They might want to further elaborate on the relationship of the subject of interest and its environment in terms of binary or rather bidirectional relations, and the consequences for making a difference between a compositional and a combinational strategy of bringing things and people together. This would be all the more interesting because these figures are each based on quite different philosophical interests. While *homo translator* acts in a multilingual world that is full of meanings, *homo hortensis* is rather interested in cultivating socio-technical assemblages committed to a common material basis.

At various points of our conversation it has been pointed out that gardenworks can be looked at as a product of people's activities and imaginations, as well-defined things that permanently need to be maintained and simultaneously reinterpreted time and again, just as works of technology. Gardens are distinct places where things may be connected in a systematic but also completely unexpected way. These things are trees and bushes, waterlines and water basins, colorful flower beds and sheer green turfs, sculptures, garden gnomes and ruins, walls and pathways. Of course, not all of these things are present in every garden, for gardens can be so radically different in terms of forms, features, and intentions that it is rather difficult to find a common denominator. However, it is characteristic of all gardenworks that they create relationships between particularities – the garden can be considered as a model of so-called nested reciprocities. Studying a gardenwork is a pertinent exercise not only to probe concepts of interrelatedness but also to get involved in the study of particular connections and one's own connectedness.

A gardenwork is thus not only a representation of order in the sense of human authorship. In this order the temporalities of plants and animals would structure the life of the gardener, who needs to cultivate them in the right spot at the right time. A gardenwork also structures the experience of visitor-observers. Since they are constantly changing, requiring adaptation to this changeability, gardens offer in a different way an experience of unruliness or outright resistance than machines do. It is therefore not humans that lend an order to the garden, but it is the garden that set limits and define our capacities to transgress them (Schwarz 2019). Working in the garden yields structure and it permanently reminds the gardener of the involvement of other stakeholders. In the garden reciprocity and attention are in a sense two sides of the same coin. Creating and maintaining a gardenwork is dependent in a particular way on the co-operation of nature. Accordingly, *homo hortensis* is precisely not "haunted by the idea of authorship," but enables experiences that make nature perceptible as a counterpart and, in a certain respect, also enforces this reciprocity as it concerns the inherent logic of plant development and needs, meteorological coincidences, the inert physics of the garden soil, and not least the encounters with other animals. The gardener and even, though in a more limited sense, the garden visitor are incorporated in this attunement to the world. It has been argued that



the body of the gardener becomes an archive of the history of the interactions with her garden, she develops a “body knowledge” in the use of her body as a technical means and of tools in interaction with the garden environment. It will be worth exploring how and in what sense this concept of a gardener-engineer’s embodied knowledge or body-at-work comes close to Tamborini’s concept of “re-reading” nature. After all, whether we interpret them in terms of translation or not, the stories we tell about objects are also stories about our own certainties, our clichés, our affects, and our categories.

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СВЕДЕНИЯ ОБ АВТОРАХ / THE AUTHORS

Альфред Нордманн,
nordmann@phil.tu-darmstadt.de
ORCID 0000-0002-2173-4084

Астрид Шварц
schwarza@b-tu.de

Марко Тамборини,
marco.tamborini@tu-darmstadt.de,
ORCID 0000-0001-7102-7479

Alfred Nordmann,
nordmann@phil.tu-darmstadt.de
ORCID 0000-0002-2173-4084

Astrid Schwarz
schwarza@b-tu.de

Marco Tamborini,
marco.tamborini@tu-darmstadt.de,
ORCID 0000-0001-7102-7479

Статья поступила 30 ноября 2022
одобрена после рецензирования 15 декабря 2022
принята к публикации 20 декабря 2022

Received: 30 November 2022
Revised: 15 December 2022
Accepted: 20 December 2022