6 Sustainability as Planetary Maintenance

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6.1 Introduction

The following investigation asks in which sense sustainability is to be understood in terms of maintenance and what the limits and implications of such an understanding are. While it may be clear that sustainability and maintenance are closely related since sustainability seeks to maintain habitats and habitability, it is less clear what this relation ultimately entails. Sustainability remains a contested concept that has spawned a growing discourse about which techno-scientific interventions are necessary and desirable, which ethical and political implications are justified and how sustainable solutions are to be governed (Salas-Zapata and Ortiz-Muñoz, 2019; Marshall and Toffel, 2005). For instance, questions have been raised about whether and why sustaining food supplies trumps sustaining the character of the land or ways of farming (Mariola, 2005). Although the importance of such debates can hardly be overstated in light of the looming climate catastrophe, it is worth noting that as a byproduct of the increasingly resounding call for more effective action and concrete sustainable initiatives, the ontological implications of the concept of sustainability are often left by the wayside. This is unsurprising since it is usually sufficiently clear that whatever sustainability or ecological maintenance ultimately means, sustainable and renewable developments appear to be superior to fossil-fuelled developments. Be that as it may, this chapter departs from the supposition that a philosophical inquiry into sustainability is nonetheless worthwhile since it helps understand and critically examine the horizon towards which sustainable developments are oriented. Accordingly, the purpose here is to try and clarify the metaphysical and ontological implications of the concept of sustainability, which can be done by explicating its relation to maintenance.

To this end, Section 6.2 attempts to clarify the metaphysical and ontological roots of the concept of maintenance. It aims to demonstrate that these roots lead to Aristotle. As a result, the concept of maintenance turns

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out to correspond to a hylomorphic ontology and correlated technical–antagonistic apprehension of reality. The purpose of the section is to explicate this correspondence and show how the concept of maintenance lies at the heart of technics. This prepares the question regarding how it informs and maps onto the concept of sustainability.

Section 6.3 develops this question by discussing the Anthropocene. It demonstrates how the technical–antagonistic aspect of maintenance returns in sustainability, now conceptualised as the striving to maintain the habitability of an increasingly unruly Earth. The question then becomes whether the hylomorphic ontology of maintenance returns similarly. Section 6.3 develops a negative answer to this question by contrasting the verticality and transcendence of Aristotle's hylomorphism with the horizontality and nihilism of sustainability. This problematises the concept of sustainability by showing how the question regarding what or who is to be sustained necessarily remains unanswered. This helps articulate the limits of understanding sustainability as technical maintenance, as it demonstrates that while maintenance and sustainability both involve a kind of movement, the movement of sustainability must be negatively characterised as a fleeing movement: while it may be clear what to move away from (unsustainable fossil-fuelled civilisation), a positive determination is kept in abeyance.

Section 6.4 argues that as long as sustainability mirrors the schema of technical maintenance, it must either ignore its nihilistic horizon or affirm its fleeing movement. In raising doubts regarding the sustainability of fleeing itself, the work of Simondon is discussed to explore the possibilities of planetary maintenance beyond hylomorphism. It concludes with an evaluation of these possibilities and their implications.

6.2 Maintenance as Technics, Technics as Maintenance

This section inquires about the metaphysical characteristics of the concept of maintenance. A glance at the concept suggests that it necessarily concerns individuals and antagonism. An individual being and associated functioning must be maintained to antagonistically 'strife against' (*anti-agon*)[1] its degradation and corruption. One gives the woodwork of a house the occasional fresh coat of paint to keep it from weathering and withering away, thus maintaining habitability. One changes the oils and filters of a car to prevent a clogged engine, thus keeping it operational. One cultivates the garden to subdue the proliferation of weeds and encourage the proliferation of crops, thus keeping a garden rather than an overgrowth. Such examples all involve some individual (house, car and garden) and functions that are prone to wear and tear. Accordingly, to maintain is to counteract degeneration and corruption, thereby literally 'keeping in hand'

(*manu-tenere)* the original identity and ideal functioning of things. Such 'keeping in hand' is characterised by a double keeping: a keeping-under[2] (the elements, the ravages of time) and a keeping-up (things: identity and functioning).

However elementary, these observations bear witness to nothing less than an apprehension of reality or an ontology: there are individuals, there is their potential decay and there is the care for their upkeep. Rather than simply given, such an apprehension grows from philosophical roots, which are in this case to be found in the fertile ground of Aristotle's metaphysics. Two of his metaphysical considerations particularly resonate with the above outline of maintenance: the first is hylomorphism, according to which things or individuals are considered in terms of form *(morphe)* and matter *(hyle)* and the second concerns the relation between nature *(physis)* and technics *(technè)*.

In Aristotle's hylomorphism, any fabricated individual[3] is constituted because a technician (*technitès*) brings matter in form. Following the canonical example, the smith knows how to manipulate the silver matter in such a way that a chalice is formed to serve its sacrificial purpose. The name for the smith's knowledge is technics (*technè*) (Aristotle, *Physics* 2.1.193a 31–2). Given the theme of this volume, it is worth observing that this can be literally understood in terms of maintenance, meaning that a conception of maintenance lies at the heart of *technè*. Just as carpenters do not by themselves create wood, smiths do not create the silver matter, since both originate in nature as trees and ores. They are given to technics rather than being its product.[4] With reference to the etymology of maintenance (*manu-tenere*), smiths take and keep this given matter into their hands to mould it. Such 'handling' is done by observing the outlook *(eidos)* of the fully formed and functional individual *(telos)*, where observing both means 'seeing' and 'complying with': the smith sees and complies with the outlook of the form of the chalice and correspondingly handles matter to bring it in the form of the completed chalice (cf. Glazebrook 2000, p. 104). Accordingly, while belonging 'to bringing-forth, to poiesis' (Heidegger 1977, p. 13), technics is less a matter of pure creation or absolute imposition than of 'taking in hand', that is, maintenance and manipulation of what is given. By implication, when defined as the *archè tès kinèseoos* (Visser, 2014, pp. 68–73), this cannot mean that the technician is *archè* in the sense of sole principle and origin. Rather, reading the genitive *tès* the other way around, *archè tès kinéseos* means to take command[5] *of* a movement, much akin to how in commandeering a ship, one takes possession, one handles a given. As Heidegger (1977, p. 8) explains: 'The silversmith considers carefully and gathers together' rather than creating from scratch.

