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Dialectics, Technoscience and Non-linearity: The Relevance of Hegelian Dialectics for Philosophy of Technology Now

Natalia Juchniewicz, Hub Zwart

Abstract:
Our article aims to analyse the significance of dialectics for philosophical reflection on technology. Drawing on the philosophy of Hegel, this article first of all reconstructs the progressive artefactualisation of thought and action, by indicating the transition from labour through tool use to the emergence of intelligent machines in the field of practice, secondly, by indicating the importance of dialectical thinking for the media theory, and thirdly, by pointing out that dialectics delivers both a conceptual and a practical understanding of the possibilities of emergence for cognitive technologies we encounter today (AI and the noosphere). Dialectics captures these dynamics in a non-linear manner, offering a conceptual grounding for addressing developments that are both universal and concrete, offering Hegelian dialectics as a dynamical method of thinking about technological progress without falling into schematism and simplifications.

Keywords: dialectics, technoscience, Hegel, media studies, mediation, artefactualisation, non-linearity

Although dialectical thinking is a core dimension of the history of philosophy and the history of ideas, it is hardly involved in philosophical analysis of technologies that are currently developing (such as artificial intelligence). Dialectics suggests an ongoing progression of thought towards more comprehensive levels of understanding, albeit via pathways of conflict and contradiction, discerning a dialectical interaction between technology and thinking between hands-on intervention and hands-off reflection. In response to critics who have argued that it entails an oppressive approach to human-technology relationships,[1] we aim to restore dialectics as a practical and non-linear manner of engaging with technology. With the help of Hegel's philosophy we will demonstrate that dialectics allows us to grasp the transition from *the material* to *the artificial* by understanding this transition as a progression of spirit towards ever broadening scopes of thought and action. At the same time, as we will show, the fact that this process is dialectical does not presuppose that it is linear or predetermined in its movement. Dialectics is at work both in technological practice and thinking as such, and in our philosophical reflections on

1 Peter-Paul Verbeek, *Moralizing Technology* (Chicago: University of Chicago Press, 2011), 155.

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these developments. The non-linear logic of dialectics furthers our understanding, not only of technological practice, e.g. the production of artifacts and technical knowledge, but also allows us to come to terms with the emergence of new, digital technologies whose inner logic is based on recursivity.[2]

To flesh out how dialectics envisions technological progress, in the first paragraph of the article, we will demonstrate how dialectics engenders technoscientific thinking by subjecting thinking itself to a process of self-criticism and negation. The motor of dialectics as a conceptual process precisely resides in negativity,[3] without which it is impossible to move from accepted or mainstream knowledge towards emerging, affirmative[4] forms of knowledge that are mediated, for instance, by artefacts. Thinking does not take place in a vacuum but is entangled with practice. Therefore, we will demonstrate how, in Hegel's approach, there is a transition from mechanical contrivances to the formation of organic and intelligent structures. In other words, we will show how Hegel discerns an unfolding from the mechanical to the chemical and the biological in technoscientific praxis. For Hegel, this practice is associated with the concept of labour, as labour requires and produces knowledge (know-how),[5] so that history becomes a process of collective self-edification through the transformation of nature.[6] The approach we propose is in line with the idea of Hegel's philosophy as emergentism.[7] Although Hegel's philosophy, as we understand it, assumes that the goal of all progress is the realisation of the idea of self-understanding, it does not pre-determine the directions and ways in which this goal will be realised, which is why we can speak of the non-linearity of dialectics and emergence.
In the second part of the article, we will explore the relationship between Hegel's understanding of dialectics and the development of media theory and mediation. Given that dialectics unfolds via negation towards the negation of the negation, we will examine what it means for media to act as a "negative" intermediary between humans and the external world.[8] According to Hegel, true knowledge is not immediate and therefore the

2 Yuk Hui, *Recursivity and Contingency* (London: Rowman & Littlefield, 2019).

3 See the distinction of the moments of the logical into the abstract, the dialectical, and the speculative in Georg W.F. Hegel, *Enzyklopädie der philosophischen Wissenschaften I: Die Wissenschaft der Logik*, *Werke 8* (Frankfurt: Suhrkamp, 1986a [1830]), §79.

4 Hegel, *Enzyklopädie der philosophischen Wissenschaften I: Die Wissenschaft der Logik*, §82.

5 See Mark Coeckelbergh, "The Tragedy of the Master: Automation, Vulnerability, and Distance," *Ethics and Information Technology* 17, no. 3 (2015). See also: Matteo Pasquinelli, *The Eye of the Master: A Social History of Artificial Intelligence* (London, New York: Verso, 2023).

6 Jeffrey Ocay, "Hegel Reframed: Marcuse on the Dialectic of Social Transformation," *Philosophia: International Journal of Philosophy* 16, no. 1 (2015): 105.

7 See Kenneth R. Westphal, "Philosophizing about Nature: Hegel's Philosophical Project," in *The Cambridge Companion to Hegel and Nineteenth-Century Philosophy*, ed. Frederick Beiser (Cambridge: Cambridge University Press, 2008).

