Technological Dasein: Extensions and Vulnerabilities of Postphenomenology

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Abstract: This paper examines the relationship between technology and being-in-the-world through the lens of extension, vulnerability, and place by introducing a new duality into the postphenomenological literature (extension/vulnerability). We argue that technology should not be understood merely as a set of external tools, but as a constitutive extension of self and being-in-the-world that simultaneously acts to introduce new human forms of vulnerabilities. By extending possibilities and capacities, technologies reshape how individuals inhabit and interpret their environments, while also exposing them to dependencies, risks, and forms of fragility that often accompany such extensions. Drawing on phenomenological perspectives, this paper explores how being-in-the-world is mediated by technological systems that both open us to specific immediate contexts and extend us to distant or virtual ones, even as they render us susceptible to ethical risks. This dual movement destabilises traditional notions of technology and place as fixed or bounded, instead presenting it as dynamic, relational, and continually reconfigured. Ultimately, we argue that technology expands the horizon of possibilities available to human beings, not only by enabling new actions, but by redefining our sense of self and who we are, while also deepening our exposure to new forms of vulnerability. We present some practical case examples from neurotechnology. In doing so, we highlight the need to critically consider how different technologies expand possibilities, reshape place, and condition both our abilities as well as our openness to risks within the experience of being-in-the-world.

Keywords: neurotechnology, place, postphenomenology, technology.

I. Postphenomenology: Introduction and Context

This article adds to the postphenomenology literature to describe an extension and vulnerability character of technology. Postphenomenology "views technologies as co-constituting human subjectivity and world objectivity." (Vindenes and Wasson 2021, 3) As Rosenberger and Verbeek (2015, 1) explain, "postphenomenologists study the relationships that develop between users and technologies." Postphenomenology is important as it "addresses questions such as: How do technologies shape our choices, our actions, and our experience of the world? How are technologies at once objects that we use for our own purposes, and at the same time objects that have an influence on us?." (2015, 1)

Here we build on the postphenomenological tradition by integrating new insights into "concepts developed by Don Ihde, the founding figure of this perspective." (Rosenberger and Verbeek 2015, 2) We follow Rosenberger and

Verbeek who state, "those working in the school of postphenomenology refine and expand on Ihde's framework, and they apply these ideas to a wide range of philosophical issues." (Rosenberger and Verbeek 2015, 2) We articulate an extension/vulnerability aspect of technology that has yet to be described, highlighting a new perspective on "the mediating roles of technologies in human-world relations." (Rosenberger and Verbeek 2015, 2)

Postphenomenology elucidates experiences that traditional phenomenologies have overlooked: "technologies, to be short, are not opposed to human existence; they are its very medium." (Rosenberger and Verbeek 2015, 2) This involves describing a general ontology and phenomenology of technological experience and then "proceeds through the application of its framework of original concepts to specific cases of human-technology relations." (Rosenberger and Verbeek 2015, 2) Postphenomenology thus outlines "the different forms that human-technology relations may take" (Rosenberger and Verbeek 2015, 13) and this is important because "these concepts have practical value for case studies of user relations to technologies" (Rosenberger and Verbeek 2015, 13) which "demonstrates the variability and context specificity of user experiences. As such, this list argues against oversimplifying or one-size-fits-all accounts of user experience." (Rosenberger and Verbeek 2015, 13)

In the final part of this paper, we apply our extension/vulnerability framework to neurotechnology case examples. To give an idea of what a postphenomenology framework looks like, we briefly summarise "Ihde's four basic forms of technological mediation: embodiment relations, hermeneutic relations, alterity relations, and background relations." (Rosenberger and Verbeek 2015, 13) For embodiment relations "Ihde points to the mediation of those technologies which transform a user's actional and perceptual engagement with the world." (Rosenberger and Verbeek 2015, 14) In other words, "when a technology is embodied, a user's experience is reshaped through the device, with the device itself in some ways taken into the user's bodily awareness." For example, eyeglasses "are a transformative mediation of the bodily-perceptual relationship between the user and the world." This example shows that postphenomenology is an important reflective study of first-person experience because it highlights "the transparency of a particular human-technology relations." Specifically, this indicates "the degree to which a device (or an aspect of that device) fades into the background of a user's awareness as it is used." Postphenomenological reflection allows a return to 'the things themselves' which is insightful especially when "the use of the device takes on a familiar and everyday character, the device itself takes on a degree of transparency." This transparency is described by Ihde when he writes, "My glasses become part of the way I ordinarily experience my surroundings; they withdraw and are barely noticed, if at all." (Rosenberger and Verbeek 2015, 14)

Postphenomenology highlights that different technologies can be "contrasted in terms of the kind and degree of transparency possible."

