Phenomenology and the Philosophy of Technology

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1. Ecological Hermeneutic Phenomenology: A Method to Explore the Ontic and Ontological Structures of Technologies in the World

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1. Introduction

Socially disruptive technologies like Artificial Intelligence (AI) and synthetic biology show that a phenomenological approach that focuses on the micro level of artefacts and the way they mediate experience, like postphenomenology, is no longer sufficient. It can already be questioned whether the introduction of the prefix *post-* comes at the expense of the phenomenon of phenomenology, as a pragmatist understanding of the human-technology relation (Ihde, 1990) neglects the existential, environmental, political, and economic involvement of human existence in the constitution of meaning beyond any functionalist or instrumentalist orientation (cf. Schutz, 1967; Blok, 2014). The focus on 'technologies in their particularities' (Ihde, 2009, pp. 21–22) testifies to a liberal faith in technological progress that stresses the individual characteristics of particular technologies—which can be redesigned and enhanced by the designer to serve society—rather than the structural characteristics associated with the existential, environmental, political and economic reality that cannot be remedied by individual designers.

For example, in order to feed the world in 2050, it is argued that the application of digital technologies in precision livestock and smart

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farming is urgently needed (European Commission, 2020). By studying how digital technologies mediate experience from a postphenomenologist perspective, we can for instance argue positively that unlike in the past, when farmers had to manage their animals as a collective herd, modern farmers are now able to engage in an individualized approach to animal care, guided by the data provided by sensors, decision support systems, and other digital tools. We can also argue more negatively that unlike in the past, when farmers were in control of their stables, they now function more as data managers who mainly manage their herds indirectly. This perspective can also raise all kinds of ethical questions, like the pain involved in the application of sensors or the ownership of the data that the animals provide. Such questions call for value sensitive redesign, for instance decentralized data processing, storage, and destruction in order to increase farmer control. What this descriptive analysis will not reveal are broader phenomena like dataism or pan-computationalism in the digital age, i.e., the idea that all physical systems—the soil and the weather, the plant and the animal, the farmer and the citizen—consists of computational data. We speak of a World of data with capital W, meaning that data is not so much a characteristic of the physical entities we encounter in the world, like the soil in which the plants are rooted and grow under the influence of weather conditions, but where data concerns a metaphysical structure that characterizes the whole of being as computational data, and affects the meaning of human and non-human living and acting in the World (Blok, 2023a). It is this type of broader phenomena that characterize the World in which we live today, that raise societal concerns about the industrialization, surveillance, instrumentalization, and commodification of agricultural production and consumption, and can no longer be neglected in contemporary phenomenology of technology. Digital technologies like an AI application or digital twin are in fact not 'particular' technologies, but interconnected and interdependent technologies in an ecosystem or World of data beyond the individual artefact.

This raises, however, a methodological question. Originally, the level of analysis of phenomenology of technology was found at the level of underlying ontological structures that govern the technological world, resulting in conceptualizations of the technologization of the world as a reservoir of resources that is present for exploitation (Heidegger,

1977), or as instrumental rationalization of social life (Ellul, 1964). Later, this essentialism and determinism was rejected in favour of an empirical or practical turn to concrete artefacts and practices, for instance the postphenomenological analysis that deviates from the 'high altitude' of Heidegger's focus on technology 'in general' and concentrates on the concrete human-technology relation (Ihde, 2010). Recently, I have criticized both versions of phenomenology for their one-sided orientation on either the ontological level, which neglects the role of concrete disruptive innovations like the steam engine or AI in the constitution of the World in which we live and act, or on the ontic level, which overlooks how new artefacts like AI-driven applications are embedded in a particular ontological structure of the World (Blok, 2022). Ihde does acknowledge a macro-perspective that situates the micro-perspective on the human-technology relation of new artefacts in a broader cultural context (Ihde, 1990). However, he is not able to analyze how the two perspectives are intertwined (Scharff, 2020), yet constitute different domains that cannot be reduced to each other. As long as we extrapolate from the micro-perspective to the macro-perspective, we quantitatively *generalize* based on the content of the human-technology relation, while neglecting the *qualitative* difference between the ontic level of new artefacts and the ontological structure of the World, as we will see. While traditional phenomenology can be criticized for its essentialist bias, resulting in its alienation of concrete technologies and practices, postphenomenology can be criticized for its descriptive bias, resulting in its alienation of the ontological dimension of the World in which each and every technology remains embedded. In this regard, we can argue that phenomenology of technology till now cannot claim to do justice to the full phenomenon of phenomenology yet.

This raises the question of what a phenomenology of technology looks like, that considers both the ontic and ontological structure of new and disruptive technologies in an integrated manner. In section 2, we first consult the traditional concept of phenomenology to find an entry point for our methodological considerations. It will become clear that Heidegger provides a progressive concept of hermeneutic phenomenology, although we are critical of his essentialism and linguistic focus in which there seems to be no room for the phenomenological consideration of ontic phenomena. The discussion of Heidegger results in a methodological concept of

an empirically informed ecological hermeneutic phenomenology that enables us to research how new and emerging technologies impact the World in which we live and act in section 3. In section 4, we critically reflect on the *epoché* of phenomenology and show that a methodological concept of ecological hermeneutic phenomenology engages in an ecological transduction from technology as thematic artefact to technology as co-thematic ontological structure in which each and every artefact is grounded. In section 5, we draw conclusions.