And does this not point to both the heart of the smithy and the archetype of all technics, namely fire? Mythologically speaking, it is by making up for

his forgetful brother's mistake (cf. Stiegler, 1998) that Prometheus offers fire and technics to otherwise ill-equipped humankind, placing it into their hands to maintain and manipulate. As pyrotechnicians, humans do not create fire from scratch, but handle and manipulate a natural given to their ends, be it in the form of torches, ovens or eventually internal combustion engines. As the latter example suggests, this understanding of technics as maintenance does not only concern so-called (and arguably mislabelled) primitive technics like torches and fireplaces (cf. Clark and Yusoff, 2014) but equally holds for modern technics like electronics, where rather than creating it ex nihilo, engineers handle, manipulate and modulate a naturally given movement (of electrons, or, put archaically, lightning) to achieve their ends. Such manipulation demonstrates how a conception of maintenance understood as 'taking-in-hand' lies at the heart of technics itself.

Considering technics in this way further points to the antagonistic aspect of maintenance. If not maintained properly, the fire dies or overgrows into a wild conflagration. The technics of fire accordingly consist of maintaining a rather precarious equilibrium, which Aristotle's thought generally articulates as the middle. This middle is most often associated with Aristotle's ethics, where it marks the virtuous position between two extremes, for example, courage between cowardice and recklessness, (Aristotle, *Nicomachean Ethics*, 1115b 17–9). Yet, the same figure returns in technics as maintenance. To maintain the middle is to domesticate the movements of nature *(physis*, which is always understood in terms of movement or *kinesis*, cf. Glazebrook 2000, p. 103*)*[6] by way of striving against two extremes that it harbours, namely corruption or going into itself on the one hand (*phftoras*, the fire dying), and unrestrained going outward on the other (*genesis*, wildfire). Such middle maintenance can be observed in modern electronics as well, where circuits have an equilibrium 'operational window' between inactivity (*phftoras*, e.g., a dead battery) and hyperactivity (*genesis*, a short circuit).

Interpreted along these lines, technics handles and maintains naturally generated movements (fire; lightning, silver and wood) and temporarily stabilises them into a form. Maintaining stabilised informed matter such as a particular wooden bed is antagonistic since it implies striving against the very natural movements that gave rise to the bed, but which also risks upsetting its equilibrium or middle. To clarify, consider how Aristotle famously states that 'if you planted a bed and the rotting wood acquired the power of sending up a shoot, it would not be a bed that would come up, but *wood*' (Aristotle, *Physics II*,1, 193a). Aristotle's example expresses the precarious equilibrium of the wooden bed: if not maintained, for instance, by just leaving it outside, exposed to the natural elements, it de-forms and recedes into the movement of physis again, either by sprouting (*genesis*) or rotting away (*phftorás*). Aristotle famously says that technics 'completes

what nature cannot bring to a finish' (Aristotle, *Physics II*,1, 199a) to express how the bed as informed matter owes its completion to nature as well as to technics. Yet, this always comes with the potential of its reverse, where nature consumes what technics completed: the bed is consumed by worms, the iron by rust, etc. This antagonism concerns, in Arendt's words, the 'unending fight against the processes of growth and decay through which nature forever invades the human artifice, threatening the durability of the world and its fitness for human use' (1958, p. 100).

This then lays out the metaphysical and ontological roots of the concept of maintenance, which corresponds to a hylomorphic ontology and correlated technical–antagonistic apprehension of reality. Maintenance understood as 'taking-in-hand' or 'handling' lies at the heart of technics itself. If sustainability at the very least resonates with maintenance inasmuch as sustainability generally concerns the maintenance of habitats and habitation, the ensuing question is whether and how the mentioned metaphysical characteristics of maintenance inform or disinform the concept of sustainability.

6.3 Sustainability as Maintenance

Sustainability closely resembles the above interpretation of maintenance. To sustain is to maintain, here not so much a specific bed or chalice, but the environment, an ecosystem, and one's *oikos* or habitat. As such, sustainability echoes the antagonism found in maintenance. As Horatius famously noted (*Epist. I*, 10,24) that 'you may drive nature out with a pitchfork, but she will keep coming back', the concept of sustainability necessarily expresses this strive against the return of nature.

After all, it now seems abundantly clear that we either find ways of becoming sustainable or degenerate into the physis whence we came. The discourse of the Anthropocene expresses this antagonism particularly well. On the one hand, it stages a highly technologised humanity, the *anthropoi*, as the dominant Earth-shaping force. On the other hand, it stages the physis, now considered beyond local natural environments, ecosystems and habitats as the planetary physis named Earth, and articulates how it has awoken from its slumber (Hamilton 2017, p. 45). While this slumber, which might be referred to as the Holocene, may have given the impression of a stable physis that sustained ever-increasing extraction of (fossil) resources, the Anthropocene orchestrates a new agon between technologised geo-humanity and the Earthly, geo-physis (cf. Zwier and de Boer 2023).

