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# *«Imagi(ni)ng Technologies»*[1] On Don Ihde's Postphenomenological Account of Technoscience: What is It Really Made of?

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**Abstract.** *Don Ihde (1934-2024) has been one of the most influential philosophers of science and technology in the last five decades. Deeply influenced by Husserl, Heidegger and Merleau-Ponty, Ihde developed what he labelled postphenomenology, i.e., a doctrine offering a phenomenological account of the ever-increasing impact of technology on our daily lives. In his reading, technological supports such as material tools and cultural artefacts allow us to broaden the scope of our gaze and, likewise, to extend the range of our knowledge undefinedly. According to what he outlined as the empirical turn characterizing the postphenomenological agenda, Ihde argued for the «technological trajectory» leading technoscientific drive consolidating the embodied and material hermeneutic processes that corroborate and exceed the constitutive and natural «limits of human vision» (Ihde 2009, 52-56). For him, current technological capacities enable us to detect unseen phenomena, i.e., previously invisible things, when employing our bare and unaided eyes. This equally applies to visual analogies and isomorphisms, i.e., the telescopic or microscopic image rendering of very small or huge things, which are nowadays visible through special lenses, and to more sophisticated hermeneutic translations, as it is apparent in the case of radio astronomy, for instance, representing a «new way of bringing close something that is both spatially and perceptually distant» (Ihde 2009, 56). For Ihde, seeing what was invisible just a few years ago results from a cumulative and communal process spanning multiple generations of interpreters and cultures in its progressive formation and constant improvement. Moreover, it is an outcome that is always provisional, perfectible, and achievable only through technological media. However, it is not just about that. Seeing what was invisible, presents challenges we can only meet by employing these renewed hermeneutic interpretation tools. In a way, we only understand what is seeable (Heidegger 1976, 349-352). Indeed, this tele-vision is only temporally and technologically attained, and more than a synchronic rendering would be needed to justify it. As Ihde holds, only a diachronic vision can work out, and this is possible when science is «technically embodied» and becomes «technoscience» (Ihde 2016, 80). For him and his visual hermeneutics, this enhanced understanding of the world enables us to grasp multifaceted phenomena like the greenhouse effect (and to deal with them accordingly). Indeed, this singularity would be incomprehensible for a single subject or a unique generation of scientists working on its discovery. My contribution aims to pay tribute to Ihde's work just months after his passing by showing the main features of his postphenomenological empirical turn and proving their consistency (or not).*

**Keywords.** Technology, Technoscience, Hermeneutics, Diachrony, Intersubjectivity

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[1] This is a paraphrase of (Ihde 1998, 163).

## 1. Introduction. Presenting Don Ihde's *phenomenological* and *instrumental* realism

The recent passing of American philosopher Don Ihde has left behind a significant intellectual legacy that warrants special attention. Alongside Albert Borgmann, Hubert Dreyfus, Andrew Feenberg, Donna Haraway, and Langdon Winner, Ihde epitomized what Hans Achterhuis once presciently defined as the *empirical turn* in the philosophy of technology (Achterhuis 2001). This current of thought, primarily cultivated in the United States, seeks to comprehend the new and current conditions of experience upon which the contemporary subject relies. It begins with the methodological premise that individuals live immersed in an increasingly technological and industrialized environment, which forms the foundation of their current lifeworld or *Lebenswelt*. Ihde is widely recognized as one of the inventors of *postphenomenology* (see Ihde 2009) – a doctrine rooted in phenomenological tradition that underscores technology's profound and pervasive influence on everyday human existence. As observed by Verbeek, Ihde's philosophical inquiries primarily revolved around the specific «relationship between human beings and technological artefacts» that are invented and continuously advanced and the resulting «mode of world disclosure» (Verbeek 2001, 123) facilitated by these «telic» (Ihde 1979, 31) and increasingly sophisticated prosthetic extensions. However, it is evident that despite the apparent originality of his numerous works – to which this essay is dedicated – this theme was not entirely unprecedented in the classic phenomenological discourse.

The focus on technology and technological aesthetic mediation was implicitly present in Husserl's work and, more prominently, in the writings of Heidegger and Merleau-Ponty. These authors initially demonstrated how sensory knowledge utilized tools beyond the mind and body through the complex concept of *embodiment*, as exemplified in Husserl's exploration of *writing*; the proper use of the «hammer» in Heidegger's case (Ihde 1986, 88) and the famous «blind man stick» argument Merleau-Ponty speaks of in the *Phenomenology of Perception* (Merleau-Ponty 2002, 165–166).[2] I will argue here that Ihde's merit lies explicitly in taking these positions to extremes, showing even their more hidden theoretical implications. Indeed, like other phenomenologists, Ihde was not satisfied with what he labels as a traditional or «idealistic view» (Ihde 1983, 27) of the philosophy of science or related epistemology, according to which *science,* i.e., theory, would precede the suitable invention and subsequent appliance of *technology*, i.e., the actual and practical means properly granting the possibility of science's theoretic advancement and constant progression (see Rosenberger 2023, 253 ff). On the contrary, technological processes, i.e., the *embodied* and *hermeneutic* possibilities (Ihde 1979, 36) they bring forth, should be the ones to be accounted for in science's effective progression, according to Ihde, and not only their *necessary* – but, on closer inspection, reasonably *ancillary* – practical implementation. Indeed, for him, scientific foresight and *imaginative* future grasp profoundly depend on technological resources and their practical disposition, not vice versa.