2. What Is the Phenomenon of Phenomenology?

As the pragmatist understanding of the human-technology relation commits to an instrumentalist orientation of phenomenology (see section 1), we return to its original conceptualization as it is developed in the work of Edmund Husserl and Martin Heidegger. In his *Ideas* from 1913, Husserl finds the starting point of phenomenology in what we simply and directly experience, without committing to any claim about the factuality of what we experience:

> We proceed in the first instance by showing up simply and directly what we see; and since the Being to be thus shown up is neither more nor less than that which we refer to on essential grounds as 'pure experiences', 'pure consciousness' with its pure 'correlates of consciousness', and on the other side its 'pure Ego', we observe that it is from *the Ego, the* consciousness, *the* experience as given to us from the natural attitude, that we take our start. (Husserl, 1972, p. 101)

Contrary to the positive sciences, phenomenology does not research the 'reality' of what we experience but focuses on the way these experiences of the world are given in our intentional consciousness of this world. Husserl's phenomenology is transcendentally oriented, as he asks for the conditions of possibility of the correlation between the way the world is given to us (*noema*) and our consciousness of this world (*noesis*) and finds this condition in 'pure consciousness in its own absolute being' (Husserl, 1972, p. 140).

Heidegger is critical of Husserl's phenomenology, because pure consciousness presupposes that we have a position in front of the phenomena that can subsequently become accessible via perception, while we are in fact always already living and acting in a meaningful

world in which we are at home and know how to live and act (Heidegger, 1996). In other words, Husserl's phenomenology reduces the relationality of the way the world is given to us and our understanding of the world to one of the relata, namely the transcendental subjectivity of pure consciousness that constitutes the meaning of the world and human being-in-the-world. Contrary to Husserl, Heidegger believes that the relationality of the givenness of the world and our understanding of the world cannot be reduced to one of the relata. He rejects Husserl's *transcendental* phenomenology and innovates phenomenology by engaging in the *hermeneutics* of this relationality of our living and acting in the world (Blok, 2021).[1] Hermeneutic phenomenology explicates the self-evident understanding of the meaning of the World as it is articulated in concepts like 'subject' and 'object', 'matter' and 'form', 'nature' and 'technology' etc.

In order to do justice to the relationality of the phenomena, Heidegger proposes the following definition: 'What is phenomenology? What is phenomenon? Here this can be itself indicated only formally. Each experience—as experi*encing*, and what is experi*enced*—can "be taken in the phenomenon", that is to say, one can ask: 1) after the original "*what*", that is experienced therein (content), 2) after the original "*how*", in which it is experienced (*relation*), 3) after the original "*how*", in which the relational meaning is enacted (*enactment*). But these three directions of sense (content-relational-enactment-sense) do not simply coexist. "Phenomenon" is the totality of sense in these three directions' (Heidegger, 2010, p. 63). We consider a simple example to illustrate what Heidegger has in mind. If I say that my desk is two metres wide, I in the first instance say something about the content of the phenomenon that I experience in the world, namely about my experience of the wideness of my desk. But in my experience of my desk, also a particular *relation* between me and the desk is assumed that determines how the desk appears; the desk appears *as* measurable. Only

1 Although contemporary efforts in continental philosophy of technology to articulate the conditions of possibility of the world are valuable (Smith, 2015; Lemmens, 2021), it is questionable whether they can move beyond the orientation on the transcendental subject and can acknowledge the relationality of phenomena that constitute the world—whether it is found in a fundamental position of pure consciousness or technological artefacts—as long as it employs a 'transcendental' approach.

if the desk appears *as* measurable, it makes sense to measure my desk and say that it is two meters wide. Also, in my measuring of my desk, a particular understanding of human existence in the world is assumed that determines how the desk appears, namely me *as* the one who is the measurer of the wideness of the desk. In my experience of the desk in front of me, this specific relation between me and the world is always already enacted and articulates the meaning of my living and acting in the world, *before* I can determine the content of any particular being-in-the-world, like the wideness of the desk. It is not only the meaning of the content of my experience of beings in the world that is phenomenon in Heidegger's hermeneutic phenomenology, but precisely the meaning of the relation and enactment that co-determines this content. In the whole of content, relation, and enactment, the meaningful World in which I live and act as measurer of my desk as measurable entity is constituted.

Can we conclude that Heidegger's hermeneutic phenomenology already provides a method to research the ontic and ontological structure of new and disruptive technologies in an integrated manner, as he asks for the content, relational, and enactment sense? This is not the case. A first reason is that, although Heidegger speaks about the content-relational-enactment-sense in his conceptualization of phenomenology, it is also clear that his criticism of Husserl's transcendental phenomenology is embedded in his criticism of the metaphysical tradition that finds its point of departure in a domain of beings and asks for the being of these beings. Contrary to the metaphysical tradition, Heidegger's phenomenology is not taking beings as point of departure, but Being: 'According to the usual interpretation, the "question of being" means asking about beings as such (metaphysics). But if we think along the lines of *Being and Time,* the "question of being" means asking about being as such' (Heidegger, 1989, pp. 20–21). In this regard, even if Heidegger speaks about the content sense in his early concept of phenomenology, he is not so much interested in the ontic phenomena—the content of my experience of the desk I am writing at—but primarily in the ontology of the desk that is primarily constituted in the relational and enactment sense.