Among others, this strife can be witnessed in extreme weather events, global warming, desertification, droughts, crop failures, dwindling biodiversity, etc. The general response to such extremes and loss of a Holocenic stable equilibrium or middle appears to consist in the maintenance of both

protagonists of the Anthropocene: the *anthropoi* and Earth qua *physis*. If, as suggested, maintenance involves the domestication and handling of physis, it is now up to geo-engineers and sustainable developers to tame the unruly Earth system and abate its threat of becoming uninhabitable (cf. Baskin 2015; Hamilton 2013). Conversely, it appears up to technology designers, educators, ethicists and policymakers to help (re)domesticate the *anthropoi* who have lost their way in excessive fossil-fuelled consumerism and who must become responsible and responsive to the Earth and its new climatic regime.

This general response serves to indicate how the antagonistic metaphysics inscribed in technical maintenance returns in sustainability, as emphatically expressed in the Anthropocene's strive between geo-technè and geo-physis. However, examination of the other aforementioned metaphysical dimension of maintenance, namely hylomorphism, will reveal a significant difference.

6.3.1 Hylomorphism and Verticality

In the Aristotelean conceptualisation, what is to be maintained or kept in equilibrium is guided by the outlook of the form. By complying with the observed form of the bed, the technician seizes the material movements of nature (trees growing and decaying) to maintain them in the form of a bed. Technical things thus 'stand upright' over against the 'growth and decay through which nature forever invades the human artifice' that Arendt mentioned (1958, p. 100). The vertical character of such 'standing upright', which also resounds in maintenance as 'upkeep' is critical to hylomorphism and deserves further attention.

To clarify this verticality: consider how the bed that rots away and thus re-enters the movements of nature (as worm food, then as bird food, etc.) only concerns the particular artefact. The general form remains untouched. It is for this reason that Aristotle ties the notion of form to that of *entelecheia*, which Heidegger renders as *en-telos-echein*, 'something's holding (or maintaining) itself-in-its-completion-(or limit)' (Heidegger 2000, p. 63; cf. Glazebrook 2000, p. 99–100). The form denotes a completion, an optimum, the ideal thing in *optima forma*. In a wordplay that references his own name, Aristotle also refers to it as the 'best goal' or 'optimal goal', the *telos ariston* (Aristotle, *Nichomachean Ethics*, 1099b.17). Put simply, it is only by observation of its complete and optimal form that one can recognise a broken bed and construct a new one (cf. Section 6.2) – how else could one recognise a thing as being broken or deficient? With regards to the verticality of 'standing upright' and 'upkeep', this means the following: if technics domesticate the material movements of nature to maintain them in form (e.g., of a bed), the complete and optimal form that guides this

process itself *stands out from* these movements of corruption and generation: it stands out and is beyond the growth and decay of physis, and is therefore metaphysical.[7]

Notwithstanding their other disputes, Aristotle remains beholden to his teacher Plato on this point. Plato's Cratylus demonstrates a similar metaphysical verticality of form, where in the discussion of a broken shuttle of a loom, the craftsman tasked with making a new shuttle observes not the broken artefact, but 'looks up to' its ideal, general and incorruptible form (Plato, *Cratylus*, 1997a, 389b; cf. Aydin 2021, p. 19). In Platonic doctrine, the particular, *material*, and therefore transitory shuttle participates in this form. Similarly, in Socrates' famous metaphor of the three beds in *The Republic X*, the carpenter imitates the ideal form of a bed (and the painter imitates that imitation) (Plato, *Republic*, 1997b, 598). Further, Plato's speculation on a *demi*urge (literally a technician or artifex) as a world-maker does not create ex nihilo but observes and is guided by outstanding, metaphysical ideas as blueprints (Plato, *Timaeus*, 1997c, 28a6).[8]

What follows is that the verticality of the hylomorphic schema is best understood as an interrupted verticality that transcends to the metaphysical. The outlook (*eidos*) or *idea* concerns a higher kind of being, because, unlike particular shuttles, beds and chalices, Plato's ideas and Aristotle's forms are themselves ever-present, untouched by vicissitude and self-sustaining, and thus require no maintenance. These general forms are observed (in the double sense of seen and complied with) in the sublunary, material and particular dealings of mortals.[9]

This may then give rise to the following question: how does the hylomorphic verticality found in technics as maintenance relate to sustainability? Does sustainability similarly look up to and observe a transcendent *telos ariston* or *optima forma*? What follows attempts to demonstrate that the answer to this question must be negative. The hypothesis to be developed is that rather than vertical-metaphysical, the figure of thought at stake in sustainability is horizontal-nihilistic.

6.3.2 Sustainability and Horizontality

To clarify this point, consider how sustainability expresses a kind of movement. This does not primarily mean the scientific, technological and political-economic progressive movement required to achieve sustainability. Rather, in the more fundamental terms of the hylomorphic scheme, sustainability expresses movement insofar as it seeks to maintain, domesticate or handle the movement of unruly matter (*hyle*) such as CO_2 back into formation (*morphe*). Although CO_2 may be the most telling example of a material movement of physis in disequilibrium (consider its resonance with

the previous example of wildfire as extreme physical genesis), one can also think of animals as matter to be maintained (sustainability as maintenance of biodiversity), of ecosystems (sustainability as maintenance of the environment) or even the Earth (sustainability as maintenance of the dynamics of the Earth system). All these examples concern a natural material movement in disequilibrium, either on the side of growth (CO_2) or on the side of decay (biodiversity). Sustainability is the attempt to maintain and to handle this movement, similar to how the upkeep of a bed or shed handles the natural movement of decay.