Moreover, Ihde expresses himself harshly against the idea that technology and the related applied science would have *theoretically* and *historically* compromised the original purity of perception or sensible investigation at the beginning of scientific theory, which, on the other hand, according to the *empirical turn* he defends, was *already technologically informed all along* (see Heidegger 1976, 342-343; Jayanti 2019, 72). Ihde accurately recovers this understanding in specific passages of Husserl's polemic against Galileo Galilei and modern philosophy, especially in paragraph 9 of the *Crisis* (Husserl 1970, 23-59; Ihde

[2] The same argument is also present in Polanyi's (1962) and Bateson's (1973) works that I am not considering here.

1998, 48).[3] This recovery is necessary to make explicit the «instrumental realism» (see Ihde 1991) he advocates in his major works. Indeed, Ihde states that perception and essential *visualism* in science explanation was also profoundly and programmatically «technologized» (Ihde 2001, 42) as far back as the ancient Greeks at least, and the mathematization behind the «idealization» and «formalization» procedures «which eventually becomes geometry», in Husserlian terms, directly, *historically* and thus *eventually* emerged «from measuring practices» (Ihde 2009, 28), i.e., from concrete and yet already absolute *technological concerns*. Perception always profited from *measures,* i.e., from more and more exact technologies or technological means that would improve or sublimate its *de jure* natural performance to appreciate what remained only temporarily *invisible*. In Ihde's terms, this condition has always been part of perception's «eidetic or invariant features» (Ihde 1979, 22), i.e., a fundamental condition of possible experience. From this perspective, Husserlian teleology remains a central and straightforward aspect of Ihde's *technoscience*. In his view, technology reveals the true nature of things, which finally becomes visible and therefore understandable to us. According to this claim, *technology enhances rather than conceals what it shows*, unlike what Husserl argued when discussing Galileo and the curious properties of his «genius» (Husserl 1970, 52; Ihde 1983, 49). This is what Ihde's *instrumental* but avowedly *phenomenological realism* is constituted of, which I will analyze in this essay, starting from its historical roots, to show some elements of possible development or potential criticality in the following.

## 2. Position of the problem(s). What is still to be *seen*? Some technological and social concerns

Indeed, Ihde overturns Husserlian skepticism towards *mathematization* – or its prodromes, in early modern thought – and arguably reserves tremendous faith or «epistemic optimism» (Jayanti 2019, 74) in the scientific positivism that forms an inescapable backdrop to our natural-born *Lebenswelt*. However, I believe Ihde also maintains some hesitations about the very status or *deep* impact of technology itself, as I shall try to show in the following. As a cultural product, technology appears to be a human factor, constitutively incomplete and always emendable (see Heidegger 1976, 344). According to Ihde, its consolidation is mainly due to the historical contribution of the human communities – as I will claim by commenting on the *earth practitioners*' case – that, over time, justify its use and, by coming together both *synchronically* and *diachronically*, also enable its coherent development, as Ihde also elucidates when reading Husserl's *The Origin of Geometry* to support the primitive *technological* foundation of phenomenological philosophy. That said, I reckon the former *temporal* and *transcendental* character has partially remained in the shadow of phenomenological – and postphenomenological – reflection and has struggled to find full backing for this entirely *social evidence*. I also think a more conscious reading of the *Origin* may reveal a latent amphiboly in Ihde's thought. I will try to show this in the seventh paragraph of this paper. There, I will take up the interpretation that Ihde himself provides of the *Origin* to do this.

Moreover, following Ihde, I also hold that knowledge makes its way *into human groups*; that is, it is formed sociogenetically and is realized by the appropriate – technological – tools that gradually inform their efforts. However, as I will attempt to clarify in the following, Ihde does not peremptorily explain whether «technologies are conditions for or occasions of advance in idealization» (Ihde 1991, 46), leaving the question of the ultimate

[3] Despite Heidegger's importance in Ihde's reflection, I choose to dwell only partially on his contribution, particularly in the fifth and sixth paragraphs, due to argumentative choices.

origin of *geometry* unanswered (i.e., whether its offspring is *social* or rather *technological*, or both, and in which sense). A few questions will emerge, given these considerations. Indeed, according to Ihde,

i) is technology a pure transcendental condition or an empirical occasion that justifies the *institution,* in Merleau-Ponty's terms, of a given knowledge at a given time in human history?

Or, if the material and thus the technological dimension of experience only plays a «facilitation role» (Ihde 1991, 46) in this constitutive and cumulative path, as Husserl's examples illustrate,

ii) does it have the *last word* on this ongoing transformation of our *Lebenswelt* and the means we have to deal with it?

Again, if «technologies incline rather than determine» (Ihde 1990, 183), this process of becoming known of the unknown or of the seen of what *is still unseen* or *to be seen*,

iii) what solidly remains of the *hermeneutic* mediation Ihde speaks of or the phenomenological organic *opacity*?

I will, therefore, begin this paper by tracing the phenomenological matrices of Ihde's argument before outlining the more original features of his thought. I will illustrate the main qualities of the *instrumental* interpretation Ihde gave of Husserl's *Crisis,* particularly the critique he moved on Galileo's method. I will then expose the points allowing Ihde to prove the *primacy of technology* in sense-experience and why Husserl's account of Galileo's traditional claim must be reconsidered in the light of a more careful reading of his discoveries and the related history of science. The conclusion I will draw from this first part is that, in reality, Galilean *technoscience* proceeds by progressive obscurations and unveilings of meaning, as Husserl correctly claims, but the former is, however, *of equal dignity as the latter* (paragraph 4). This fact denies, in my reading – and Ihde's – the questionable purity of original sentience, which is always, and retrospectively, *technologically* biased.