(Rosenberger and Verbeek 2015, 15) For example, "a hearing aid ideally should function parallel to the visual eyeglasses example." However, "auditory transparency is much more difficult to attain, a fact well recognized by audiologists and others. A significant number of people attempt to use hearing aids, but the difficulty of embodiment is sometimes such that they give up." The lack of transparency for hearing aids comes from a variety of factors such as "the stuffiness of the feeling of the device wedged into the ear, to the devices' inability to distinguish between local and background sounds for amplification." (Rosenberger and Verbeek 2015, 15)

Another important ontological feature for embodiment relations is a magnification/reduction structure where technology "simultaneously magnify or amplify and reduce or place aside what is experienced through them." (Rosenberger and Verbeek 2015, 16) In other words, technology offers a "desired change in our abilities, but always also receive other changes, some of them taking on the quality of tradeoffs, a decrease of a sense, or area of focus, or layer of context." For example, "a hammer enables one to strike a nail with force, but occupies one's hand in the process. A pair of binoculars enables one to see over a distance, but at the sacrifice of visual awareness of one's immediate surroundings. A telescope image of the moon, Ihde notes, enables us to see its surface in great detail, but removes the moon from its context in the sky" (Rosenberger and Verbeek 2015, 16).

In the sections on extension, vulnerability, and place, we build on this and argue that technology does not only have this magnifying or reduction structure, instead we argue that technology opens new aspects of the world through unconcealment or *aletheia*. Rather than framing this in terms of what is magnified or reduced it is important to conceptualise this as opening possibilities for being-in-the-world and changing our place within it. For example, a person picking their cell phone out of their pocket opens them to the world-wide-web and extends their ability to reflect with more information at their fingertips. Another example is a person in an electronic wheelchair extends their being-in-the-world and enables them to move and interact with the world that would not be possible without this device. Likewise, having facial recognition software monitor self-service checkouts out a grocery store enables extra security by opening an electronic exit if the technology determines the person has paid for everything they walk out of the store with. Finally, having keys to a car that can remain in the driver's pocket and unlock the door when they are detected as close to the vehicle; all these demonstrate examples when technology opens and extends our possibilities in the world. To further add to this, instead of referring to a reduction in possibilities, we find it important to link vulnerability to extension capabilities of technology. Referring to the previous examples, being dependent on a cell phone for information could make said person vulnerable to being overly reliant on the phone and not developing their own problem-solving abilities. The electronic wheelchair example opens other vulnerabilities such as mechanical

failures which could increase the risk of an accident. Facial recognition systems are known to contain biased algorithms and so opens the potential for discrimination. Finally, keyless entry fobs have been known to be at risk of signal cloning where criminals can intercept the frequency emitted by the device to unlock and drive the vehicle.

At the outset it is important to note that the key difference between our ontological structure of extension/ vulnerability and the magnification/ reduction structure can be explained as follows. Magnification enhances or amplifies an existing human capability through technology. Alternatively, reduction occurs while amplifying one capability, technology simultaneously diminishes others. It is clear this is different to what we offer in this article as the extension relation focuses on possibilities where technology creates new actions, experiences, or opportunities that were previously impossible or impractical. Vulnerability is distinct too as it focuses on new possibilities created by technology that also introduce risks, or challenges. Telehealth is an example of extension that increases access to care but also creates vulnerabilities such as privacy breaches, technical failures, or exclusion of people with poor internet access.

The other three aspects of Ihde's postphenomenolgical framework are not as relevant to our paper but we will briefly mention them here. Hermeneutic relations "refer to technologies which are used through an act of perceiving and interpreting the device's readout." (Rosenberger and Verbeek 2015, 17) For example, "a user looks at the watch's face, interprets the hands or digital display, and through this hermeneutic relation experiences a transformed access to the precise time of day." The transparency of the hermeneutic relation:

> will depend on the particular level of familiarity one brings to the interpretation of the device's readout. Take, for example, a complex medical imaging technology such as an fMRI. For a new medical student entirely novice with regard to this technology, she or he may need to concentrate and slowly decode the meaning of the colorful brain-shaped display. But for the expert, much of the content and context of the readout will appear in a perceptual gestalt, and she or he can focus attention on the area of interest within the image. (Rosenberger and Verbeek 2015, 17)