This is confirmed in *Being and Time*, where Heidegger characterizes phenomenology in the following way: 'The expression "phenomenology" signifies primarily a *methodological conception*. This expression does not characterize the what of the objects of philosophical research as subject-

matter, but rather the *how* of that research' (Heidegger, 1996, p. 50). This 'how' does not mean only the 'how of philosophical research' or the method of phenomenology, but at the same time also the 'how of the objects of philosophical research' or the relation that has to be thought from out of this relation itself. Phenomenology not only involves a shift from the relata (beings) to the relationality of our living and acting in the World (Being), but also a shift to a particular enactment of this relation in order to let that which shows itself be seen in the very way in which it shows itself. Phenomenology characterizes the 'how' (relation) of being-in-the-world and at the same time the 'how' (enactment) or the way in which philosophy reflects on this relation.

In the first instance, hermeneutic phenomenology *explicates* the self-evident understanding of our living and acting in the World by following the indication towards the relation and enactment sense in philosophical concepts like 'object' and 'subject', 'theory' and 'practice', 'matter' and 'form'; it provides access to the meaningful World in which we are always already at home by articulating the dominant meanings of the World and concepts we live with in our daily life and practices. In the second instance, hermeneutic phenomenology consists in the *destruction* of these dominant meanings of the philosophical concepts in light of their original meaning (*theorein*, *hule*, *eidos*, and so on) in order to articulate a critical or progressive meaning of these concepts. By questioning the original meaning of the philosophical concepts that determine our living and acting in the World in order to explore new meanings, it becomes possible to critically assess the appropriateness of these concepts. This means that hermeneutic phenomenology not only acknowledges that our interpretation of the meaningful World in which we are always already at home is pre-structured and guided by the philosophical tradition, but also always remains open to revision, open to a new exploration of meaning. In this respect, a hermeneutic circle between our being at home in a pre-structured meaning of the World, our destruction of this meaning and our exploration of new meanings is characteristic for Heidegger's hermeneutic phenomenology (Heidegger, 1996, p. 62).

With this, it becomes clear that Heidegger's hermeneutic phenomenology is intrinsically linguistic (Blok, 2021, pp. 44–52). In his *Introduction to Phenomenological Research,* Heidegger argues that the point of departure is found in a turn of speech that has a 'fundamental

methodological significance for the philosophical problematic' (Heidegger, 1994, p. 33). Language is not understood here as an instrument in the hands of man but concerns the meaning of the words that articulate and structure the meaningful world in which we always already live and act (Blok, 2021, pp. 44–52).

The linguistic orientation of Heidegger's hermeneutic phenomenology confronts us with a second reason why Heidegger's hermeneutic phenomenology does not yet provide a method to research the ontic and ontological structure of new and emerging technologies in an integrated manner. On the one hand, it is clear why a hermeneutic phenomenology that takes not beings but Being as the point of departure relies on language, as language is not a being nor an instrument in the hand of human beings, but a relational phenomenon that articulates the meaningful World in which we live and act. On the other hand, if we want phenomenology to take the ontic and ontological structure of new and disruptive technologies into account, we have to move beyond the linguistic focus of hermeneutics and engage in an *ecological* hermeneutics of material—ontic—phenomena.[2]

By phenomenology as ecological hermeneutics, we don't mean the interpretation of material beings, as opposed to Being itself, through interpretative tools and technologies like lenses, sensors, computers, etc. (Ihde, 2022). For Ihde, material hermeneutics involves the extension of hermeneutics from texts to physical entities that mediate our experience. On the one hand, it is indeed important to acknowledge that hermeneutics is not intrinsically connected with linguistics in the strict sense of the word, as language is primarily about meaning, and material entities like trees and steam engines, humans and AI systems are meaningful and as such, can be subject to hermeneutics. These material entities have a voice that has to be heard in phenomenology. But this doesn't imply, first, that material hermeneutics should be limited to the meaning of material beings in the world and the way they mediate experience, but should actually consider both the meaning of the material entity (content-

2 We choose the notion of 'ecological' hermeneutics here, rather than material- or thing-hermeneutics, because our concept of hermeneutics does not only consider things in the World but also the materiality of the ecological conditions on which they depend, which extends to the ecosystems of planet Earth that provide the materials these things are made from and the fuels to energize them, as we will see in the next sections.

sense) *and* the meaning of the World in which they appear (relational and enactment-sense) in an integrated manner. The materiality that our ecological hermeneutic phenomenology is interested in is therefore not limited to material *beings*, nor to the materiality of these beings as presented to our understanding (World). It also encompasses the materiality of these beings as they withdraw from human experience (Earth) (see section 5).

3. Phenomenology as Method

How can we use ecological hermeneutic phenomenology as a method to research the ontic and ontological structure of new and disruptive technologies in an integrated manner, finding a middle ground between the one-sided orientation on either the ontological level (Heidegger's phenomenology) or on the ontic level (postphenomenology)? Although we were critical about the 'essentialism' of Heidegger's phenomenology in the previous section, we consult now a late seminar which provides an opening to develop an integrated concept of ecological hermeneutic phenomenology.