## 3. Galileo untold. Against *mathematization* and towards material hermeneutics

I hold the overall intention of Ihde's works is to restore full dignity to technology as a genuine and, most importantly, *primitive* tool for knowledge. According to him, technology should no longer be understood as the handmaiden of science but as its actual *engine,* i.e., what makes science what it is (see Heidegger 1976, 345). Curiously, Husserl – one of the main phenomenologists Ihde considers – had an ambivalent opinion of technology and its findings.[4] This view emerges most clearly in *Crisis*. Accordingly, Husserl's *Crisis* represents a keystone and a necessary moment of reflection to rethink the author's previous production and the general *responsibility* of phenomenology about a more comprehensive theory of knowledge, both on a sensitive and intellectual account. In this text, Husserl calls into question the entire Western rationality, i.e., how our scientific method has attained outstanding results we can appreciate nowadays.

[4] I support this by relying on reading the text of *The Origin of Geometry*, which I will comment on in the seventh paragraph.

*Crisis* brings a rebuke and a profound critique of this specific way of doing science. However, in Husserl's opinion, why would it be so harmful if it produced such evident and beneficial results? At what cost would it have obtained, and what would have gone wrong? For Husserl, this method would be guilty of neglecting the primitive evidence of the so-called lifeworld or *Lebenswelt,* i.e., the natural or primordial source of knowledge and complete sensible trustworthiness of everything surrounding us. According to this viewpoint, this negligence progressively pushed scientists to fall back on the abstraction of mathematical models they relied on, which are the only ones capable of rendering the complexity of their breakthroughs.[5] Moreover, such forgetfulness would have produced an unbridgeable distance between the observer and the things *themselves* and a whole series of relationships that the phenomenological method aims to reconstruct on new, more solid, reliable bases.

In this text, Galileo Galilei is the forerunner of this nefarious manner and thus the main culprit for the resulting forgetfulness.[6] According to Husserl and here quoting Ihde, «in inventing the modern science», Galileo «forgets the lifeworld and its perceptual, praxical, historical, origins and distances and substitutes an idealized, abstracted world of mathematics for the foundation» (Ihde 2016, 43), i.e., for the proper justification of the former. Contrary to this pragmatical idea of forgetting, Husserl aims to retrieve the *concrete practices* giving rise to what he calls the natural «origins of geometry» (Ihde 2016, 43), i.e., the different and authentic groundwork of every successive and superior mathematical act of *measurement*, here meaning the practical and *perceptual* relation we entertain with our nearby world and the objects we may find within. For Husserl, Galileo would have provided a vague and artificial account for our everyday sense experiences because the

[5] Husserl associates this practice with *geometry.* He holds both a positive and a negative account of this discipline when he combines it with techniques. This is a feature that Ihde also noticed. According to Husserl, we are all and act like «geometricians» (Husserl 1970, 26) in scientific discovery. We all employ the same *instruments.* Here, the geometric lexicon should not only be applied to *geometricians* or so-to-say scientists. Instead, we Western people have proven to all be united in a complex «geometrical task» (Fink 1995, 177), as Husserl writes to Fink, i.e., to be committed to a «methodology» which is «universal» (Husserl 1970, 27–28) and eventually becomes all-encompassing. The geometrical task follows a teleological principle according to which what is intuited in perception goes through a process of refinement, progressive approximation to ideality and the tendency to attain pure forms. Due to the «universal inductivity» dominating the «intuitively given world» (Husserl 1970, 38-39), this method also entails an *indirect mathematization* of sensible qualities, as the case of *plena* testifies, and so a sense of alienation that is patent in modern science. Husserl holds this inductive process may only successfully lead to a knowledge of «predictions […] which can be carried to infinity» but does not attain «real evidence» (Husserl 1970, 50-52), i.e., the intuitive content that phenomenology instead aims to grasp.

[6] The figure of Galileo has often been the subject of ungenerous criticism. In *Human Condition*, Arendt blames Galileo for neglecting the «adequacy of senses» in his scientific model, making him one of the best representatives of the «Archimedean wish» (Arendt 2019, 261-262) of dominating nature. Following Arendt, the mathematization of algebra beyond the contribution of original *geometry*, here intended as the ancient practice of land surveying and division, forced the latter to abandon concrete domains of experience for ideal abstraction. This also distanced the observer from the direct object of observation, collocating the former on a «cosmic, universal standpoint» (Arendt 2019, 270) upon which everything seems unrelated to justify even the most ecologically nefarious actions. The same goes for Serres and the fact that we «have lost the world», and we did so when we have endorsed «*acosmic* philosophies», i.e., those that only respond to «[m]astery and possession» (Serres 1995, 29-32). I will not deal with these authors here. However, one of the aims of this paper section is to restore a phenomenological and, above all, postphenomenological, less unfortunate interpretation of Galileo's contribution to science.

*mathematical* models upon which his speculation is based are useless for comprehending what our *Lebenswelt* is genuinely made of.