However, where the hylomorphic scheme in technical maintenance is guided by a positively determined metaphysical form such as the complete and optimal bed or chalice, movement in sustainability is primarily determined negatively: away from pollution, no more externalities and no longer depleting fossil resources (and, on the associated political spectrum: no more inequality, no poverty, no exclusion, etc.).[10] In short, a movement away from a fossil-fuelled Holocenic mode of existence that has become untenable in the Anthropocene. But if the ideal of sustainability seeks to depart from the fossil-fuelled era, which destination does this departure seek? Or, put in the terms used in the above interpretation, if sustainability is a kind of maintenance, and if technical maintenance is guided by an optimal form that can be observed, what would be the corresponding *optima forma* guiding sustainability?

As it appears, the negatively determined ideal of sustainability hardly resembles the positively determined Platonic *idea* and Aristotelean *eidos*. It is here that sustainability meets nihilism, which in Nietzsche's formulation means '[t]hat the highest values devaluate themselves. The aim is lacking; "why?" finds no answer' (1986, p. 9). Plato's ideas and Aristotle's forms can be understood as such 'highest values', but they have lost their fecundity. Leaving aside the genealogy of this loss, the aforementioned antagonism between geo-technics and geo-physis in the Anthropocene makes it manifest. The Aristotelean conception ultimately implied cosmic stability with an enduring presence of optimal, outstanding forms. This was paradigmatically expressed in the unchanging and perfect circular movement of the superlunary sphere (moved by a still more perfect unmoved mover) but similarly engages the optimal forms of technics such as the ideal, unchanging and stable form of the chalice, bed or Plato's shuttle. By contrast, today's geophysics, geology and Earth systems science attest to a volatile cosmos, in general, and Earth, in particular. As a result, it becomes impossible to speak of the Earth's optimal form. If still meaningful at all, one must face the metaphysical *nihil* of this optimum and admit its contingency. Although the Earth can indeed be said to have gone through an optimum, where relative stability and climatic conditions

allowed for civilisation to flourish, this optimum now appears as a happenstance exception rather than the rule, the rule being an unruly planet where contingency rather than perfect cosmic stability reigns (cf. Clark 2011; Hamilton 2017).

Responding to being deprived of an ultimate positive idea or eidos, sustainability formulates its ideals negatively: no more externalities, no more pollution, zero waste, etc. If there are 'sustainable development goals', the goals in question primarily indicate reparations and corrections of wasteful ways that now appear erroneous.

A symptom of this situation is that all ultimate positive determinations now appear deeply suspect: is there an optimal form of the relation between technics and nature? Offering a formulation of this optimum would be a hazardous undertaking. At best, it would be unmasked as some romantic and harmonious projection. At worst, it would be ridiculed as some green fantasy. Furthermore, political suspicions are bound to arise: for whom exactly would it be an optimum? For humans? Which ones? For Global Northmen who wish to prolong their security, rule and comfort? In the words of Stacy Alaimo (2012, p. 562):

> Scholars in the humanities, or, more aptly, the posthumanities, may well ask what it is that sustainability seeks to sustain and for whom. Questions of social justice, global capitalist rapacity, and unequal relations between the global North and the global South are invaluable for developing models of sustainability that do more than try to maintain the current, brutally unjust status quo.

Timothy Morton (2018, p. 77) similarly asks:

> What exactly are we sustaining, if not the one-size-fits-all agricultural temporality pipe that has sucked all lifeforms into it like a vacuum cleaner, pretty much, over its 12,500-year run?

Irrespective of whether such suspicions are justified, the relative ease by which they now emerge[11] serves to indicate, in Nietzsche's terms, the devaluation of the ideal optimum, which thereby no longer serves as a beacon to orient the movement of sustainability.

In this qualified sense, sustainability can be said to be nihilistic. Rather than a pejorative moral judgement, this names a formal characteristic, or rather an in-formal characteristic, since the outlook of an optimal form is absent. This does not necessarily mean that sustainability lacks any ideals whatsoever but articulates how the status and topology of the ideal have changed. To clarify, consider the potential objection that in the final analysis, sustainability is not only negatively determined (no more externalities, etc.)

but also positively oriented towards an optimal outlook or ultimate idea. This idea could then be formulated as something like 'enduring sufficient quality of life for everyone'. Yet on the one hand, such a formulation paints such a vague vista that in comparison to the idea of eidos of Aristotle's optimal bed, it rather appears as an idyl. On the other hand, as remarked previously, a closer examination of such an ideal demonstrates its deeply contested character: sufficient quality for whom? Which quality exactly? Who is excluded from 'everyone' (humans? animals? other life forms, etc.)?

Accordingly, the ideal no longer follows the verticality of a metaphysical optimum that speaks for itself from on high. Instead, the ideal of sustainability corresponds to a horizontal topology. The mentioned suspicions (sustainability for whom? which quality of which lives? etc.) demonstrate that rather than speaking from transcendent heights, the ideal of sustainability becomes contested on a horizontal terrain.[12] Accordingly, it becomes less a question of looking up to an ideal than of constructing one from the ground up, a process inescapably accompanied by political contestations of who and what is included and excluded. The observation of optimal forms makes place for their generation. In Latour's words, the transcendent notion of 'Nature' makes place for 'world' as 'that which opens to the multiplicity of existents, on the one hand, and to the multiplicity of ways they have of existing, on the other' (Latour 2017, p. 35). The political contestation regarding sustainability ultimately comes down to 'what existents have been *chosen* [to exist], and what forms of existence have been *preferred?*' (ibid. p. 37; cf. Zwier and de Boer 2023, pp. 76–81). The question concerning what exactly is to be constructed thereby necessarily recurs. However, since the blueprints from Plato's Timaeus have gone missing, their negatives must suffice: whatever is to be constructed, it must be less polluting, less exclusivist, less anthropocentric, etc. The ideal guiding sustainability thus appears negatively determined as 'less suboptimal', while a positive determination recedes like a horizon when approaching it.