8 Dieter Mersch, "Tertium Datur. Introduction to a Negative Media Theory," *Matrizes* 7, no. 1 (2013).

dialectical process presupposes a medium as a middle term. The fact that media not only broadens our range of visibility, but also creates distance, thereby challenging us to develop new relationships with nature, necessitates addressing the issue of the *artefactualisation of human action and thought*. We will investigate this process by focusing on the concept of the *noosphere* as an emerging form of global consciousness resulting from technoscientific transformations.[9] Additionally, we will demonstrate how the institutionalization of thinking itself into socially shared forms leads to the emergence of the so-called "second nature"[10]—a sphere of reference for subjects with respect to themselves and others which is technologically saturated.

After presenting Hegel's theory of technological development and explaining its significance for media theory and the meaning of second nature, in the third part of the article, we will focus on presenting *dialectics as a non-linear process*, for two reasons. Firstly, dialectics is not only a way of thinking but also a way of acting. It requires practice, and this practice is not always consistent in its choices, especially in the context of technoscience. In other words, science does not develop linearly because it develops through detours and collisions, and through both quantitative and qualitative change. Secondly, the dialectical schema itself does not in any sense assume that progress is linear. At best, it is a spiralling process resulting in Hegel's anticipation concerning "the return of the spirit to itself" on a higher level of self-awareness. This also implies that we see Hegel's philosophy not as one historical formation among others, but as *a program of thinking* which allows us to come to terms with societal and ideological transitions of the present, and which is therefore presented here in interaction with current technological developments and in dialogue with prominent contemporary perspectives that are moving in the same direction. Referring to the views of Reza Negarestani and Yuk Hui, we will argue that it is precisely this non-linear logic of dialectics as a return (recursivity) that allows us to conceptualize contemporary technologies as learning machines. We will demonstrate, therefore, how Hegel's dialectics allows us to envision the transition from understanding technoscience as the study of that what is material to conceiving technoscience as the ability to create what is artificial, algorithmic, and digital. A non-linear dialectical approach allows us to simultaneously perceive development and change, but also the preservation and incorporation of forms of action and thought characteristic of earlier stages. Hegelian dialectics shows us how the development of the human spirit and its knowledge of itself and the external world develops, but it also serves as a thinking model for artificial learning machines. The fact that Hegel's theory allows us to draw such far-reaching conclusions about the relationship between the spirit and the machine, constitutes a significant contribution to the research in technoscience, media theory, artificial intelligence, and

9 Pierre Teilhard de Chardin, *The Human Phenomenon* trans. Sarah. Appleton-Weber. (Brighton, Portland: Sussex Academic Press, 2015 [1955]).

10 See Georg W. Bertram, "Two Conceptions of Second Nature," *Open Philosophy* 3, (2020).

the challenges posed to philosophical reflection by technological development. Finally, in the conclusion, we bring together the key arguments of our paper.

1.

Although Hegel is not generally considered a philosopher of technology, and explicit discussions of technology in his work are relatively sparse, when we follow the inherent logic of his thinking, a dialectic of technology undeniably announces itself.[11] In this section, we will present the contours of a Hegelian philosophy of technology in outline.
The starting point of dialectical thinking and practice is an initial situation of relative equilibrium (first moment) which is challenged and disrupted by negativity (second moment), coming from the outside (otherness) but at the same time revealing inner contradictions and biases at work in these initial convictions. These challenges must be superseded by reconciling and incorporating the opposing tendencies into a more comprehensive understanding (the negation of the negation, third moment). Therefore, Hegel sees dialectics as praxis: the self-actualisation of thinking,[12] and thinking as a process of self-negating.[13] Dialectics posits that, at the beginning of thinking, there is an abstract assumption about reality (M_1) which must be negated and contradicted (M_2) leading to a moment of *Aufhebung*—sublation or incorporation—which is a negation of the negation (M_3). In other words, Hegel's assumption is that thinking is negating because, in the face of a given conceptual way of apprehending reality, which can be described as positive, it formulates an opposition and then seeks to overcome this critical opposition in the negation of the negation.[14] Sublation means superseding the contradiction, negating the previous, tumultuous, and contested moment of development while preserving and enhancing it into a new form. It is not a synthesis, because rather than adding two elements together (which in the case of contradiction between two previous moments of development would be nonsensical), it means understanding the opposites as inevitable dimensions of one and the same process. Dialectics is a method of exposition in which our most fundamental concepts are shown to be self-contradictory, resulting in a striving to supersede these contradictions.[15]

11 See Hub Zwart, *Continental Philosophy of Technoscience* (Cham: Springer, 2022).

12 Zwart, 36. See also Emil Oestereicher, "Praxis: The Dialectical Sources of Knowledge," *Dialectical Anthropology* 1, no. 3 (1976).

13 Robert B. Pippin, *Hegel's Realm of Shadows: Logic as Metaphysics in The Science of Logic* (Chicago, London: The University of Chicago Press 2019), 141.

14 About the "triplicity" in Hegelian thought see Pippin, 147.

15 Michael Forster, "Hegel's Dialectical Method," in *The Cambridge Companion to Hegel*, ed. Frederick C. Beiser (Cambridge: Cambridge University Press 1993), 132.