In the *Zollikon Seminars* from 1959–1969, Heidegger introduces the phenomenon of phenomenology by consulting Kant's idea that *being* is not a real predicate, but merely the positing of a being (Kant, 1990). If we say that an artefact like a table is in the room, the *being* of this table is not a predicate that can be derived from the table itself, like its colour or form. If we analyze, unravel, or decompose the table, we never find its *being*. To the extent that we can nonetheless experience that the table exists, we have to conclude that its being is always taken for granted and assumed in our dealings with tables in our daily practice. To what extend do we *assume* the existence of the table? Heidegger distinguishes between three meanings of this assumption: (1) to expect, for instance, I assume that the delivery service will deliver my new table today; (2) to suppose, for instance, I suppose this table is made from wood or that it is a Jugendstil table; (3) to accept, for instance, my acceptance and openness for the *being* of the table. Heidegger distinguishes between the *suppositio* and the *acceptio* of the existence of the table. The *suppositio* refers to a hypothesis about the table that can be proven to be true or false, such as whether it is made from wood or whether it is a Jugendstil (German

Art Nouveau) table, while the *acceptio* refers to the basic assumption of the table's existence itself, which doesn't need to be proven but rather *shows itself from itself* (i.e., directly). For Heidegger, it is this *acceptio* that provides access to the phenomenon of phenomenology. On the one hand, we accept the existing table as it shows itself from itself. This existing table we perceive is an *ontic* phenomenon, i.e., it concerns a being. On the other hand, we accept the existence of the table as it shows itself from itself. The existence of the table is not perceivable like its colour or form, but shows itself from itself as an *ontological* phenomenon, i.e., it concerns the *being* of the table (Heidegger, 1987).

Contrary to Kant, Heidegger argues that the human does not *posit* ontological phenomena, as if the existence of the table is dependent on the perception of the transcendental subject. Ontological phenomena are also not objective, as if the existence of the table is only a matter for the table itself. Humans make and use tables to write letters on and have conversations at. These ontological phenomena are not subjective nor objective but *relational*, as the existence of the table shows itself from itself in my living and acting in the World. I enact this relation, as I exist myself and make or use these tables. At the same time, the ontological phenomenon of existence is not a neutral general characteristic of all beings, as the example of the table can make clear. Heidegger argues that the existence of the table can for instance consist in its being ready-at-hand as a useful thing (*Zuhanden*) or as present-at-hand (*Vorhanden*) in the room. Although we tend to perceive *human* existence in a similar way as the existence of non-human beings, namely as present-at-hand, Heidegger argues that we are not in the room in the same way. If I experience the existence of a table, I am not present-at-hand in the room like the table, but I am situated here at my place in the room and at the same time there at the table. Only thanks to this distinction between my place here and the table there, can I experience the table and its existence. My existence in the room is characterized by my *situatedness* here and there in the room, while the table is not situated but present-at-hand in the room according to Heidegger (1996).

For the purpose of this chapter, we will refrain from discussing Heidegger's comparison of the characteristics of the existence of the table in comparison with those of human existence. More important is the acknowledgement of a difference between ontic phenomena (the

existing *table* in front of me) and ontological phenomena (the *existence* of the table in front of me), that ontological phenomena are not neutral or general characteristics of all beings but articulate a variety of ways of being-in-the-world, and the acknowledgement that ontological phenomena are not *posited* by the transcendental subject but are *accepted* by human existence. Any *suppositio* about the table—for instance that it is in Jugendstil style—can be proven or rejected, but that does not hold for the existence of the table. We have to *accept* the existence of the table and also that I have a relation with the table through making and using it. Its existence cannot and also does not have to be proven, but it is a prerequisite for any suppositions regarding the table; the table must exist in a particular way before I can say something true or false about it.

According to Heidegger, science and technology only have access to ontic phenomena—the table, the molecular structure of the wood it is made from, the DNA of the wood, etc.—and can develop hypotheses about these beings and their mechanisms, which can subsequently be engineered in science and technology. Ontological phenomena demand a different, singular method that cannot be undertaken by science and technology, namely a method that is open for the *acceptio* in each and every supposition. Heidegger's objective is not to reject the suppositions of science and technology in favour of the *acceptio* of phenomenology, but by engaging in the phenomenology of the *acceptio* in each and every scientific supposition, we develop a knowing relation without being absorbed by its suppositions:[3] 'to say the same thing about the same thing' (Heidegger, 1987, p. 30). Because we attribute existence to the table as it belongs to the table, while ontological phenomena (the acceptance of the existence of the table) cannot be perceived like ontic phenomena (the perception of the existing table in front of me), the methodological question emerges of how we have access to these ontological phenomena, and how they become the

3 In this chapter, we concentrate on the methodological dimension of the concept of phenomenology, and not on the existential dimension that is central in Heidegger's concept of phenomenology. For him, the actual engagement with phenomenology requires a transformation of human existence, namely from the human as the subject of the supposition or hypothesis underlying ontic phenomena to the human as openness (*Dasein*) for the *acceptio* in each and every supposition. By engaging in a phenomenology of the *acceptio* in each and every scientific supposition, we develop a free relation to science and technology. This existential dimension of phenomenology is beyond the scope of this article.

Sache of phenomenology.