Yet, if sustainability faces a receding horizon, if what ultimately is to be sustained remains elusive, this destitution hardly constitutes a hindrance to its movement. This is unsurprising when considering that not every movement seeks a destination. In fleeing a crime scene or the site of a disaster, one is not concerned with arriving anywhere in particular. For sustainability, the designated crime scene and the site of disaster is the globally warming wasteland of Holocenic fossil-fuelled civilisation. Rather than requiring a clear destination, the necessity of fleeing the scene suffices to instigate its movement. Today's virtually ubiquitous recital of sustainability as 'sustainable development', 'sustainable entrepreneurship' and 'sustainable growth' (e.g., Ploum et al. 2018) attests to this imperative of movement, which neither has nor requires any ideal goal or optimal form.

To recapitulate, the initial observation was that sustainability mirrors technical maintenance, given how it concerns a metaphysical antagonism between (geo)technè and (geo)physis. The question was whether the hylomorphic metaphysics that characterises technical maintenance correspond similarly. The answer is, on the one hand, sustainability follows hylomorphism insofar as it anxiously seeks to maintain and contain matter (*hyle*) such as CO_2 in formation (*morphe*). On the other hand, due to its nihilistic character, sustainability parts with hylomorphism and is no longer guided by a transcendent optimal form. Since sustainability moves away from something determinate (unsustainable fossil-fuelled civilisation) towards nothing determinate, its movement is best characterised as flight. Maintenance in the sense of moving matter (*hyle* such as CO_2) away from disequilibrium remains central, but the *morphe* found in the hylomorphic scheme no longer guides such movement. As a result, not some optimal form, but the fleeing movement itself is to be maintained.

6.4 Technical Maintenance of Actuality or Potentiality?

The above diagnosis of sustainability's nihilism and flight of course does not imply that it should be altogether abandoned. It could be argued that the widely advocated idea of 'becoming more sustainable' can simply do without a positively determined optimum since determinations of the sub-optimum from which to flee are sufficiently clear. Habitability simply trumps the alternative. Be that as it may, this raises the question of whether such flight is itself sustainable or is itself to be sustained. Does moving towards sustainable technical maintenance of the Earth ultimately imply perennially fleeing from sub-optima? It appears that since it mirrors technical maintenance, sustainability must either ignore this question and prioritise actual evasive maneuvers or affirm a sustained fleeing movement. Perhaps, both options offer a sufficient response to the situation of the Anthropocene. Still, and this is the wager of this final section, it may be worthwhile to further explore the limits of this situation. Although such an exploration cannot be expected to formulate a full-fledged alternative and some post-nihilistic conceptualisation of sustainability, it can shed light on the presuppositions that undergird current conceptualisations to open alternative avenues. One way in which this can be done is by once more returning to the technical character of sustainable planetary maintenance.

The technical maintenance mirrored by sustainability corresponds to the cybernetic figure of the homeostat in its specific guise as a thermostat. The now popular image of the Earth-as-thermostat shows this: relatively modest technologies like solar panels and the more ambitious technologies like solar radiation management are alike in aiming to dial back the runaway thermostat of global warming (Zwier and Blok, 2019, pp. 622–7).

Such dialling back corresponds to the negative feedback in cybernetic homeostats, where the system's output (classical example: observed steam engine speed) feeds back into the system's input (the steam inlet, by way of a centrifugal governor), to minimise the difference between the intended and observed behaviour and maintain an operational equilibrium condition. This equilibrium echoes the aforementioned Aristotelean equilibrium as optimum (*telos ariston)* between *genesis* (e.g., an overdriven steam engine) and *corruption* (e.g., a halting engine). Dialling back the Earth-as-thermostat similarly feeds back observed outputs such as '5°C too high' to inputs such as 'produced emissions'. Yet, because of sustainability's nihilistic character, the difference is that the optimum setting of the thermostat remains unresolved at worst and a perennial political contestation at best (cf. Zwier and de Boer, 2023).

If the thermostat thus portrays the technical character of sustainability, this raises the question of whether technics primarily consists of maintaining homeostasis and equilibrium. Aristotle and sustainability answer positively: technics maintains the material movement of *physis* in equilibrium. Conversely, Gilbert Simondon answers negatively. His work is therefore instructive for exploring the limits of sustainability.

6.4.1 Simondon versus Hylomorphism

Simondon criticises the hylomorphic scheme for being an abstracted, deadlocked and ultimately misguided way of metaphysically considering technics and ontology in general. It is abstract because it corresponds to a specifically aristocratic and detached way of perceiving reality. Seeing the technical process in terms of pre-given matter to be 'handled' (i.e., maintained) into pre-established forms 'corresponds to the knowledge of someone who remains outside the workshop and considers nothing but what enters and exits it' (Simondon 2020, p. 30). For Simondon, such a perspective not only concerns workshops, artisans and technics but also fundamentally characterises metaphysical thinking and the tradition of philosophy (cf. Combes 2012, p. 1). This tradition privileges static *individual beings* (cf. Section 6.2) such as 'final optimal form' and 'pre-given matter', and in so doing wrongfully overlooks the process of their *individuation*. Conversely, in attempting to 'grasp ontogenesis in the whole unfolding of its reality', Simondon's project consists of seeking 'to know the individual through individuation rather than individuation through the individual' (2020, p. 30).