Hegel's dialectical schema is based on the logic of syllogism, where a *general* understanding passes through *particular* dimensions of thinking to finally realise itself in a *concrete* result.[16] This syllogism allows us to understand why Hegel's theory, especially thinking via the "middle term," is so significant for contemporary reflections on technology and also, as we will demonstrate, for media theory. The dialectical syllogism has a teleological character, thus establishing a principle for both thinking and goal-oriented action, while challenging the existing state of knowledge. Furthermore, the middle term serves as an intermediary, which has the ability to reveal and transmit the content but disappears in the conclusion of such a syllogism in the sense of becoming uplifted or incorporated. Hegel explains this clearly in his *Science of Logic*:

> Through a means the purpose unites with objectivity and in objectivity unites with itself. This means is the middle term of the syllogism. Purpose is in need of a means for its realization, because it is finite – in need of a means, that is to say, of a middle term that has at the same time the shape of an external existence indifferent towards the purpose itself and its realization.[17]

The fact that the goal requires a means for its realization indicates that in Hegel's thinking, there is an instrumental dimension in reason. However, this moment of instrumentality certainly does not exhaustingly coincide with thinking as such. Thinking and action do not merely stay within the realm of mediation. Rather, dialectically, they lead to the negation and elevation of knowledge, in close interaction with technology, being both a product and a driver of knowledge, bringing it to a higher level of performativity. This process is evident in Hegel's understanding of the role of labour, which is intimately connected with the development of tools and technoscience, and becomes increasingly recursive and performative rather than merely instrumental.

According to Hegel, technology co-evolved with human labour and although the first mode of labour is the compulsory work by the servant, Hegel stresses the mediating and transformative nature of labour, resulting in technical know-how and practical knowledge. Agricultural and horticultural labour are mechanical practices compelling plants to produce biomaterials, while the domestication of animals entailed combinations of compulsion with collaboration and trust. All these practices generated important forms of practical knowledge. The next stage is chemical labour (metallurgy, ceramics, etc.), where the middle term (the mediation) between subject and object is the tool (the hammer,

16 See Aliston Stone, "Adorno, Hegel and Dialectic," *British Journal for the History of Philosophy* 22, no. 6 (2014).

17 Georg W. F. Hegel, *The Science of Logic* (Cambridge: Cambridge University Press, 2010 [1812]), 659.

the furnace, etc.), which is itself a product (the materialisation of a concept: consciousness transformed into a thing), but also, as Hegel phrases it, the persistent "norm" of labour, because the handling of such tools requires significant skill. The attitude of artisans towards their tools is one of veneration, Hegel notices, while the servants' attitude towards their products is desire held in check.[18] Finally, the agricultural revolution also entailed the development of biological tools (e.g., fermentation). Thus, we may distinguish mechanical, chemical, and biological tools (e.g., ploughs, fertilisers, and yeast respectively).[19] This also reflects the structure of Hegel's *Logic*,[20] moving from mechanism (from §195 onwards) via chemism (from §200 onwards) to life (from §216 onwards),[21] explaining not only *why* this development is logical (e.g. how the mechanism of indifferent parts gives way to the more intimate interaction between chemical components, and how the *finite* chemical process gives way to life as an *infinite* unfolding), but also *how* previous forms are incorporated into the next (e.g. how life incorporates mechanical structures and chemical processes on a higher level of complexity and functionality).

As indicated above, for Hegel, work does not merely involve the processing of nature to achieve specific goals but also allows for and requires the development of practical knowledge or "know-how." Therefore, according to Hegel, while engaging in work, labouring subjects also advance their practical understanding of nature, enabling the creation of technological artefacts such as (increasingly advanced) machines. Human labour has the tendency to start from primary, mechanical forms of labour. The more abstract human labour becomes, the more humans are in a position to withdraw themselves from labour and to substitute their own interactivity with external nature.[22] Humans will increasingly need more power, more mechanical motion, and this they find in external nature in the form of natural energy sources (wind, water, fossilised matter, etc.). In other words, pure motion requires and gives rise to an abstract and mediated relationship with nature (e.g., humans harvesting pure, abstract energy) via the abstract external activity of the machine.[23] This also explains the why and how of the replacement of human beings by

18 Georg W. F. Hegel, *Phenomenology of Spirit*, trans. A. V. Miller (Oxford: Oxford University Press, 1977 [1807]), 118.

19 Zwart, 61.

20 Hegel, *Enzyklopädie der philosophischen Wissenschaften I: Die Wissenschaft der Logik*, *Werke 8*.

21 These references refer to the so-called *Lesser Logic*, but a similar structure can be discerned in the so-called *Greater Logic*. Here again we notice the same logic of the unfolding of the concept (*Begriff*) from mechanism (§409), via chemism (§428) up to life (§469). And here again, Hegel emphasises how the chemical process initially entails negativity (dissolving and destroying the chemical object) but becomes incorporated in life as a productive process, although after death, the chemical process will resume its destructive work of negativity.

22 Georg W. F. Hegel, *Hegel and the Human Spirit: A Translation of the Jena Lectures on the Philosophy of Spirit (1805 – 1806*, trans. Leo Rauch (Detroit: Wayne State University Press, 1983 [1805-6]), 121.