Heidegger starts with an ontic phenomenon like an apple that falls from a tree on the ground, which is described according to the Newtonian laws of gravity as a point of mass changing its location from one location in space to another. We can then ask what is presupposed in this description of the apple. What is presupposed is the natural scientific concept of nature, according to which the apple does not fall *from* the tree *to* the ground but changes its location in law-governed fashion within a homogeneous space and time. By asking what is presupposed in this description of the apple, we encounter the *supposition* that the apple is a point of mass that changes its location in law-governed fashion. Based on this supposition, we experience the apple as point of mass. We can then also ask what is *accepted* in this supposition about the apple, namely the existence of homogeneous space and time in which an apple can be found; only if the existence of a homogeneous space and time is accepted, the apple does not fall *from* the tree *to* the ground as its natural place, but changes its location in space and time in law-governed fashion.

The move from the *suppositio* to the *acceptio* is not the product of abstraction and generalization. If I see a green apple in front of me and say, 'there is a green apple', then 'there is a green apple' corresponds with the thematic perception of the green apple in front of me. There is, however, no thematic perception that corresponds with the 'existence' of the apple. We will not find the existence as characteristic of the apple if we look at the apple. With regard to the greenness of the apple, we can generalize inductively or deductively from one instance of a green apple to the general concept of 'apple' as such, or from a general idea of 'greenness' to the singular apple that falls under this category. But the generalization from the green apple to greenness and from greenness to colour is not possible in case we want to articulate the 'existence' of the apple. How should we proceed if we want to articulate the *acceptio* of existence in a phenomenological way?

We first consult the phenomenology of Husserl, as he distinguishes between two ways of having access to being, namely generalization and formalization (Husserl, 1972). Generalization is a method to understand things in terms of more and more general concepts. Green, for instance, is a colour, and colour is a sensory quality. It seems to be the case that

we can go on with generalization, from a green apple in front of me to colour, to sensory quality, and to object as such. Green is then a sensory quality, and all sensory qualities of an object, whereby object as such is the most general concept. And yet, there is a rupture in the increasing generalization. The question is whether the generalization from green apple to colour is the same as that from green apple to object as such. According to Husserl, this is a rupture, because the generalization from one particular green apple to green and to colour is determined by the subject matter itself and remains also testable based on this subject matter, whereas the generalization of the same particular green apple to object as such is not determined by that subject matter. The concept 'object' does not 'lie' in the material content of the green apple, like the general green lies *within* the various particular green apples.

For this reason, Husserl speaks about *formalization* instead of generalization, a generalization which is not based on the *material content* of green apples, but a generalization which is empty in content. If we say that 'the stone is an object', we are not reliant on the stone but are precisely free of its material content and formalize towards the concept of 'object'. Moreover, we do not have to generalize step by step in order to find the highest generalization 'object' as such. Husserl therefore calls 'object' a formal-ontological category which is not the product of generalization but of formalization. Does this distinction help to understand how phenomenology has access to the *acceptio* involved in each supposition, namely not via generalization, but rather via formalization?

We can argue that the *acceptio* of existence, just like the concept 'object', does not lie in the material content of green apples, like the general green lies within green apples. If we want to thematize the *acceptio* of homogeneous space, rather than spatial beings like apples, the method of generalization does not help. Although the apple is spatial, the abstraction of the singular apple in front of me and generalization will not result in the concept of space as being is not a real predicate, i.e., spatiality is not a characteristic of the apple like its colour or its form and the abstraction from particularities of the apple will never lead to the concept of space. Rather, every spatial being is *in* space, and the concept of space is therefore not the product of abstraction of any particular space. This is also missed by the effort to abstract from the

spatiality of the green apple and formalization towards space as such. As spatial beings are *in* space, any abstraction of this spatiality and any formalization that is empty in content misses the access point to the *acceptio*. We should not neglect the content sense of the phenomena, i.e., the spatiality of spatial beings like the apple, and therefore, we are hesitant to conclude that formalization provides access to the *acceptio* of space and call for an *ecological* hermeneutic phenomenology. How should we proceed if we want to articulate space in a phenomenological way, if we cannot rely on generalization and formalization?

Because the apple is spatial, we don't have to formally renounce from the material content of the apple but should hold on to the materiality of the apple that exists in space, that is extended and therefore something spatial. When we pick up the apple and take a bite of it, then this spatiality of the apple is not perceived thematically. At the same time, space is perceived nonthematically in each and every thematic perception of *spatial* beings like apples. In order to get access to the *acceptio* of space in the perception of the apple, phenomenology should not generalize or formalize from the spatiality of the apple but on the contrary, adhere to the thematically perceived—the apple as spatial being—and thematize the *acceptio* in each and every thematic perception, the spatiality of the apple which is itself unthematic but necessarily given. Heidegger provides the example of a cup in space: 'What happens to the cup when we look away from it and turn toward space as the theme? The process of thematization is reversed. Nevertheless, if I make space the theme, I cannot leave the cup out of consideration. Space as a theme is where the cup exists. Therefore, if I were to leave the cup out of consideration completely, I would not be able to apprehend the character of space as that where the cup exists. I must merely let the cup become nonthematic' (Heidegger, 1987, p. 39). Access to the *acceptio* of space is provided by phenomenologically reversing the thematic order: we let the thematic content—the cup in space—become nonthematic, and the nonthematic—the spatiality of the cup—thematic.