So, in his reading of Galileo, Husserl would draw a straight line separating the «prescientific» and the «scientific or objectively constituted world» (Ihde 2016, 45) and, with that, the classical distinction between «primary and the secondary qualities» (Wiltsche 2017, 156) in object experience, finally detaching for good the domain of undisputable and valid science from the one of aesthetical and less relevant appraisal. Indeed, following Ihde's claim, this vision would also lead Husserl to the eventual devaluation of scientific enquiry *tout court*, thus *bringing him to forget*, this time, the astonishing strides made by Galileo's «contemporary science studies», including «multidimensional practices that include internal culture, embodiment in machinery», naming processes that «*only part of which is mathematical*» (Ihde 2016, 47, emphasis mine), i.e., only part of which abstractly constructed and beyond the grasp of the sensible and visual data confirmation of the *Lebenswelt* we are in. For Ihde, Husserl would have misinterpreted Galileo's thoughts and the typical or conventional «distrust of the senses that was rhetorically popular in his time» (Ihde 2016, 47), i.e., in the 16th, 17th and 18th centuries, and this was mainly because of the ever-improving technologies that scientists like Galileo could dispose of by the exact historical period Husserl is here implicitly considering (see Cahoone 1986).

Thus, Galileo would not have totally undervalued sensory experience in favor of absolute mathematical rigor – to which suitable observation can lead in technoscience – *but only criticized a particular way of seeing and interpreting things he could see differently.*

## 4. On what *Lebenswelt* really is. Revelation and concealment are two sides of the same coin

According to Ihde's reading of Galileo – and revisitation of Husserl's – the former faculty of seeing, indeed, the one primitive, natural and made possible by unaided or naked eyes, turned out to be just *unfitting* for some of the astronomical objects it tried to reach, as it became apparent when employing a prosthetic device such as a telescope for the first time, for instance, in Ihde's historical reconstruction. Indeed, some objects can be «closer than they appear» (Morton 2013, 27; 2018, 10), as Morton recently claimed too, but also much farther away and in a different shape, size or color than how we saw or imagined them from our limited and earthbound perspective. Indeed, the employment of more sophisticated means of scientific apperceptions and discoveries, such as the well-known «telescope» in Galileo's particular case, led to a dramatic «perceptual shift» (Ihde 1990, 56) of the human eye's natural possibilities. This shift, i.e., the newly acquired ability to see new things, previously invisible, or to see them in greater detail, *historically* became only possible through the employment of «new instrumentation», hence granting brand «new perceptions» (Ihde 1990, 56). Indeed, a telescope, as a technological tool and as a matter of «technoscience» or «instrumentally embodied science» (Ihde 2016, 80), lets us see what we do not see clearly and does so by constantly adding more details during the time of our observation but, also, what we do not see at all and thus «let be» (Ihde 1979, 10) particular and new objects for the appreciation of our enhanced or new-born sensibility.[7]

So, following Ihde, Galileo actually «*never leaves the lifeworld*» (Ihde 2016, 55, emphasis mine; see also 2022, 114), he is in because the employment of scientific apparatus from which he can derive his new knowledge does not represent an undue and *mathematical* – in Husserlian terms – abstraction of the scope of the lifeworld he just wanted to analyze

[7] As I will say, it is difficult to settle the question around Ihde's realism, which also suggests a correlationist position with ambiguous features.

with more clarity.[8] Conversely, only the necessary *embodiment* of the latest scientific means, i.e., the practical use of the latter made available to humanity from the very day of its first discovery and application, can «amplify and magnify ordinary capacities», enabling us to extend the scope of our gaze indefinitely and thus see and theologically accept, for instance, the telescopic details of moon's «mountains, seas, and craters» (Ihde 2016, 50, 56; see Sartenaer 2014, 33-35). So, I claim that while recognizing Husserl's point value – since Galileo does not improperly *mathematize* the lifeworld – Ihde also rejects the vision of an immaculate lifeworld where technology imposes itself and forever pollutes its vision. Indeed, the vision has never been *pure*, and the substitution of one paradigm for another, in Kuhn's terms, is not neutral, but neither is it harmful in itself (see Ihde 2022, 2). As Ihde holds, «for every revealing transformation of the world, there is a simultaneously concealing transformation of the world which is given through a technological mediation» (Ihde 1990, 49; see Heidegger 1976, 345). Furthermore, as evident in Husserl's argument regarding the Galilean scientific method and innovation, technological progress always entails «both gain and loss» (Ihde 1990, 17). Indeed, to *gain* a deeper understanding of something, to go further in vision, it is necessary to *sacrifice* some level of detail or to accept as given what was previously appreciated through the senses, as elucidated in Husserl's concept of *horizon* or phenomenological «sedimentations»[9] and the related *positive* account of technology and maintenance of knowledge he endorses, which I will delve into further in the following (see Rhéaume 2016, 47-49).

Finally, I claim that while the necessity of aesthetic mediation and the instrument's inherent potentialities and limitations remain integral to the scientific and phenomenological experience, according to Ihde's technoscience, such *mediation* can be progressively reduced or refined. In the next paragraph, I will explicitly explore this multifaceted aspect of technological mediation and Ihde's interpretation.

## 5. Introducing *knowledge gathering technologies.* On Ihde's embodied and hermeneutic relations

Indeed, Ihde contemplates the lesser or greater possible influence of technological mediation in science representation. This influence ranges from difference of degree to sheer difference of nature. He argues that by formally admitting a solid distinction between «embodied» and «hermeneutic relations» (Ihde 1979, 36) in aesthetic experience, as he seminally does in his first original work, *Technics and Praxis.* Accordingly, embodied relations are those in which the instrument, i.e., the external tool, is *physically* and directly implemented in the subject's body and becomes, to all intents and purposes, the organ through which the subject appreciates the surrounding world. Glasses, or contact lenses, pertain to this realm, for instance. Indeed, the embodied relations, considered this way, are closer to the ones that classical phenomenology had already contemplated. In this sense, Heidegger's hammer remains firmly attached and adherent to the hands of the subject who uses it, and so does the stick the blind man employs in the example of Merleau-Ponty. Here, the latter genuinely becomes an additional but completely annexed part of his body when

[8] «[T]echnoscience was never separated definitely from the lifeworld» (Ihde 1998, 153), which always remains the common ground in which every discovery rests, settles, or is progressively culturally reabsorbed, granting the new ground for knowledge eventual spread (see Ihde 2010, 85-86).