23 Hegel, *Hegel and the Human Spirit*, 121. See also Pasquinelli, 5.

machinery. Labour, as a mechanical activity, builds on the resources of nature. As soon as these resources are grasped, it is possible to conceive and subsequently build the machine. The machine changes human bodily power into the mechanical power of the external artefact. The work becomes more abstract and, as a result, easier, so that production can increase due to its uniformity, i.e., a shift of focus from quality to quantity. At the same time, the capacity of the worker is reduced to one particular skill, which implies an unconditional dependence on the social context (the presence of a demand for this skill). Skill becomes mechanical and acquires the ability to let machines take the place of human labour. Hegel focuses here on the fact that new forms of labour create also a new societal context which is much more collective and where individual activities become a part of social production which can eventually be automated.[24] Although initially the mere quantity of mechanical production constitutes a negation of the quality associated with craftwork, eventually these massively produced artefacts will assume new qualities which supersede those that can be realised through manual labour (thereby negating the negation). The dialectics of labour might be understood as a transformation from bodily work through tools to machines. This allows societies to outsource the work of workers to machines, but also makes them dependent on those machines and the system which supports them.

Thus, dialectics discerns a syllogistic dynamic in technoscientific practice. Technoscience evolves from *general* conjectures (theory) via *particular* experimental insights (gained during the process of transformative labour) down to *concrete* products and outcomes resulting from this. Dialectics sees technoscience as a particular way of disclosing and mediating nature (rather than treating nature as immediately accessible to human experience and knowledge). It is a critical exposition of technoscientific research practices as they appear on the scene—the path or journey of technoscientific consciousness, passing through a series of configurations or stations of knowledge towards more comprehensive forms of understanding.[25]

In line with Hegel's logic outlined above, three modes of machines emerge in the course of the history of knowledge and the development of technology. Firstly, mechanical machines (clockworks, weighing scales, etc.) which function in a quantitative manner (dissecting and measuring the world, parcelling out products as quantities). Secondly, the chemical machine (electrolysis machinery for instance), where quality and proportion become increasingly important. Thirdly, biological machines where the organism's inherent goal-oriented (teleological) behaviour is exploited for productivity. While these three waves of machines exploit natural resources, we currently witness the emergence of intelligent

24 Georg W. F. Hegel, *Enzyklopädie der philosophischen Wissenschaften III: Die Philosophie des Geistes, Werke 10* (Berlin: Suhrkamp, 1986b [1830]), §526.

25 Zwart, 7.

machines or thinking machines, e.g., advanced computers and artificial intelligence (forms of thinking which bypass consciousness), especially developed for technoscientific research. In other words, we notice a gradual displacement from labouring bodies via mechanical machines to sophisticated technoscientific hybrids. Whereas humans used their intelligence to exploit natural resources, now human intelligence is becoming extended or saturated by technology. In technoscientific research we see the *Geist* at work, sublating the subject-object divide through practical and intellectual activities[26] in the context of an institutionalised practice. In the next paragraph, we will examine how dialectics impacts our understanding of technology, not only in terms of tools, but also as a cognitive-practical medium in the relationship between humans and nature, as well as with other people.

2.

The dialectical transition from what is physical and mechanical to what is intellectual and noetic constitutes the broadest framework of changes in the field of technology, which becomes logically intelligible in the light of Hegel's theory, as we have seen. Importantly, technology plays the role of an intermediary between the labouring subject and the external world, thus emerging as a medium. As mentioned above, the syllogistic logic of Hegel's dialectics posits technology initially as the middle term, a necessary intermediate element of teleological actions but not their essence. Initially, the goal transcends the means used to accomplish the action. Yet, at the same time these means are more enduring than the action itself. Therefore, rather than occasionally fostering human action, these means increasingly will tend to *structure* the human-nature interaction and eventually, the means will increasingly determine the *goals* to be achieved (e.g., mastery of nature via machines as the ultimate goal of the interaction).

This way of thinking, involving technology as a "third" interactive element between the subject and the world, restructuring both the subject and the object-pole of the process, is at the core of the study of media and understanding their role in shaping human thinking and action. As Mersch argues, the interest of dialectical philosophy in media stems from the proximity to expressions such as *mediation* or *Vermitteltheit* (*mediatedness*), "which also play a prominent role in Hegelian dialectics and can be read as the basic function of the 'medial'."[27] All these terms—the "medium" as well as "mediation" and the "medial"—belong together. They do not constitute a subdomain of reflection, but rather turn out

26 See Natalia Juchniewicz, "Dialectical Technology: Hegel on Means, Tools and the Machine," *Filozofia* 73, no. 10 (2018).

27 Dieter Mersch, "Meta / Dia: Zwei unterschiedliche Zugänge zum Medialen," *ZMK Zeitschrift für Medien- und Kulturforschung: Medienphilosophie* 1, no. 2 (2010): 1.

to be fundamental for the entire tradition of Western thought. What remains unclear, however, Mersch argues, is whether there is a certain structure—the "medial" or its "mediality"—that conveys processes of *mediation* (or *mediatedness*).