Although Heidegger provides an indication of how to proceed if we want to articulate space in a phenomenological way, we also have to be critical towards his approach. Although Heidegger's phenomenology clearly starts with ontic phenomena, as the example of the cup in space makes clear, his concept of phenomenology focuses on the

relational and enactment sense of the phenomenon (see section 2). His phenomenological analysis reveals for instance that the apple that changes its location in a law-governed fashion accepts homogeneous space and raises critical questions about the *acceptio* because I am not in space like the apple that changes its location. In this effort, his method of phenomenology neglects the content sense in his analysis. On the one hand, this is understandable, as the focus on the content sense runs the risk of neglecting the relational and enactment sense, and Heidegger blames the theoretical attitude of Husserl's method of phenomenology for solely concentrating on the content sense (Heidegger, 2010, p. 63). On the other hand, Heidegger's focus on the relational and enactment sense of the *acceptio* runs the opposite risk of neglecting the content sense of the phenomena, as we will see show in the remainder of this section.

Here we have to come back to the essentialism of Heidegger's phenomenology (section 2). According to Heidegger, each and every ontic phenomenon like the existing table *presupposes* ontological phenomena like the existence of the table, but not the other way around. Ontic phenomena like existing tables and apples *accept* existence, as existence is already nonthematically accepted in each and every thematic perception of a table or apple, but ontic phenomena do not *affect* ontological phenomena like existence as such. This is consistent with Heidegger's criticism of the metaphysical tradition, that it finds its point of departure in a domain of *beings* and asks for the being of these beings by abstracting from these beings, and with this, by thinking their *being* out of these beings via generalization or formalization. Also in Heidegger's phenomenology, a domain of beings is the point of departure—existing tables—but for him, the ontological phenomenon of existence has nothing to do with existing tables and is also not affected by ontic phenomena like tables; for this reason, he argues right at the start of *The question concerning technology:* 'The essence of technology is by no means anything technological' (Heidegger, 1977, p. 7). And yet, we can question whether this is true, whether ontic phenomena indeed have no ontological impact.

The example of the invention of the mechanical clock that increasingly replaced elemental clocks can make this clear. A mechanical clock measures intervals of time and takes time as homogeneous linear-

chronological time for granted. The invention of the mechanical clock is *grounded* in the *acceptio* of time as linear chronological time. Only if I accept time as linear chronological time, it makes sense to invent an artefact that counts intervals of time like a mechanical clock. The *acceptio* of time as homogeneous time is, however, not of all times. While time is circular in elemental clocks and oriented on the cyclical movements of the sun or plant life cycles, for instance, time appears as linear in mechanical clocks. What explains the shift in the *acceptio* of time as circular to time as linear chronological? The invention of the mechanical clock is not only grounded in the *acceptio* of linear chronological time, but paradoxically enough also *founds* this shift in our *acceptio* of time, to the extent that the innovation of the mechanical clock destructs the *acceptio* of time as cyclical and constructs the *acceptio* of time as linear and chronological. In other words, the *acceptio* of time is not always the same but changes, and this change of the *acceptio*—time as linear and chronological—does not only affect ontic phenomena, the invention and evolution of the mechanical clock that counts intervals of time as grounded in the *acceptio* for time as linear chronological—but also the other way around, as the invention of ontic phenomena—the mechanical clock—affects the ontological phenomena involved—it *founds* the *acceptio* of time as linear and chronological. The shift in our *acceptio* of time does not happen with the first invention of the mechanical clock, but is *founded* by the invention, dissemination, and use of the mechanical clock and of accompanying phenomena like calendars, forecasting, etc. (Blok, 2022). In this regard, we can question Heidegger's assumption that ontic phenomena do not affect ontological phenomena, and with this, we can question Heidegger's essentialist concept of phenomenology and argue that phenomenology should not only take ontic phenomena as the point of departure for the phenomenological analysis of ontological phenomena, while neglecting the possible impact of ontic phenomena—the invention of the mechanical clock—on the ontological phenomena—the impact of this invention on the *acceptio* of time as linear and chronological.

In our proposal for a concept of an ecological hermeneutic phenomenology, we therefore engage in an empirical turn to consider the content sense of ontic phenomena—the invention, evolution, and dissemination of the mechanical clock—and their ontological impact on the relational sense and the enactment sense that founds and grounds

the World in an integrated manner.[4] In the founding *of* and grounding *in* the *acceptio* of time as linear and chronological time, through the invention of the mechanical clock, our understanding of the World and our living and acting in the World changes. If I watch the clock at the railway station and conclude that the train I expected to catch is already gone, I, in the first instance, say something about the *content* of the phenomenon that I experience in the world, namely about the physical clock in front of me that indicates that the train left the station too early. But in my experience of the clock, also a particular *relation* between me and the World is assumed that determines how clocks and trains appear. If the clock indicates that the train left the station *too early,* the appearance of the train is chronologically calculated in terms of the passage of time. It is expected to arrive in five minutes, for instance (future), is entering the station right away (present), or can already have left the station (past). Only if the relational sense between me and the train is linear and chronological does it makes sense to be at the railway station at eight o'clock to catch the train, *wait* for the train that is five minutes late, *expect* the train to come within five minutes, etc. Only if the train appears *as* linear and chronological being does it makes sense to watch the clock at the railway station and say that the train left the station too early. Also, in our experience of the clock and conclusion that the train left the railway station too early, the enactment of this relation by human existence determines our living and acting in the World, namely *as* linear, chronological being who tries to be at the railway station at three-thirty, five minutes before the train is expected to arrive, for instance. In my walking to the railway station, this specific relation between me and the World is always already enacted and articulates the meaning of my living and acting in the World, *before* I can determine whether I have to hurry up to catch the train, or can take it easy and have a coffee at a terrasse. In the linear, chronological World, human existence is understood as a non-cyclical, irreversible process along an axis running from a past to a future (Jünger, 1979). The ontological impact of the innovation of the mechanical clock (content sense) impacts being (relational sense) and thinking (enactment sense)