[9] For Husserl, these sedimentations are indispensable for meaning to be «stabilized and communicable across space and time», for they provide, accordingly, «the historical process spanning generations» of geometricians (Blomberg 2019, 79, 81).

used, i.e., a tool of extended sensitivity and not just a factor of unfortunate bodily compensation. Accordingly, this addition does not alter the primordial nature of perception, that is, what a healthy subject would see or could see under certain and ideal circumstances, but only extends its range of effectiveness. In a sense, the closed fist or the palm of the open hand would make or substitute the hammer work, even if this would be way more complicated than the carpenter at stake had initially realized.

Similarly, the blind man may be able to do without the stick. Indeed, the stick *facilitates* or *inclines* certain operations, making them drastically easier to perform but not allowing him to do what is just beyond human possibilities. Phenomenologically, this does not cause particular problems for reflection. However, things get complicated when the mediation becomes more pressing and evident, as in the case of Galileo's employment of the telescope. Indeed, as the nature of Ihde's *hermeneutic relation* prescribes, the instrument no longer physically adheres to the observer's body. Indeed, the instrument is not nor becomes a part of their body; it does not count as such within the dynamic unity of its body schematism, as Merleau-Ponty would have claimed. If we adhere to the previous examples, the instrument does not straightforwardly transform into the subject's eyes or hands. Instead, according to the sketch that Ihde reports in *Technics and Praxis* and other writings (see also Ihde 2012, 103), the object or the observed world in its entirety shows itself through the lens offered by the instrument, revealing characteristics that would otherwise be unattainable by the unaided or natural eye. In a certain sense, the instrument *provides* this spectacle, and no longer does the observer's body that properly learns to use it. The telescope's lens *sees* a given aspect of the celestial body, not the eye of the observer. This also seems to be the core of the Galilean argument: anyone could see that they are right if only they would look through the lens, i.e., if only they would accept to see the world with different and *technoscientific* eyes (see Hasse 2018, 246 ff). In Ihde's words, this *hermeneutic* shift produces both an increase in a «series of gradation» in the sensible rendering of the world and more dramatic and theoretically questionable «qualitative changes» (Ihde 1979, 33), again, in the *visual* restitution of this aesthetic complexity. Only in this second case do «knowledge gathering technologies» (Ihde 1979, 36) play a crucial role in Ihde's *technoscience*. Indeed, complex and *invisible* features progressively become *visible* and theoretically acceptable «through the development and embodiment of knowledge gathering through instrumentation» (Ihde 1979, 36).

On closer inspection, the phenomenologically-based *embodiment* I mentioned above also slips and changes place in the relationship we possibly entertain with our *Lebenswelt*: it is the *body* of science, i.e., of its operational *instrumentalization*, the one becoming the genuine organ of knowledge and its conceivable advancement. In this sense, for Ihde, the aesthetic continuity is preserved or sublimated in the new *corpus* of meaning responsible for its constitution and maintenance.[10] This eventually provokes dramatic changes in *macroperception* or socio-cultural domains of science comprehension and data diffusion, as he mainly clarifies in *Instrumental Realism* (see Ihde 1991, 22). This shift also often elicits unconscious historical paradigm substitutions, i.e., the fact that things previously considered erroneous have become accepted nowadays or unusual tools have become the main ones responsible for accurately understanding things, as seen with the telescope and its incredible astronomical legacy. This is what happened, according to Ihde, with the use of X-rays in medicine or all those technologies that compensate for our natural inability to see things naturally *invisible* to our eyes (see Ihde 1998, 152). Indeed, X-rays, MRI, and other alternative *sensible* means of data acquisition and *hermeneutic* rendering do not limit

[10] The text I am considering here is from 1979, so *digital* and so to say, *immaterial* possibilities were less developed than today. However, Ihde did not neglect this point in more recent works, as I will claim in the following.

themselves to make us see what we do not *as we would do* if we were actually able to penetrate the flesh of those we want to heal in this case, as physicians of all times or epochs wished to do. The machine using X-rays does not see with our own eyes *but with its own,* as do modern telescopes when making us see or give us the account of lightyears distant galaxies, also on a partial yet less relevant as initially thought *inductive* account, something Husserl would not have accepted in these terms either (and neither does Ihde, as I am going to claim in the following paragraph).