Mersch argues that it is impossible to offer a "positive" definition of media because the essence of that what mediates between the subject and the world is based on "assisting," "conveying meaning," or simply "being transparent" (being a *diaphanes* in the Greek sense of this concept).[28] The medium is meant to bring nature closer to us but at the same time introduces distance (separation, negativity) between subject and object. The medium thereby intensifies the very distance which the medium purports to overcome. Therefore, the dialectical schema of transitioning from what is positive (e.g., embeddedness of humans in nature) through what is negative (separation, via the intrusion of technology as a third term) to the negation of negation (superseding this separation, this divide, with the help of technology), is about discovering both the "negative" and the "positive" role of media as something which provides the subject with an outcome (a world) that has attained entirely new meanings. At the same time, the media that bring this productivity about, are themselves consumed in the course of the process. Hegel himself literally writes about this negativity of media:

> A house, a clock, may appear as purposes with respect to the instruments employed in their production; but the stones, the crossbeams, or the wheels, the axles, and the rest that make up the actuality of the purpose, fulfil this purpose only through the pressure which they suffer, through the chemical processes to which they are exposed, with air, light, and water, and from which they shield the human being; through their friction, and so on. They fulfil their vocation, therefore, only through their being used up and worn out, and only by virtue of their negation do they correspond to what they are supposed to be.[29]

This Hegelian understanding of technology as a means for action, disappearing in its fulfilment but significantly affecting the final result of the action, resonates with the post-phenomenological understanding of technological mediation as "doing something" with the meaning of the world for a human being.[30] The dialectical syllogism realises itself in a *concrete* outcome or product, as we have seen, a *concrete* technological contrivance for instance. At the same time, much more than post-phenomenology, we would argue,

28 See Dieter Mersch, *Medientheorien zur Einführung* (Hamburg: Junius, 2006).

29 Hegel, *The Science of Logic*, 666.

30 Don Ihde, *Technics and Praxis* (Dordrecht, Boston, London: D. Reidel Publishing Company, 1979), 18.

Hegelian dialectics emphases how this *concrete* result recursively affects the general system: human collective societal existence as a whole. Dialectically speaking, such concrete outcomes, in the form of a tangible machine may become what Hegel refers to as a *concrete universal*, eventually redefining the whole spirit of an era (e.g., redefining the collective world as the era of the windmill, the automobile, the computer, etc.). Thus, Hegelian dialectics reveals a fascinating paradox, already touched upon above. On the one hand, technologies are temporary means to achieve a goal. At a certain point, human subjects will have consumed, and will do away with, their car, their computers, their iPhone: the action has been achieved, and the means (the medium) has been consumed in the course of the action. At the same time, these so-called means outlive and have redefined human action. From now on, human subjects remain highly dependent on these "means" of "mediums" precisely because they have redefined collective human action.
Hegel's dialectical philosophy of technology suggests that, while technology transforms into increasingly abstract forms (from the body to the mechanical machine to the intelligent machine; from compulsory labour to abstract labour to technoscientific labour), it is also evident that the principle of intermediation—inserting transformative media between the subject and the world—generates the problem of redefining the relationship to nature as that what surrounds humans and grounds their embedded world. Initially, possessing technology seems to imply having the means to control and subjugate nature to human purposes. Following this approach, Hegel himself makes statements about using tools and machines as having "technics" or employing *techne*. Yet, Hegel is well aware of the negativity of technology, consuming its own resources. In his social and political writings, moreover, Hegel fleshes out how in modernity, the subject is no longer confronted with "pure," "naked," "raw," nature but rather with processed, domesticated nature, partly incorporated in the social:

> Within social needs, as a combination of immediate or natural needs and the spiritual needs of *representational thought* [*Vorstelltung*], the spiritual needs, as the universal, predominate. This social moment accordingly contains the aspect of *liberation*, because the strict natural necessity of need is concealed and man's relation is to *his own opinion*, which is universal, and to a necessity imposed by himself alone, instead of simply to an external necessity, to inner contingency, and to *arbitrariness*.[31]

As Kislev phrases it: nature, which is Hegel's name for the immediacy of the world, is

31 Georg W.F. Hegel, *Elements of the Philosophy of Right*, trans. H.B. Nisbet (Cambridge: Cambridge University Press, 1991 [1821]), §194.

continuously being overcome, or humanized, or spiritualized. "Therefore, we can say: step by step, the world becomes increasingly artificial."[32] The transition mentioned in the first paragraph of this article, from what is mechanical-chemical to what is biological-noetic, is precisely related to the emergence of this new relation between the human subject and nature.

This process is well described by another dialectical thinker, Teilhard de Chardin. Teilhard argues that dialectics confronts us with a spiralling view on history, starting (as a first moment) with human awareness of mechanical processes, which were then put to use, followed by the self-conscious use of chemical and biological processes, eventually giving rise to a plethora of new life forms (first in the context of artisanal agriculture but now via technoscience and intelligent machines). The moment the human being understood these mechanisms and began to self-consciously manage these processes, resulted in disruptive interventions, eventually affecting the condition of the planet in a *negative* manner, but also in the necessity of taking responsibility for the future course of evolution. The sublation of the above tension (the necessity to *negate the negativity* of human technological activity) is, according to Teilhard, related to the transcendence of boundaries between the "natural" and the "artificial," announcing synthetisation or the "synthetic" in the sense of *bringing together again*, the literal meaning of the Greek verb *sullogizesthai*[33] i.e., the dialectical turn from understanding life by dissecting it (negation) towards understanding life through reconstruction, bringing a plethora of partial insights together again (the negation of the negation), resulting in artificial life or hybrid life forms (living machines), where the non-living is incorporated in the living.