Alterity relations are the third type of technological experience that Ihde refers to where we relate to devices "similar to how we interact with other human beings" (Rosenberger and Verbeek 2015, 18). Rosenberger and Verbeek state, "one common form is computer interface schemes that pose direct questions to the user, such as the ATM machine that displays questions on its screen (Would you like to make a withdrawal?), or the 'dialog box' that opens on a computer screen to provide program installation instructions." It is predicted that as technology advances "we will see more and more devices designed with an alterity-style interface" which is "increasingly seen in automated interactive customer service phone calls, GPS devices that read aloud driving directions, and

voice interactive personal assistant smartphone applications." (Rosenberger and Verbeek 2015, 18)

The fourth and final type of technological experience outlined by Idhe are background relations: "technologies that make up the user's environmental context." (Rosenberger and Verbeek 2015, 18) Examples of this "include the running refrigerator on the other side of the room, or the central air conditioning and/or heating system that goes on and off automatically throughout the day." Here technology is 'off to the side' forming and shaping the ground or landscape of experience "protecting us from the elements or keeping our food safely chilled, but do so in ways that do not require direct interaction." (Rosenberger and Verbeek 2015, 19)

Before moving to outlining our new approach to the technological experience of extension/vulnerability, we review 'cyborg relations' which is pertinent as it relates to the case examples from neurotechnology analysed later. Peter-Paul Verbeek has been the key proponent to describe this relation which involves "brain implants, domotics, and augmented reality devices, relations in which technologies start to merge either with the human body or with the environment." (Rosenberger and Verbeek 2015, 20) Cyborg relations are "more intimate than a relation of embodiment." Cyborg relations present a "fusion, in which the physical boundaries between humans and technologies are blurred, and technologies merge with our bodies." Furthermore, in contrast to an ambient background relation, augmented or virtual realities can present "a relation of immersion, in which a technological background interacts actively with human beings." This adds "an extra layer to our experience of the world" where "new intentional relations between humans and the world come into being." (Rosenberger and Verbeek 2015, 21)

Cyborg relations are important to discuss as "the technologically mediated character of intentionality takes on a different shape." (Rosenberger and Verbeek 2015, 21) Cyborg relations present a more intimate fusion as they merge with our physical body such as "neuro-implants for deep brain stimulation; cochlear implants that enable deaf people to hear again; or artificial heart valves and pacemakers." From cyborg relations, a hybrid intentionality emerges where "rather than being a technologically mediated form of human intentionality, it is the intentionality of a new, hybrid entity: a cyborg." Here "humans and technologies form a new entity, which is directed towards the world in a hybrid way, integrating human and nonhuman elements." Intentionality changes with cyborg relations as it now "has a bi-directional character: human beings are directed towards technologies that are also directed towards them." (Rosenberger and Verbeek 2015, 22)

Rosenberger and Verbeek note "this bi-directionality can have several implications." (Rosenberger and Verbeek 2015, 22) For example, "it opens the possibility to be immersed in how smart environments perceive and act upon human beings, as is the case for some persuasive technologies that give

unsolicited feedback on one's behavior." This is particularly relevant for our case study on neurotechnology as cyborg relations could affect autonomous decision-making through "an induced intentionality" where technology has the power to direct attention and intentionality. Although this cyborg relation highlights some of the vulnerabilities associated with it, there can also be an extension relation. For example,

> "Google Glass is a good example of such an augmented reality technology. People wearing it can get information on objects and buildings they see, and potentially also about human beings, when the technology would be equipped with face recognition technology; they can exchange messages, take pictures and record videos, and surf the internet in the background of their activities."

This shows that technology such as brain-computer interfaces could offer both an enhanced extended relation to the world but also opens us to potential vulnerabilities too. This is because of the nature of cyborg relations where intentionality is hybrid and "bifurcated: there is a split in people's directedness at the world, because two parallel fields of attention emerge"; (Rosenberger and Verbeek 2015, 22) from the human and from the technology.