So, the images we can now appreciate, thanks to this more and more refined *instrumentation* process, are nothing but the hermeneutic *translation*, in human language and means of comprehension, of specific entities we otherwise could not sensibly grasp, but which is accomplished using tools that we have constructed and learnt to read and decipher, as I will claim in the seventh paragraph. Indeed, as Morton said, the things we now perceive are not how they phenomenologically *appear*, i.e., how we sensibly appreciate them. In my opinion, as I argued in the conclusion of the previous paragraph, this proves that a certain phenomenological *opacity* always remains and that the technological mediation, in this case, can be shifted but never cancelled altogether.[11]

## 6. *Whole earth measurement.* On seeing the invisible

This is also why I believe the *hermeneutic* and *post-perceptual* moment preserves specific importance over *induction* possible drifts in Ihde's thinking. Indeed, in his work *Expanding Hermeneutics* and the *Whole Earth Measurement* central claim (Ihde 1998, 50-60), the author argues that the shift towards always better yet increasingly less intuitive and technologically abstract mediation should not be solely nor primarily interpreted based on inductive reasoning or least not in its most direct implications today, as Husserl's Western rationality was paradigmatically supposed to do. Indeed, *actual* modern science and *mathematization* have gone separate ways. According to Ihde, and in alignment with Husserl, we can phenomenologically comprehend something as long as we can perceive it, even vicariously rather than intuitively, in a certain sense, or personally. Therefore, our grasp of things and our control over them extends along the range of our gaze and the interpretative *moment* that follows, as proposed by Ihde with his justifications of *hermeneutic relations* and their many theoretical implications. According to this view, the advancement of technology is the primary driver of science and thus of our knowledge, which in turn shifts by increasingly differentiating, quantitatively and qualitatively, the value of the always necessary instrumental mediation. But suppose hermeneutics and its *moment* make us see beyond, i.e., where our eyes could not reach. In that case, as it is, technology allows us to consistently consider those aspects of the world we previously did not know about and we can now *technologically* appreciate.

Indeed, in *Expanding Hermeneutics,* Ihde states that we can *perceive* the «*Earth-as-planet*» (Ihde 1998, 57), i.e., Earth on a genuinely global scale and thus *sense* what is happening – has, or will happen – on its soil, and in every moment we wish to, thanks to ever-improving technological *worldly* appreciation we can profit on. This is done through the use of ever-increasingly powerful surface scanning tools, such as modern satellites. Ihde also proves this point by considering the case of the *greenhouse effect,* i.e., strange evidence which would be difficult to explain and comprehend in a classic phenomenological account. Suppose we take Morton's *hyper-objective* and *meshy* categories momentarily

[11] See also Heidegger's *The Age of the World View* on the «distinctive type[s] of greatness» that follow one another in the course of technological advancement (Heidegger 1976, 354 – partially modified).

(see Morton 2018, 42-46). We would immediately feel uncomfortable in realizing the *viscosity, non-locality, temporal undulation, phasing* and *interobjectivity* of complex phenomena like global warming and the greenhouse effect, i.e., the reality and the hermeneutic relevance of *hyper-objects* that are only visible and intelligible as such by innumerable intuitions and thus *registrations* extended to technological *measurements* also operating in place of our senses (see Shirokanova 2014, 120). According to Ihde's technoscientific claim, current instruments give full-blown «access» (Ihde 1998, 57) to phenomena like these. Indeed, current instruments here can easily recognize those and provide a worthy representation of them. When they do this, the «[g]reenhouse gases» we can account for are not just «"inferred"», i.e., are not *mathematically* and improperly anticipated without material support and eventual sensible confirmation, as Husserl would polemically claim against Galileo, but are «"instrumentally" perceived» (Ihde 1998, 57), i.e., they count as legitimate *phenomenological* phenomena.[12] In this sense, planet Earth becomes «measurable» or will be teleologically and *eventually measured*, given the indefinite series of representations we had or can have of it, thanks to the orbital satellites above it making it «instrumentally presentable» (Ihde 1998, 53).

Yet, in discussing Ihde's hermeneutic mediations, I believe we should address a latent yet existing feature that needs further attention. Based on what has been said so far, I hold that the instruments Ihde speaks of are created over the succession of cultural traditions as legitimate expressions of the joint commitment of different scientific communities. This sequence of *substitutions* or improvement phenomenologically reveals scientific progress and validates the advancement of knowledge through the material supports on which it relies. Now, I reckon it is also essential to underlie the *temporal* and, thus, *historical* evolution of a sort of «structural truth» (Merleau-Ponty 2010, 52) that allows us to technologically grasp phenomena under continuous transformation and for which only the constant upgrading of tools can adequately account. I believe Ihde suggests this claim by introducing the regulatory idea of *diachrony*. He mainly does so in *Expanding Hermeneutics* (Ihde 1998, 50) and *Husserl's Missing Technologies* (Ihde 2016, 80). By *diachrony,* we should here mean a conception of time passing that focuses on the cohesive succession of its units rather than its *synchronous* and, thus, immediate blending. Indeed, according to Ihde, in scientific representation, a *synchronic* time rendering alone would be unfitting when trying to depict what *hyperobjects* are*,* such as the greenhouse effect, in Morton's account. Arguably, a «*synchronic* whole Earth measurement» (Ihde 1998, 50), i.e., the hypothetical and technological possibility to *instantaneously* calculate the entire planet's countries and territories temperatures at once, would not be sufficient to understand what the greenhouse effect really is, because «very longtime records» must also «come into play» (Ihde 2016, 80; see Kenderdine 2015, 33; Wapner & Matthew 2009, 216) to properly define it. As Ihde holds, indeed, this synchronic evidence would be nothing but a «blip» in the much longer and «*diachronic* history of Ice Age cycles over the last ten thousand years» (Ihde 1998, 50-51), i.e., the fulcrum of *deep* terrestrial eras we should precisely consider when trying to detect this terrific heat raising (and, namely, to when we *now* know we must trace the urgency of this phenomenon back, taking as a landmark something seemingly far removed from our present encounter).[13]

[12] As Ihde argues, «technologically *mediated* perceivability» phenomenologically «reduces and transforms the presumed strong distinction between Husserl's plenary perception and the equally presumed indirect and abstract reduction to merely pure shapes» (Ihde 1998, 53).