Teilhard describes the emergence of spiritual mediums (language) and cognitive tools which ultimately provide the basis for hyperintelligence or distributed reflection on a planetary scale. Consciousness is seen as an integral dimension of being: from primal cellular consciousness via human self-consciousness (i.e. the co-evolution of consciousness, tool-use, and language) up to the emergence of a global noosphere (the global web of technology, intelligence, and information, resulting in hyper-consciousness).[34] This description of the unfolding of consciousness from immediate awareness up to hyperintelligence, we argue, can be understood as a description of the journey of the Hegelian spirit, from the perspective of advanced technoscience. This "hyper" aspect of these new forms of intelligence is especially intermingled with the collective / systemic / distributed (and therefore enhanced) nature of noetic activities such as extended thinking, calculating, communicating and deliberating, as well as with noetic products such as electronic devices,

32 Shachar F. Kislev, "Six Hegelian Theses about Technology," *Techné: Research in Philosophy and Technology* 24, no. 3 (2020): 17.

33 Zwart, 210.

34 Zwart, 209.

computer networks, and global social networks. Distributed intelligence as suggested by Teilhard is a technological materialisation of Hegel's objective spirit, conceived as an extended, externalised and institutionalised structure on which individual thinking and creativity to large degree depend.[35]

The "institutionalized structure of the spirit" is also an expression of the fact that the subject is not primarily related to nature in the sense of an external ambiance but more and more to what is often referred to as a "second nature," which is the sphere of social relationships and institutions and their multiple practices and habits of disciplining individuals into their actions and thinking.[36] Bertram defines second nature as: "constituted by indeterminate cognitive activities within a specific historical tradition," functioning as the framework for cognitive activities in general. In this sense, human beings grow up in the midst of second nature: nothing they do can be accomplished independently of it.[37] Objectivity primarily refers to the field of objects, encountered by the spirit in the process of interaction and cognition. It has, however, also the second meaning; something is objective because it is shared with others in a way which makes intersubjectivity possible. This double understanding of objectivity in close connection with the double understanding of nature allows for a distinction between at least two meanings of the concept of media. Firstly, media are literally means inserted between humans and nature, forming the basis for the technosciences as a development of both thinking and practice. However, media also pertain to what exists between people, within the "artificial" nature created by humanity's cultural activities. The media that fall under the second meaning include language, writing, and law but also currently mass media and social media, which form the basis for building (as well as disrupting) intersubjective relationships.

The fact that by technologically processing the second nature we are actually processing social relations raises the question of the direction in which technology and technoscience will further develop. If we are convinced that this development inherently follows a dialectical path, this requires us to think dialectically about the emergence of new technological forms of action and thinking and the challenges for norms and values (*Sittlichkeit*) they impose.[38] We will address these issues in the third part of our article.

35 Zwart, 188.

36 See David Forman, "Second Nature and Spirit: Hegel on the Role of Habit in the Appearance of Perceptual Consciousness," *The Southern Journal of Philosophy* 48, no. 4 (2010).

37 Bertram, 68.

38 Bertram, 76.

3.

The fact that through "artefactualisation," which involves building intermediaries, i.e. introducing a "third element" between humans and nature, subjects become self-aware and extrapolate their own self onto nature,[39] allows us to posit that artificiality is the horizon of current historical developments. Negarestani emphasizes that self-consciousness is a project of the spirit and of the self, the effect of processual changes. It is the effect of inner transformations resulting in novel forms of intelligence. Artificiality, in this context, means not only the production of artificial things as extrapolations of the spirit, but also the production of novel forms of thinking, of cognitive skills and new forms of conceiving, of "bringing into conception."[40] The transition from reflecting on external objects (e.g., Cartesian epistemology) as expressions of the spirit towards these newer cognitive functions, entails an ascent towards more comprehensive levels of thinking: a decisive shift from science as studying the external world to technoscience as constructing new forms of thinking and action, such as artificial intelligence. Importantly, as Negarestani points out, the Hegelian model of thinking is inherently intersubjective because it is based on language and building relationships with others. Its frame of reference is not the *abstract* autonomous ego but *concrete* thinking and reflecting networks or communities. Therefore, the model of artificial intelligence that can be developed within the framework of this theory is also entangled with language, understood not only as a medium but as a "semantic space within which computation and logic converge"[41]

While interpreting Hegelian *Phenomenology of Spirit*, Negarestani states:

> Through the logic of self-relations as the form of self-consciousness, mind attains the ability to treat itself as an artefact of its own concept. It artificializes itself, conceiving itself from the viewpoint of an unrestricted world that belongs to no particular where or when. In other words, through self-relations as the formal condition of self-consciousness, mind is now able to investigate the conditions required for its realization, to adapt to ends and purposes that are not given in advance, and to explore the possibility of its realization in types of structures other than those that naturally constitute it. The history of this kind of self – the minding self – is, then,

39 Reza Negarestani, *Intelligence and Spirit* (Falmouth, New York: Urbanomic, Sequence, 2018), 25–26.

40 Negarestani, 47.

41 Negarestani, 19.

> strictly speaking a project of artificialization in the above sense.[42]