II. Technology and Extension

The idea of a technological extension relation is briefly and implicitly found in Merleau-Ponty's *Phenomenology of Perception*. When describing a walking cane, he says "the blind man's stick has ceased to be an object for him, and is no longer perceived for itself; its point has become an area of sensitivity, extending the scope and active radius of touch, and providing a parallel to sight." (1945, 165) Here the stick extends our ability in:

> the exploration of things, the length of the stick does not enter expressly as a middle term: the blind man is rather aware of it through the position of objects than of the position of objects through it. The position of things is immediately given through the extent of the reach which carries him to it, which comprises besides the arm's own reach the stick's range of action. (Merleau-Ponty 1945, 165)

This extension is then incorporated into an extended 'body schema' where "if I want to get used to a stick, I try it by touching a few things with it, and eventually I have it 'well in hand,' I can see what things are 'within reach' or out of reach of my stick." This body schema allows us "to get used to a hat, a car or a stick" by being "transplanted into them, or conversely, to incorporate them into the bulk of our own body." This highlights the "power of dilating our being-in-the-world, or changing our existence by appropriating fresh instruments." (Merleau-Ponty 1945, 165)

As Richardson (2007, 206) notes, this "corporeal schema describes the expandable, inherently open, and tractable nature of embodiment. In the context of everyday activities, the experience of one's own corporeal schema is not fixed

and may encompass a range of potential body-aspects and body-images in the form of material and technological mediations and cultural and historical contexts". An example of this expandable body schema which extends our place and being-in-the-world can be applied to a simple case of binoculars. Rosenberger and Verbeek state,

> "not only is a user's bodily perceptual capacity to see across a distance greatly transformed, and not only may the binoculars themselves grow transparent in an accustomed user's hands, but the user's entire field of vision is altered. When looking through the binoculars, the user's field of awareness becomes filled by the content brought forward by the device, and the totality of user's vision is framed by a circle of darkness." (2015, 16)

What is missing from this description is the extension happening in this context. In other words, here the person looking through the binoculars extends their possibilities for being-in-the-world by being transported to be able to identify the football that was kicked into a distant tree and understand a plan to retrieve it. Likewise, a refrigerator enables and extends our ability to keep milk from expiring and prevents us from having to go to the store frequently. This is the extending feature of technology we wish to highlight. Vulnerability is also present when using binoculars. For example, walking while using binoculars could cause a tripping risk as peripheral vision is affected. There are also reports of headaches, vertigo, and eye strain from prolonged use. After discussing the extension feature of technology in this section, we turn to vulnerability in the next section.

We will now analyse the extending characteristic of technology that transforms our being-in-the-world with reference to Rapp's (2023) article which discusses wearable technologies as extensions. In Rapp's article, he conceptualises "wearable devices as extensions of our intentionality and introduce the extension relation to explain how wearables may alter how we relate to the world." (2023, 79) This builds upon both Ihde and Verbeek's postphenomenological tradition which was "not developed to be applied to wearables and thus may not be sufficient to pinpoint all the modalities through which this technology affects our experience." (2023, 80)

Rapp presents a

> "more comprehensive notion of intentionality, i.e., the extended intentionality, which takes into account the perceptual and the conscious ways through which we relate to the world, as well as the world itself. The extension relation shows that wearables may extend the intentionality itself, increasing the human opportunities for bodily and consciously appraising the world, as well as for acting in this world." (2023, 82)

Rapp argues Ihde's fourfold framework for postphenomenology "are insufficient to characterize the mediating role of wearables." (Rapp 2023, 88) He suggests an 'extension relation' needs to be recognised which "remains open to different interpretations about what is extended and how it is extended." Rapp

recognises that the idea of "extensions is not new in the history of thought about technology. Technical artifacts have been seen as extending the human organism by amplifying bodily and/or mental abilities." (Rapp 2023, 88)

When introducing his concept of extended intentionality, Rapp starts by recognising that "humans do not experience the world directly, but always via a mediating artifact which helps to shape a specific relation between humans and world." (Rapp 2023, 88) Rapp adds that "wearables extend human intentionality" and this extended "intentionality is constituted of three different aspects, the motor intentionality, the conscious intentionality, and the world toward which the intentionality is directed, allowing us to understand the various ways in which wearable technology transforms the opportunities for us to relate to the world." Rapp argues wearables may extend both motor and conscious "levels of intentionality increasing the human opportunities of bodily and consciously relating to the world, thus enhancing how we perceive, think of, imagine, remember, and so on." He adds that wearables may also extend and expand "the entities of which this world is made and widening the person's opportunities for acting in this world." (Rapp 2023, 89) He represents this in a figure where extended motor and conscious intentionality aim toward this extended world.