[13] As Ihde says in the following, earth measurements «must also be related to the *diachronic* readings of the past», which in turn «are made possible by the material "calendars" left by the Earth itself» (Ihde 1998, 59).

Current scientific methods and computer modelling enable this *diachronic* reenactment and thus to fully appreciate this complex data, i.e., a piece of *perceivable* unitary information yet composed of multiple, cumulative temperature reports across innumerable ages. Still, this sensible awareness is a recent and fully *hermeneutic* achievement and, in some ways, an always improvable «technique», according to the terms Ihde employs in his books. Indeed, none of us was present in the Ice Age, but neither was the technology we used to *see* it. Nonetheless, we somehow can see what it was and what the melting of ice *meant* for our planet's life's present spread. For Ihde, scientists who want to understand this fact, i.e., global warming, along with the greenhouse effect and its consequences, must learn to «read» the many «interrelations» (Ihde 1998, 59) underlying Ice Age *sensible* and *deep time* confirmations (see Hird 2013, 109, 117). When they do so, they effectively run a «*reconstructive*» (Ihde 1998, 59) capability they can profit from because of current technoscientific means, i.e., the ability to retrace in an *instant*, even implicitly, all previous measurements to grasp the significance and ecological weight of the present one (and what those who come after will have).

## 7. What *technoscience* is truly based on (?). To-and-fro *The Origin of Geometry*

Before coming to conclusions, it is necessary to take one last step forward and explore possible elements of conflict that I mentioned in the second paragraph. As stated earlier, while I think it is consistent that technological progress substantiates the value of these discoveries, it is also worth remembering the *historical* evolution and *inter-subjective* support on which this progress always rests since the *correlationist* and, ultimately, phenomenological assumption of *world disclosure,* as held by Verbeek, cannot be overcome entirely in Ihde's *realist* perspective. Furthermore, it is vital to specify how these *historical* and *intersubjective* features can phenomenologically stand together and interact in this «asynchronous simultaneity» (Verma 2017, 8) of the data they carry and that Ihde emphasizes concerning technological records and *all-time* evidence. Indeed, Ihde did not overlook this aspect. In *Expanding Hermeneutics,* he paradigmatically asks himself, «[h]ow many phenomenologists does it take to detect "Greenhouse Effect"?» (Ihde 1998, 50); I believe by invoking these very theoretical issues (and a funny joke, too). From this point of view, it is not sufficient to ask how this greenhouse effect became visible but also to whom one(s) should *ultimately* attribute its discovery or *origin*. Accordingly, only «many earth science practitioners» could realize the diachronic and hermeneutic «generalization» (Ihde 1998, 50), leading to the progressive identification of this complex, otherwise invisible piece of evidence. Indeed, those practitioners profited from technologies that allowed them to grasp the countless traces of that phenomenon, *communicate* them, and come together in a unitarian intra- and intergenerational community of solid scientific commitment.

I claim this interpretation is *phenomenologically* sound if we also consider the bright side of Husserl's ambivalence on technological mediation, of which Ihde is aware in his attentive reading of *The Origin of Geometry* and mainly proves in *Instrumental Realism* (Ihde 1991, 18, 46) and *Husserl's Missing Technologies* (Ihde 2016, 24). *The Origin of Geometry* is the third *Appendix* of paragraph 9 of the *Crisis.* It is relevant in this context because of the specific attention Husserl here dedicates to the question of *writing,* i.e., the primordial *technological* faculty of pinning down some pieces of information we consider essential or worthy of being read and passed on to someone who might read them in the future. Husserl is primarily interested in this «technique» because he believes it is crucial to show how his theory of sedimentation (see D'Amico 1981, 11), the eventual reactivation of a given content, and the historicity of the *a priori* works (see Husserl 1970, 362; Pradelle 2008, 236). Moreover, in *writing,* Husserl underlines the quantitative-qualitative shift that

Ihde also upheld in his material hermeneutics. Indeed, according to Husserl, writing «raises consciousness to a higher level» (Ihde 2009, 20; see also 1998, 187; Housset 1997, 203-204), also granting the possibility of «accumulation» and the «progress of idealities» (Ihde 1991, 46) as well as its «perfectible» (Thierry 1997, 94) and intimal constructive nature.[14] Indeed, in Husserl, writing gives a specific essence and duration to the content they aim to express and results in «communalization» (Husserl 1970, 364), banding fellow geometricians at work in the constitution of the sense of a composite «ideality that no one has ever thought» (Merleau-Ponty 2001, 57) as a single or isolated individual. This technical reaching entitles synchronic and, most importantly, *diachronic* communication between different generations of exegetists (see Zhang 2021, 127, 133).

Still, according to this very text, «every science», i.e., every technoscientific enterprise, in Ihde's terms, «is related to an *open chain of the generations to those who work for and with one another*», namely «researchers either known or unknown to one another who are accomplishing subjectivity of the whole living science» (Husserl 1970, 355-356, emphasis mine; see Goris 2014, 15).[15] Here, several generations of *geometricians* can bond using language and writing, indirectly subsuming and, from time to time, reliving the results acquired by the previous ones and instrumentally constituting the everlasting «community of geometricians» (Stiegler 2009, 230; see also Husserl 1977, 120-126), as we previously saw commenting on the case of the *many earth science practitioners*.