Dialectical thinking, we argue, not only provides the possibility for reconstructing the trajectories of historical development of various artifacts but also offers the opportunity to contemplate on the transformative role of these artifacts within technoscience as such. Although history has produced a bewildering multitude of concepts and artifacts, not every concept or artefact has substantial significance. Most of them only produce incremental (quantitative) change, or are quickly discarded, as they fail to live up to their expectations. The idea of substantial (qualitative) change, however, implies that some technological innovations and technology-driven actions can have a *general* and *qualitative* meaning[43] superseding the role of these technologies as mere means while rather emphasising their world-changing repercussions. Hegel's interpretation of human nature emphasises our fundamental openness to change and becoming, but the important point here is the discontinuous nature of qualitative change, engendered by technology and resulting in the establishment of new behavioural patterns, norms, and values. Yet, a key element of Hegelian thinking is the awareness that continuity in a linear sense (quantitative growth) nonetheless entails the possibility of disruption, of digression from a linear pattern. Instead of seeing technologies as the means that are consumed when the end result is reached (as outlined above), the ends themselves become redefined due to the transformative power of the means, resulting in qualitative change of society as a whole. The non-linear approach to progress emphasizes that technological developments entail positive and negative elements in historical change both on the objective and the subjective level of human development. Here, dialectics discerns a process of transgressing previous social forms, but not necessarily in the sense that we are trapped in this movement of negation. Rather, pushed to the extreme, negativity is bound to unleash a negation of the negation, working towards *Aufhebung*, incorporating the (initially disruptive) novelty into the inherent dynamics of social existence. As also suggested by Negarestani, the consolidation and adoption of specific elements of change are part of the social and historical process.

This approach, understanding dialectics as a process of qualitative and nonlinear change, resonates with the research of Yuk Hui, who examines the emergence of cybernetics by studying the relationship between subject and object (humans and nature) in the tradition of German idealism, which eventually engendered the conditions for creating computing machines. In other words, his research is not a philosophy *of* technology, but rather an explication of philosophy *itself* as a practice of reflection which is inherently connected

42 Negarestani, 25–26.

43 Kislev, 5.

with technology. His key concepts (recursivity and contingency) are both responsible (in their interaction) for the dialectical progress of technological systems:

> It is in the systematic thinking to Fichte, Schelling, and Hegel that we find elaborations of the recursion form. The *ich* is the point of departure in which every confrontation with the *nicht-ich*, which Fichte calls a check (*Anstoße*), forces the *ich* to return to itself, and it is revealed as such. The movement between the *ich* and the *nicht-ich* is the fundamental principle (*Grundsatz*) of the philosophical system.[44]

Dialectics is not a mere repetition of purely *recursive* patterns, but continuously challenged by contingency. Therefore, it is a self-reflective logic, at work not only in history, but also in nature:

> In Schelling's early philosophy of nature, contingency is the expression of freedom and nature. In Hegel's philosophy of nature, contingency is a test for the auto-determination of the Notion. (…) Here the progress of the spirit is also the progress toward the death of nature. In this sense, Hegel is probably a step closer to cybernetics, or *mechanical organicism*. In early twentieth century, recursivity is formalized and systematized in cybernetics and other, parallel developments: for example, computation theory (Gödel-Turing-Church) and automata (John von Neumann). Then it arrives at artificial intelligence (AI), machine learning, and more complex forms of automation. Alternatively, paraphrasing Hegel, maybe one can say that this machinic organicism characterizes the new form of the absolute spirit of our epoch.[45]

In other words, rather than seeing dialectics as a reflection on cybernetics from an external philosophical perspective, Hui explores the basic affinity (up to the point of identity) between dialectics and cybernetics. This means that dialectics allows us to explore cybernetics and its logic *from within*. This echoes a basic Hegelian conviction, namely that we can understand technology and technological change because technology is inherently *rational*, albeit in the *dialectical* sense of the term, so that a dialectical philosophy of

44 Hui, §2. See also John W. Burbridge, "The Necessity of Contingency: An Analysis of Hegel's Chapter on 'Actuality' in the *Science of Logic*," *in Art and Logic in Hegel's Philosophy*, ed. Warren E. Steinkraus and Kenneth I. Schmitz (Atlantic Highlands, N.J.: Humanities Press, 1980).

45 Hui, §19.

technology not only allows us to fathom the dialectical dynamics of philosophical change, but also fosters the self-understanding of thinking as such. In other words, starting from the *status quo* at a given point in time (the first moment), technology is an externalisation of the spirit (second moment) which eventually allows the spirit to return to itself (third moment). Hui refers to this third moment (this reconciliation of philosophy and technology on a cosmological level) as cosmotechnics or "third nature."

Hui points out that dialectics, as an expression of both the relationship of the subject to nature, which is absorbed in the cognitive process of the spirit, and as a principle of internal transformations of the spirit itself, should be understood non-linearly.