4 For the further elaboration of the paradoxical relation between founding and grounding, see Blok (2022).

at once and constitute the World in which we live and act.[5]

Because ontic phenomena like the invention, dissemination, and adoption of the mechanical clock turns out to have an ontological impact on the relational and enactment sense that constitute the World in which we live and act, we can criticize Heidegger's one-sided orientation on ontological phenomena. We don't reject Heidegger's method of phenomenology as such but move beyond the essentialist bias of his concept of phenomenology, in which ontic phenomena only function as a point of departure for considering ontological phenomena. Instead, we propose a concept of an *empirically* informed *ecological* hermeneutic phenomenology as a method for researching both ontic and ontological phenomena in an integrated manner. Ontic phenomena—a thing like the mechanical clock in front of me—not only *accept* ontological phenomena—linear, chronological time—but also the other way around; ontological phenomena like linear, chronological time presuppose ontic phenomena like the invention, evolution, and dissemination of mechanical clocks. Ecological hermeneutic phenomenology should therefore research what is taken for granted in ontic *and* ontological phenomena in an integrated manner, and consider the content, relation, and enactment sense that constitute the World in which we live and act.

We call our concept of empirically informed ecological hermeneutic phenomenology *transductive*. Phenomenology does not abstract from the thematically perceived—the perception of a thing like the mechanical clock in front of me—but on the contrary, adheres to the thematically perceived and thematizes what is taken for granted in each and every thematic perception—the *acceptio* of time as linear and chronological—which is itself unthematic but necessarily given in the evolution and dissemination of the mechanical clock. The thematization of the ontological phenomena by letting the ontic phenomena become nonthematic does not proceed inductively or deductively, but proceeds as if we look at them sideways, laterally, by passing by, or *transductively* (from *leading through* or *across*),[6] namely *leading through or across* the

5 We call this founding *of* and grounding *in* the *constitution* of the World, namely of the World in which time appears as linear chronological and human existence lives and acts in this World.

6 Our concept of transduction deviates from the one Simondon introduces in

ontological phenomena by letting the thematic (ontic) phenomena—the mechanical clock—become nonthematic and thematizing that which is concomitantly unthematically but necessarily given—the *acceptio* of time as linear mechanical—as ontological phenomena. The concept of time as linear and chronological, which we take for granted, becomes evident through its manifestation by the transductive articulation of the *acceptio* of time in each and every experience of the ontic phenomena. This transduction of the *acceptio* of ontological phenomena from the experience of ontic phenomena provides access to the phenomenon of phenomenology.

4. The Rehabilitation of the Content Sense in Phenomenology

The content sense of ontic phenomena like mechanical clocks is not limited to the clock *as we experience* them. Traditional phenomenologists like Husserl argue that the way the world of positive facts is given to us (noema) is correlated to the subjective way of apprehending this world (noesis). Seen from this perspective, the content sense is limited to the phenomena as we simply and directly experience them. For this reason, Husserl argues that we should not commit to any claim about the factuality of what we experience, and brackets (*epoché*) the existence of the world external to consciousness in order to focus on the way these facts present themselves to our conscious self-experience. 'The genuine transcendental epoché makes possible the "transcendental reduction"—the discovery and investigation of the transcendental correlation between world and world-consciousness' (Husserl, 2012, p. 164). The same holds for postphenomenologists, who focus their research on cases of technologies that stay close to human experience and articulate the human-technology relation (Bosschaert & Blok, 2023).

But the content sense of sundials, hourglasses, mechanical clocks, atomic clocks, etc. is not limited to the way we experience them, as they

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his work (Combes, 2013), as transduction for him concerns the process of productively differentiating and individuating new beings at an ontic level (a new species in biological evolution, a new technology in technological evolution), while we conceptualize transduction as leading through the *acceptio* in each and every such production at an ontological level.

are made from (scarce) materials, bear the traces of the material and energy they were made from, the ecological conditions to which they are adaptive, etc. This materiality of the ecological conditions is not only correlated, but also *un*-correlated being that can be observed if we think of technological artefacts like AI-driven devices and look *under the hood,* and experience the *black box* that informs its operations, the material stubbornness or obstinacy of technologies that allow certain designs and do not allow others, and their capacity to remain a misfit in the ecosystem in which they are embedded. Especially in times of global warming, we experience the dependency of technologies on the biosphere of planet Earth that provides scarce materials but also the elements like water, wind, and fire that can make them wear out and can take their existence away.