This said, I believe we find here, and perhaps on an equal level of importance, both in Ihde's and Husserl's texts,

i) the *technological* account offered by writing and *whole Earth measurements*, and, of course,

ii) the *intersubjective* aspect presented by the *many* writers and readers who use its means of dissemination or, in Ihde's case, the scientists' always at work.

This is, as I see it, a potential theoretical amphiboly. Indeed, while it is clear that the subjects in question communicate artificially through technologically evolving supports, like writing, science or technoscience itself nonetheless evolves through these social, intra- and inter-generational exchanges and, in a certain sense, owes its very improvement and ultimate foundation to them (see de Boer et al. 2018, 741).

## 8. Conclusions. «On *cinematographic possibilities*».[16] What is still to be imagined?

Ihde's philosophical testament is significant and definitely worth reading. His death probably prevented him from seeing or fully grasping artificial intelligence's already astonishing current achievements. For this reason, I think Ihde perhaps remained too attached to a very *human* way of doing science, so to speak, and did not seriously consider an autonomous use of the technoscientific tools themselves, i.e., without a *social* reference

[14] In this sense, the primitive repeatability of the *datum* and the further construction or *overwriting* of all knowledge – and *measurement,* in these terms – also pass through this very idea that sense may also be materially consolidated and intergenerationally preserved. However, this consolidation occurs within a historical and intersubjective *concurrence*, which rests on the eidetic possibility that the sensible world and its meaning can be *subsumed otherwise*, and in an entirely positive key, than the *mathematization* we have seen at work in Galileo's Husserlian perspective.

[15] In *Instrumental Realism*, Ihde also acknowledges that Husserl, in this text, «embodies science in its community and activity» (Ihde 1991, 18). On this topic see also (Ihde 2022, 6).

[16] (Ihde 1979, 90).

(see Langsdorf 2016, 114). In his prose, the hermeneutic moment remains a filter or a constitutive «opacity» (Ihde 1979, 12) that is always necessary to understand what the instruments make us see. For these reasons, in his reading, the latter are never independent entities and never break free from our aegis. From this point of view, Ihde is still very attached to classical phenomenology, at least in his commentary on Husserl and Heidegger. Despite the realist stance it claims to take, the content of experience and what technology allows us to understand has to make sense *to us*, i.e., increasingly distant yet still highly involved observers. But, as a matter of fact, if we also change, as our tools change, then the question remains as to how we will be able to interact with each other and with them tomorrow.

Moreover, Ihde never wholly endorsed nor understood the digital capacities of *hermeneutic* mediation – something that was perhaps within his reach – as Vincent Blok is currently doing. I will conclude my article by extrapolating a few excerpts from his current research, which I feel aligns with the general intentions of Ihde's work. According to Blok, the *datafication* of our visible and sensible world, i.e., the digital transformation and rendering of its physical and analogical coordinates, recently caused an epochal shift similar to the one caused by Galileo and his revolutionary employment of Lipperhey's telescope in the Modern Era. This revolutionary *ouverture* – of which we should not be afraid, as I argued above – also «disrupted our relation to the world as it destroyed the geocentric orientation» (Blok 2023, 12) and, in a certain sense, the whole world we used to live in before its detection. The same happened to humans who become «astral», as also pointed out by Arendt, «as they found a new Archimedean point in the universe outside the world», making the universe itself a world, i.e., «a new secure starting point on which our knowledge of the world can be based» and this thanks to «the technical mediation of the telescope» (Blok 2023, 12). Blok claims a similar thing is also going on now with the launch of *Destination Earth* or *Destin-E,* i.e., a «digital twin» or «real-time realistic digital model» (Blok 2023, 4) of a physical entity, as our planet is. Sponsored by the European Commission, this digital duplication aims to «predict the effects of climate change and the impact of adaptation and mitigation strategy» (Blok 2023, 4) on our planet, the latter possible only based on «comprehensive community dialogue» between the numerous institutions involved and «common understanding of usage scenarios» (Hoffmann et al. 2023, 2-3) along with digitally «shared infrastructure» (Nativi et al. 2021, 2).

This digital model will eventually compensate for our inability to proceed within *embodied* terms, in Ihde's words, or *hermetically* by trial and error by adding «new capabilities where advanced technologies can make a difference» (Hoffmann et al. 2023, 1). As a faithful copy of our physical world, *Destin-E* will, therefore, retain not only the lessons of the past but will also be able to develop consistent patterns for its future thanks to the «rich observational dataset» (Blok 2023, 4), it will rely on and the arranged ability to *diachronically* «visualize, monitor and forecast» events to come (Nativi et al. 2021, 6). Given its data-driven essence, this model will hopefully be able to lower itself into the *deeper* dimensions of past and future, thanks to its superhuman computational abilities and thus sublimating Toadvine's wish, for example, i.e., to gain «awareness of an ancient geological past that precedes us and opens our imaginations to an indefinitely distant future after us» (Toadvine 2024, 205). According to Blok, since this *deep* temporality is humanly inaccessible, «it is only via a supplement like a digital twin», like *Destin-E*, in the case of our planet, «that we have access to this origin while such a twin can never claim to re-present this original anymore» (Blok 2023, 22), or actually never did.[17]

[17] With the same hope, Blok argues, scientists make use of artificial intelligence to complement and replace human and physiological intelligence because artificial intelligence systems «can interact

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with the world in the present, are trained by past data, and extrapolate towards the future» (Blok 2023, 27). In contrast, human intelligence appears to be firstly and mostly «bound to an orientation on the future», and this is because of individual mortality, i.e., a «future death that will never become present as a data entry point» (Blok 2023, 27).

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