> "Hegel understands this well, since first of all dialectics is a non-linear movement, and in order to advance toward the Absolute, contingency is necessary to affirm freedom and to avoid becoming merely formal (formal in contrast to content [Inhalt]). Contingency stands out as a concept fundamental to rationality and creativity (…). Contingency will not yield a system unless this contingency becomes necessary (…)".[46]

The dialectical understanding proposed by Hui is based on the concepts of recursivity and contingency, involving an incorporation of earlier moments in the process of *Aufhebung*,[47] with contingency as a necessary element of development. Hui clearly emphasizes that Hegel's dialectical model is not deterministic in the sense of having a straightforward path of development predetermined from the start because, in that case, his theory could not apply to the actual exercise of any free action of the spirit. However, it is a process that occurs within the spirit itself. Therefore, Hegel speaks of the "Spirit's algorithm," an algorithm that, as Negarestani points out, is its own developmental outcome. In this sense, the concept of the spirit in Hegelian theory may indeed serve as an inspiration for the idea of machine learning or, speaking in Hui's terms, recursive forms of algorithms.

Conclusion

The aim of this article was to indicate why the logic of dialectics is essential for contemporary philosophy of technology and to demonstrate how dialectical transformations of technology are grounded in the dialectical movement of becoming, as captured by Hegel's philosophy. Also, we emphasised that Hegel's dialectics is not primarily a historical

46 Hui, §3.

47 Hui, §16.

formation (reflecting early nineteenth-century technological developments, and therefore a topic of historical research), but rather allows us to understand the internal logic of current technological developments. Above all, we wanted to emphasize that dialectics, although it constitutes a conceptual understanding of transformations in the realm of logic, ontology, and epistemology, is not merely theoretical but first and foremost practical. Moreover, we see emergentism as a key element of both Hegel's own theory and technological development.

Dialectics is not an anachronistic constellation of thoughts about outdated forms of theory and practice, but a vibrant research program allowing us to come to terms with technological and societal developments that are currently unfolding, in close interaction with each other, offering an elaborate reflection on technological artifacts and their processual changes. This exposure to contemporary transitions invigorates dialectics itself, so that Hegel's thinking is liberated from the constricted perspective of historical author studies and turned into a critical diagnostic of the present. Thus, our purpose was to point out how dialectical thinking and practice enable not only the gradual artefactualisation of action and thought itself, giving rise to noosphere and artificial intelligence, but also open up pathways for critical reflection and societal action vis-à-vis these unfolding developments.

We began our reflection with the notion of labour to demonstrate how it constitutes, for Hegel, an interactive process linking theory with practice. In Hegel's philosophy, we see a gradual development of increasingly self-directed human thinking and action, distancing itself from the immediate and natural, and becoming increasingly self-produced and artificial, which for Hegel represents the expression of nature being reshaped by culture. We also emphasise, however, that this 'liberation' from external mastery at the same time entails a technological and increasingly technology-driven restructuring of the world of labour, depriving former artisans of the autonomy that was once based on their artisanal knowledge and skills. In our article, we not only demonstrated the dialectics of labour, tool use, and material nature, but also the quantitative and qualitative development of forms of thought. Likewise, we explained how abstract and general forms of understanding give way to a focus on particular dimensions of the dialectical process, which realises itself in concrete artifacts as exemplifications of a more comprehensive dialectical unfolding.
In Hegel's view, as we subsequently demonstrated, technological progress and the advancement of human knowledge is linked to progressive artefactualisation, as can be seen through the notion of medium. We showed that media, understood in the Hegelian sense, act as a "positive" enabler, but also as a "negative" disruptor, producing both proximity and distance, in ways that are not immediately recognised, affecting the subject's relationship to the world, restructuring which the external world is perceived in a particular way. This also impacts the sphere of values and relationships built with

others on the institutional level (*Sittlichkeit*), as our so-called "second nature": the social and cultural world which serves as the proper reference point for modernity according to Hegel. In other words, although we continue to interact with external nature, even on a global scale, an even more significant cultural role in human existence is played by the nature and development of social life, which we share with others.

The insight that the ongoing artefactualisation of thought and action, expressed as the "second nature," is based on abstraction from the material and natural, leads to the necessity of posing the problem of the dialectical principle itself. Dialectics has been depicted as a schematic style of thinking, but a thorough reflection on dialectics as a process of simultaneous thinking and action, as opened up by Hegel's philosophy, reveals its non-linearity, which is especially relevant for a philosophical rethinking of technology. Referring to the arguments of Negerestani and Hui, we showed how dialectics, particularly when related to the concept of spirit (besides materiality), offers a basis for thinking about algorithmicity and artificial intelligence as consequences of the interaction between action and thought at work in technological development.

Our reconstruction of the progressive artefactualisation of thinking and practice using Hegel's philosophy is primarily a conceptual analysis, but it enables our understanding of concrete exemplifications of the processes involved. By revisiting the concept of dialectics, we attempted to uncover the principle of technical thought and action and to connect this form of reflection on technology with current challenges, such as the conceptualisation of media or artificial intelligence. In our view, a dialectical understanding of technology not only amounts to a philosophical reflection on technology as such but also entails a philosophical reflection on philosophy of technology itself. The dialectical interconnection of theory and practice in the field of technoscience, allows us to observe relationships between general concepts and concrete exemplifications that enable us to regard philosophical thinking as a theory that must reflect on its own foundations, notably in the sense that technology provides a real basis for thinking as a practice.

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