Thinking ontogenetically requires a transfiguration of the hylomorphic scheme. Among many other examples (cf. Voss 2018, p. 110), Simondon concretely develops such thinking in his analysis of brick moulding, where he replaces stability with the concept of metastability. Rejecting the

hylomorphic differentiation between pure matter and form, Simondon (2020, p. 22) explains:

> To give a form to the clay is not to impose the parallelepiped form onto raw clay: it is to pack the prepared clay into a fabricated mold. If we start from the two ends of the technological chain, the parallelepiped and the clay in the quarry, then we can experience the impression of realizing in the technical operation an encounter between two realities of heterogeneous domains and of instituting a mediation through communication

A brick cannot be made from wet sand, which would simply disintegrate upon drying. Hence, rather than passive matter waiting to be actively informed, the clay matter is positively determined as a potential for deformation (Simondon, 2020, p. 25; cf. Combes 2012, p. 5). On a molecular level, clay is already in-formed in the swampy soil in such a way that the *other* material form of the mold:

> limits and stabilizes rather than imposing a form: it provides the goal of deformation and achieves it by interrupting it according to a definite contour […] the mold plays the role of a fixed set of modeling hands, acting like halted kneading hands.
>
> (Simondon 2020, p. 25)

The individuation of a brick establishes *communication* between hitherto heterogeneous domains of becoming. In this sense, it is similar to how the individuation or becoming of plants first established communication between a cosmic order (light energy) and an intramolecular order (mineral salts, oxygen, etc., cf. Combes 2012, p. 4). Similar to how a plant is the communicative medium connecting these orders, brick moulding establishes communication between the clay and the brick mould. Since it is itself technically prepared, 'the pure form [of the mold] already contains actions, and the raw material is the capacity of becoming; the actions contained in the form encounter the becoming of the matter and modulate it' (ibid., p. 25). For Simondon (ibid., p. 41), this marks the insufficiency of the hylomorphic schema, which:

> does not account for implicit forms, since it distinguishes between the pure form (which is called form) and the implicit form, which is conflated with other features of matter under the name quality.

The reference to 'kneading hands' and 'modulation' recalls the interpretation of technical maintenance as taking in hand or 'handling' of *physis*

(Section 6.2). When Simondon criticises the hylomorphic schema of the metaphysical tradition, it accordingly remains questionable whether this critique can be fully directed at Aristotle himself. After all, as the example of the bed made clear, the wooden matter out of which the bed is made is, in Simondon's terms, 'implicitly formed'.[13] Still, Simondon's ontogenetic consideration of communication between two chains of becoming (the clay with potential for deformation and the mould as a potential limit to deformation) marks a significant departure from hylomorphism. When these chains enter into communication in the technical operation of brick moulding, something new enters into reality. This is to say that in contra hylomorphism, there is no pre-given, transcendent and complete optima forma that serves as the ultimate orientation point (*telos ariston)* for a technician. Instead, the form is an outcome or 'endpoint' (Combes 2012, p. 5) of the technical operation: 'The technical operation integrates implicit forms rather than imposing a totally new and foreign form on a matter that would remain passive vis-a-vis this form' (Simondon 2020, p. 42).

Instead of unchanging, stable beings like Aristotelean forms or Platonic ideals, Simondon privileges the metastable: 'The original state of being is a state that goes beyond coherence with itself, that exceeds its proper limits: original being is not stable, it is metastable' (Ibid. p. 369).[14] As Yuk Hui (2016, p. 84) explains:

> 'metastable' describes a transitional state through which the individual as product is given to us, but further individuation can take place when the individual is stimulated by external information or by energetic excitation from within.

Simondon's paradigmatic example is crystallisation. It cannot be understood as the imposition of form, but only as communication. When a supersaturated solution enters into communication with heat energy, it starts to crystallise, which in turn triggers more crystallisations. The condition for this occurrence is that the amorphous solution is neither stable nor unstable, but metastable: the solution is charged with potential and when a threshold is passed, the amorphous state transitions to a crystalline structure, without 'the contribution of some foreign form' (Simondon 2020, p. xxiii). Ascribing the process of becoming found in crystallisation to reality as such, and referring to the potential charge of a supersaturated solution, Simondon (2020, p. 352) points out that

> This charge of the undetermined can be called nature (…) a veritable reality charged with potentials actually existing as potentials, i.e. as an energy of a metastable system.

If hylomorphic ontology ultimately understands reality as self-maintaining *actuality* in terms of transcendent forms (see Section 6.3.1 and footnote 9), Simondon's ontogenesis understands reality as self-maintaining *potentiality*, always maintaining 'a reserve of becoming' (2020, p. 358) that gives rise to new communications and individuations.

6.4.2 Metastability or Elusive Homeostasis

Simondon's conceptualisation of technics and metastability raises the following question: if, as argued (Section 6.3.2), sustainability qua planetary technical maintenance is characterised by flight, what does Simondon's revision of technics and hylomorphism imply for this characterisation?

The philosophy of individuation does not counter nihilistic devaluation by formulating a new optimal form to guide sustainable planetary maintenance. It does not indicate the optimum setting to which the Earth's runaway thermostat should be dialled back. The possibility of such static anchoring points is principally refused. Instead, Simondon sidesteps this metaphysical trajectory. Rather than maintenance geared towards some *actuality*, which is to say, recalling Heidegger's characterisation of metaphysics, some 'enduringly present' optimal form (cf. Section 6.3.1), Simondon's thought considers the question of sustainability as one of maintaining *potentiality*. Not the homeostat, thermostat or any other stable state, but becoming is to be taken in-hand. Such taking in-hand or maintenance would then not consist of *the conservation* of form against physical corruption and generation, but in establishing novel *communications*.