This extension relation adds to the postphenomenology arsenal, where extension highlights how technology can "proactively and dynamically change the person's perception, transparently merging with their perceptual capabilities and multiplying their perceptual opportunities." (Rapp 2023, 89) An example is augmented reality glasses which "dynamically alter how the person sees …. as if they were a new organ completely integrated into the person's perception acting for the realization of the mutable organism's goals and desires, while offering multiple perceptual modalities." Furthermore, Rapp's framework extends postphenomenology as "Ihde's relations do not account for how the person's world may be extended. While the reading glasses merely change the perceptual focus on the world, AR wearable glasses may introduce new entities in this world (e.g., by displaying virtual objects that integrate with the real world)." (Rapp 2023, 90) Wearables open and extend being-in-the-world "as the device may offer multiple potential transformations of a person's bodily-perceptual encounter with the world." (Rapp 2023, 91) This is contrasted with "eyeglasses, which offer the same perceptual alteration to everyone when they are worn, the computational capabilities of wearables may differently and dynamically transform the perception of the world depending on the goals, context, usage modalities, and the person's characteristics." This is an example of technology as "multistable mediators of human perception" where it "may produce a variety of perceptual variations in order to convey different perceptual possibilities that a phenomenon can exhibit while experienced from different vantage points." (Rapp 2023, 91)

This highlights how technology is able to "extend our possibilities of action upon and within the world: in other words, action capabilities of the person are changed as a result of the mediation operated by the technology." (Rapp 2023, 101)

Technology can reveal new entities which implies "not only new opportunities for interaction with such entities but also e.g., for communicating with others." Rapp gives an example of "smart clothing. Here, the individual's possibilities of acting within the world are extended by enhancing their communication means, as new invisible entities, like emotions, are moved to the visible." Importantly, this could also be linked to neurotechnology, where those who have lost the ability to speak could use smart clothing to now communicate with others through brain-computer interfaces which read and decode brain signals. This highlights how the extension relation of technology "may extend both the person's possibilities of acting within the world and the person's world itself." (Rapp 2023, 103) Rapp summarises the extension relation as opening "new opportunities for action, in the sense of extended person's possibilities of self-expression and action within the world, and even the potentiality of extending the person's world itself." (Rapp 2023, 108)

Other authors have discussed similar extending capabilities but have not been grounded in or compared to the postphenomenological literature. This includes Lawson (2017, 99), who argues technology can be "conceived of as some kind of extension of the human organism by way of replicating, amplifying, or supplementing bodily or mental faculties or capabilities. This basic idea of extension recurs throughout the study of technology, and is found in discussions of technology that go back at least as far as Aristotle." Aristotle, like Lawson and us, clearly recognises the dual nature of 'techne,' rightly seeing it as imitating nature with associated possibility for positive and/or negative outcomes. In his paper Lawson discusses the book *Understanding Media, subtitled The Extensions of Man* by Marshall McLuhan, who also "depicts technologies as extensions of humanity: "During the mechanical ages we had extended our bodies in space. Today, after more than a century of electric technology, we have extended our central nervous system itself in a global embrace, abolishing both space and time as far as our planet is concerned." (Lawson 2017, 101) Lawson explains McLuhan's views by noting he distinguishes "two broad classes of extensions of the organism: extensions of the body and extensions of cognitive functions." McLuhan claims that extensions of the body "were introduced during the mechanical age. Examples of them include weapons such as bows, spears and knives, which are analysed as extensions of hands, nails, and teeth. Likewise, clothing is seen as an extension of the skin, to extend its function of bodily heat control and protection. The wheel is seen as an extension of feet in rotation." (Brey 2000) Alternatively, extensions of cognition include

> "those of sight and sound. Thus, the radio and telephone function as long-distance ears, and visual media, including writing and print, are extensions of the visual function. Electric media are analyzed, moreover, as extension of the information processing functions of the central nervous system. That is, electric media take over functions of information management, storage and retrieval normally performed by the central nervous system." (Brey 2000)

With the rise in technology, McLuhan famously claims the human is "an organism that now wears its brain outside its skull and its nerves outside its hide." (Lawson, 2017, 101)