The content sense of ontic phenomena like the mechanical clock does not only concern the things *as we experience them,* as in traditional phenomenology, but also the *materiality* of these ontic phenomena like the mechanical clock *beyond* what we can directly experience. This has consequences for our method of phenomenology. In fact, the content sense of the materiality of ontic phenomena like mechanical clocks *res-cends* (from *res-*, matter, thing), rather than trans-*cends*, our living and acting in the World in which we encounter and experience these clocks. While Husserl's concept of phenomenology commits to an *epoché* regarding the real existence of the phenomena and engages in a *transcendental reduction* to get access to the phenomenon of phenomenology, our acknowledgement of the ecological conditions of ontic phenomena beyond our experience enforces our rejection of the *epoché* of phenomenology. In fact, the phenomenological *epoché* testifies to a *state of exception* (Agamben, 2005), a suspension of our commitment to the materiality of the ecological conditions of planet Earth, while this materiality precisely calls for a *state of inclusion*. Therefore, contrary to traditional phenomenology, ecological hermeneutic phenomenology engages in a *res-cendental transduction* to get access to the phenomenon of phenomenology. Ontic phenomena like the mechanical clock *hold, interiorize,* or *contain* this materiality of the ecological conditions and we should therefore reject the *epoché* in favour of the res-cendental transduction of the content, the relational, and the enactment sense that constitutes the World.

This *res* concerns not only the materiality of ontic phenomena like clocks, but also encompasses the broader ecological context. It includes the Earth as the source of scarce materials needed to build the mechanical clock, the environment in which factories are established to build these clocks, and the role of the Earth as a dumping ground for waste materials produced by these factories, etc. In other words, it concerns the ecological conditions on which these ontic phenomena depend for their existence. The material substantiality of planet Earth is the condition of possibility of every technology and its functioning, which means that technologies like mechanical clocks do not only have an ontological impact on the relational sense and the enactment sense of the World but are also *constrained* by the materiality of planet Earth. For instance, the emergence of quartz clocks since the 1980s is dependent on small and cheap electronic oscillators that are regulated by quartz crystals and resulted in more accurate timekeeping compared with mechanical clocks. As such a dependency, we can consider the content sense of ontic phenomena like the materiality of quartz clocks as a constraint of the relational and enactment sense that structures our living and acting in the World; without the availability of material recourses to make mechanical clocks, no innovation, evolution, and dissemination of this invention could have taken place and with this, no transformation of the relational and enactment sense of time as circular time (elemental clocks) to time as linear, chronological time (mechanical clocks) would have emerged. The invention, evolution, and dissemination of ontic phenomena like the mechanical clock constitutes the relational and enactment sense of the linear, chronological World on the one hand, but is constrained by its materiality (content sense) on the other. An ecological hermeneutic phenomenology acknowledges both the relational and enactment senses that structure the World *and* the content sense of the ecological conditions of planet Earth as a pattern of constraints for each and every technology that constitutes the World.

This acknowledgement of the materiality of the ecological conditions of planet Earth as a constraint also makes it possible for phenomenology to extend its social engagement and ecological involvement beyond a purely functionalist or instrumentalist orientation. While many philosophers of technology still take for granted the material conditions of Earth's biosphere, such as the provision of scarce materials, fuels, and

waste disposal for our technologies, climate change requires philosophers of technology to engage in a 'terrestrial turn' in order to consider the planetary context in which these technologies emerge and function (Lemmens et al., 2017). Our proposal for an ecological hermeneutic phenomenology of technology enables us to actually engage in the social and ecological conditions of new and emerging technologies.

5. Conclusion

In this chapter, we critiqued the one-sided focus on either the ontological level of technology, which overlooks the role of concrete disruptive innovations in shaping the World in which we live and act, or the ontic level, which neglects how new and emerging technologies are embedded in a particular ontological structure of the World. Because the invention, evolution, and dissemination of new and emerging technologies has an ontological impact on the World in which we live and act, phenomenology as a method of philosophy of technology should move beyond the essentialist bias of traditional phenomenology and the descriptive bias of postphenomenology.

We developed a methodological concept of an empirically informed ecological hermeneutic phenomenology that enables us to research how new and emerging technologies (content sense) impact being (relational sense) and thinking (enactment sense) at once and constitute the World in which we live and act. With the rehabilitation of the content sense of new and emerging technologies, we move beyond the essentialist bias of Heidegger's phenomenology. The rehabilitation of the content sense also moves beyond the descriptive bias of postphenomenology, as it is not limited to new and emerging technologies *as we experience* them. While traditionally, phenomenology commits to an *epoché* regarding the real existence of the phenomena, our acknowledgement of the materiality of ontic phenomena beyond our experience forced us to reject the *epoché* of phenomenology. Ecological hermeneutic phenomenology is a methodology to engage in a res-cendental transduction from the content sense of new and emerging technologies to the relational and enactment senses that co-constitute the World in which we live and act. The materiality of planet Earth is a *constraint* for the content sense of new and emerging technologies and

the way they impact the relational and enactment senses that *structure* our living and acting in the World.

In the context of this chapter, we only applied our methodological concept of ecological hermeneutic phenomenology to the case of the mechanical clock and did not yet consider the way digital technologies constitute the World of data in the digital age (see section 1). Our hypothesis is that the method of ecological hermeneutic phenomenology enables us to transduct from the content sense of individual digital technologies like AI applications and digital twins to the relational and enactment senses of the World of data, and to critically reflect on the dataism or pan-computationism that characterizes the situation of the World today (Blok, 2023a). The exploration of this hypothesis is beyond the scope of this chapter and remains open for future research.[7]

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