Within the scope of sustainability and the theme of the Anthropocene, this primarily indicates communication between technologised humanity and Earth. Whereas sustainability here sees antagonism between the geo-technè of humanity and the geo-physis (Section 6.3.1), Simondon's thought allows for seeing novel communications and individuations. This not only means that an otherwise statically determined humanity now wields newly individuated technologies such as solar panels and geo-engineering facilities but also indicates the ongoing individuation of humanity and the Earth. A significant aspect of this individuation is that humanity no longer merely lives *on* Earth but must live *with* the Earth. This can be regarded as a novel communication, similar to how the living individuation of plants first established communication between a cosmic order and an intramolecular order.

While investigating the implications of this novel communication remains an ongoing task (cf. Hamilton 2017; Zwier and de Boer 2023), it is clear that it cannot be constrained to an Anthropocentric perspective according to which the situation is imposed by humanity. Just like the clay and the mould are considered as two chains of becoming, technologised

humanity and the Earth likewise find themselves communicating anew. Regarding technics, specifically, Simondon holds that its evolution is not imposed by human forms, but it individuates by itself as a quasi-living being (cf. Lindberg 2022, p. 54). His interpretation of the Guimbal turbine shows that although human anticipation and invention essentially belong to the process, the turbine shapes its own conditions of operation and thus '*renders itself possible*' by constituting a 'techno-geographic milieu' (Simondon 2017, pp. 57–8). The turbine only works when inserted into the water, only when it establishes novel communications that condition the water to function both as the energy source and the cooling mechanism. Whereas Heidegger still prioritised Aristotle's silversmith as 'carefully gathering together' the material movements of nature into an observed form (cf. Section 6.2), for Simondon such gathering or self-conditioning is non-anthropocentrically interpreted as the outcome of several individuating chains: the technical individuations internal to the turbine which contain 'an entire electrical factory' (2017, p. 58); the water becoming milieu for its functioning and the social individuations resulting from its generated energy, etc.

Viewed from this perspective, the question comes to concern the new techno-geographic milieu of the Anthropocene. Rather than sustaining some ineffable optimal form, the task then consists of understanding what living *with* the Earth entails. Simondon's ontogenetic reworking of hylomorphism, technics and ontology opens avenues for investigating this question beyond the limits of sustainability understood as planetary technical maintenance. Although such an investigation remains to be carried out further, two presumably informative considerations can be offered in closing.

First, a critical dialogue with Simondon appears in order. It could be argued that the Earth becoming uninhabitable of itself nothing else than a physical individuation on the level of the Earth System, where a situation crystallises that no longer happens to support the individuations that are associated with civilisation. This raises the critical question of how Simondonean thinking can accommodate this kind of 'negative individuation' or what Bernard Stiegler refers to as 'disindividuation' (2006).[15] As noted, Simondon abandons metaphysical dualistic *oppositions* of form versus matter and (human) technics versus nature, to instead privilege *compositions* of physical, living, psychical and technical chains or 'regimes of individuation' (Simondon 2020, p. 12). Yet, this seems to imply a certain unidirectional or even upward development moving from the physical (e.g., crystals) to the living (e.g., organisms), to the technical and to the psychical (human) and social. What, however, if the physical individuation of the planetary habitat that renders it uninhabitable, thus comes to undermine rather than support 'higher level' individuations like psychical and

social individuations? If such a question is on point, it could be argued that in stressing individuation as becoming or Aristotelian *genesis*, its companion term of *corruption* now comes to haunt Simondon's philosophy of potentiality and becoming.[16] In any case, Simondon's attempt to move beyond a rigid opposition between matter and form, as well as between nature and technics, allows for addressing such critical ecological questions anew (cf. Lindberg 2022, p. 62).

Second, it may be clear that abandoning maintenance as conservation of an actuality in favour of maintenance as communication with a potentiality comes at a cost: it becomes experimental rather than cybernetically controlled (cf. Bardin 2021, p. 38). Experimental does thereby not necessarily refer to a strictly controlled scientific experiment but involves receptivity and generosity to what remains beyond control and what remains potentially new. This calls for a different comportment: rather than either seeking to conserve some optimal form or flee from the sub-optimum (cf. Section 6.3.2), Simondon's thinking invites a progressive comportment that welcomes new individuations. Instead of the homeostatic control according to some existing yet elusive optimum, it opens towards mediation with what remains hidden, with what is always '*richer than its self-coherence*' (Simondon 2020, p. 369). It is here that Simondon (2020, p. 411) equates the philosopher and the technician:

> Thales, Anaximander, and Anaximenes are technicians above all else … the veritable technician is the one who is a mediator between the community and the hidden or inaccessible object.

Concerning the abovementioned question of whether sustainable planetary maintenance is finally characterised as flight, it remains to be decided whether this experimental cost is too high. If the currently accepted view understands sustainability as the maintenance of either some actual planetary optimum, or at least a habitable minimum, then rethinking maintenance in terms of potentiality may appear too naively optimistic about individuations and its 'potential becomings', too audacious or even reckless in light of what needs actual attention. On the other hand, the alternative appears to be the affirmation of the sustained fleeing movement of sustainability. What is more, even when (rather favourably) assuming that the optimal thermostat setting is sufficiently clear and uncontested, past attempts to dial it in can be evaluated by their fruits. It then appears that today's rather blatant failures to reset the thermostat point to more than a few rotten apples (cf. Malm, 2018). As the 2023 IPCC Synthesis Report states:

> In 2018, IPCC highlighted the unprecedented scale of the challenge required to keep warming to 1.5°C. Five years later, that challenge has become even greater due to a continued increase in greenhouse gas

> emissions. The pace and scale of what has been done so far, and current plans, are insufficient to tackle climate change.
>
> (IPCC 2023)

Seen in this light, even if Simondon's privileging of potentially novel communications and progressive comportment appear preposterous in the light of looming catastrophe, the failures of sustainability's planetary technical maintenance might be read as a justification to nonetheless venture in this direction.

6.5 Conclusion

This chapter asked in which sense sustainability is to be understood as maintenance and what the limits and implications of such understanding are. It argued that sustainability follows the metaphysical schema of technical maintenance, but runs up against a limit of form. Whereas technical maintenance knows the optimal form of what to maintain (a bed, a house and a bicycle), sustainability only knows the suboptimal form that should not be maintained. As a result, it engages in a fleeing movement. Although understandable and even justifiable in light of the present climatic situation, the question remains whether such flight determines the limit of what planetary maintenance means. By way of its critique of hylomorphism and emphasis on individuation and potentiality, Simondon's work opens an alternative avenue. Exploring this avenue suggests that sustainability and planetary maintenance need not mirror the schema of technical maintenance, but might investigate newly established communication between technics, humanity and the Earth. If Simondon is thereby read as a critique of maintenance and its adherence to hylomorphism, a critique cannot be understood as rejection or refusal, but as delimitation. Accordingly, while technical maintenance of individuals such as chalices, beds or even planets is necessary, Simondon suggests that it is not sufficient. It neither exhausts the potential of technics nor how it is maintained or 'taken in hand' nor how it enters into individuating communication with the Earth.

Whether one opts for sustainability's flight or Simondonean experiments, it appears that the conditions for considering these options are given for now. Perhaps, the response to this gift must be to cultivate it further, to ask which potential Earth is to be maintained, for which individuals or individuations and to which potential ends.

Notes

1 Throughout this chapter, etymological references are used, not to prove or fix their final meaning, but simply to suggest that the genealogy of the words we use is not inconsequential and can inform and inspire reflection on what we – often implicitly and unreflectively – mean by them.

2 The Dutch word for maintenance is 'onderhoud', which literally translates as 'under-keep', thus expressing this characterisation of maintenance.
3 Fabricated individuals (e.g., a chair) differ from natural or physical individuals (e.g., a tree) insofar as the latter carry their movement towards from within themselves (the tree becoming full-grown), whereas fabricated individuals involve an external movement in which the technician or craftsperson plays a role (a tree never grows into a chair). Given the present focus on maintenance and sustainability, this chapter focuses on fabricated individuals and leaves the question of natural individuals (and whether they ultimately derive from a technical paradigm) open. See Heidegger (1998, pp. 202–4); Glazebrook (2000, p. 99).
4 The required intermediary technical steps of turning trees into lumber or ores into silver do not contradict their physical givenness.
5 Next to 'origin' and 'principle', *archè* also means 'command', as Agamben (2019) makes clear in 'What is a command?'
6 The word 'nature' similarly expresses movement, as it derives from 'nāscī' or 'being born, being generated' or simply 'growing'.
7 Meta means after, beyond, above or transcendent, which is how metaphysics is traditionally understood: after and above the physical.
8 In modern philosophical thought on technology, the clearest echoes of this vertical metaphysical thinking can be found in the work of Friedrich Dessauer (cf. Dessauer, 1956; cf. Mitcham, 1994, pp. 29–33).
9 The metaphysics of interrupted verticality thereby resonates with Heidegger's definitions of metaphysics as 'enduring presence' (*Beständige Anwesenheit*) and 'onto-theology' since observed forms or ideas are enduring and constitute the highest (*theos)* instance of being (cf. Heidegger 2002, pp. 42–75).
10 This can be observed in the 'sustainable development goals' such as 'no poverty', 'zero hunger' and 'reduced inequalities', combined with industrial development with 'no externalities' like pollution, use of fossil resources, etc.
11 The very phenomenon of this 'relative ease' may of course well be interpreted as a laborious and hard-fought achievement by critical scholars, activists, etc.
12 In Morton's work, 'ontology […] is a vital and contested political terrain' (2013, p. 20). One could find the devaluation of the highest goals anticipated in Descartes' mechanistic universe, where true goals are restricted to the domain of human morality, yet only as 'conjectures', whereas real optima forma are inaccessible: 'for it does not appear to me that I can without temerity seek to investigate the [inscrutable] ends of God [les fins impenetrables de Dieu]' (Descartes, 4th meditation (1911, p. 20).
13 Simondon acknowledges this in his discussion of Aristotle's bed: 'Here, the technical operation accommodates the living form and partially diverts the latter for its own benefit' (2020, p. 42).
14 According to Anne Sauvagnargues, Simondon's philosophical extension of the thermodynamic notion of metastability is crucial for his account of reality: 'Metastable being, in disequilibrium, involves this state of asymmetrical disequilibrium which accounts for tension and the production of the new' (2013, p. 58).
15 Where it could be argued, as Stiegler does, that the becoming uninhabitable of the Earth primarily points to the bankruptcy of psychical and social-collective (dis)individuation since the 'physical individuation' of ecological collapse is rooted in unfettered consumerism (cf. Stiegler et al. 2021).
16 In 'The Limits of Human Progress', Simondon touches on this problem but is mostly concerned with the 'saturation' of potentials, rather than corruption (cf. 2010).

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