Steffen Steinert reviews the history of 'the extension theories of technology' (2016, 61) where he quotes the idea from Ralph Waldo Emerson who states, "all the tools and engines on earth are only extensions of its limbs and senses." (Steinert 2016, 62) Steinert claims "it was not until German philosopher of technology Ernst Kapp has presented his account that artifacts and even complex technology are a projection of human organs, that this idea found its first proper philosophical elaboration." It is said that Kapp argues "the tool is a reproduction (in German, '*Nachbild'*) of the human body." Furthermore, "with a nod towards Plato, Kapp calls the organism the '*Urform'* that is considered to be the prototype for all instruments." Kapp claims technology or "the tool is an unconscious reproduction (projection) of the organic archetype (the *Urform*)." He adds "humans not only project their organs into their artificial means but these artificial means also enhance and support the bodily organs." For example, "a hammer enhances the bodily strength of the fist." (Steinert 2016, 63)

Returning to our earlier example from Merleau-Ponty, Steinert notes that he "makes the claim that our body can be extended via the use of tools. He argues that our body is an open system that can incorporate external means. He uses three cases of tool-use to illustrate this idea: Wearing a feathered hat, driving a car, and using a blindman's cane. In all three cases, the artifacts are incorporated into the body." (Steinert 2016, 65) Steinert includes a few quotes from the *Phenomenology of Perception* such as "to get used to a hat, a car or a stick is to be transplanted into them, or conversely, to incorporate them into the bulk of our own body." Steinert explains these are examples when technology "withdraw and become parts of the body, thereby being an extension of bodily synthesis." These examples show the mediation process of technology where "the texture of the street is perceived through the stick, and the condition of the road is perceived through the car." Instead of perceiving the stick or car directly, "these tools and instruments, they become transparent (they withdraw) and extend our sense perception." (Steinert 2016, 65)

Steinert also mentions McLuhan recognises that "technology is not only an extension of human intentions and desires but also an extension of our capabilities." (2016, 68) Steinert comes close to the ambitions of our article when he states McLuhan's "version of the extension idea pays critical attention to the effects that the use of technology has on us and on our capabilities." In other words,

> "a technology may enhance some of our natural capabilities, but we should not be oblivious to the negative effects of technology on our capabilities. The Internet, for example, is said to have an undesirable effect on our thinking capacities and learning abilities. Some authors have forcefully argued that the Internet turns us into superficial thinkers and suffocates our ability to concentrate and contemplate." (Carr 2011)

Although not explicit, Steinert touches on vulnerability here as the flipside of extension.

One other notable author that Steinert reviews is Phillip Brey. Firstly, he states: "Brey starts with the observation that nature has endowed us with an original set of tools to realize our intentions. This original tool set consists of the limbs that we control, our sense organs, and our mental faculties." (Steinert 2016, 69) Steinert explains, "Brey's main thesis is that technology extends our original means by which human intentions are realized. In other words, we can add external means to our original set of tools." Technology can be defined as "all means that are not part of this original toolbox." This clarifies that technology extends "the range of actions or tasks that we are capable of performing" and these augmentations can be classified as an "either complementary or amplificatory extension." Steinert summarises this by explaining "Complementary extension takes place when the artifact adds a novel capacity. A lighter, for example, adds a new capacity that was not part of our original toolbox." Alternatively amplificatory extension "takes place when the artifact affects a capacity that already exists. This can happen in three ways." The three ways are replacing, supplementing, or enhancing. Steinert says a replacement "makes the organ or faculty redundant. Driving a car, for example, makes the legs redundant." Whereas a supplementation "refers to performing a function that the organ is also performing but where the artifact adds to the functionality. Clothes, for example, perform the same function as the skin." Enhancing technology is "where the functional power of the organ is enhanced because the artifact and the organ cooperate and enter into a symbiotic relationship. Brey's own example is the telescope that extends visual perception because it teams up with our eyes, comprising a functional unit." (Steinert 2016, 69)

Before moving onto the next section on vulnerability, it is important to mention the work of Van Den Eede (2014). Specifically, they see "the human being as essentially an undetermined creature, in the sense of insufficiently defined but also incomplete. We are a deficient being (*Mangelwesen*), but we compensate for this lack by taking action, more specifically by deploying tools and prostheses." (2014, 154) This theoretical analysis can be enhanced by linking to Lacanian psychoanalysis where the subject is fundamentally lacking (Ruti 2008). When we join Lacan with Van Den Eede we can say that "because of this deficiency and the corresponding potential for compensation, the human being is – borrowing from Max Scheler – world open: our survival is not dependent on a particular environment. We carry our technological environment to a certain extent with us." (Van Den Eede 2014, 154)

As a transition into the next section on vulnerability, it is also important to mention Van Den Eede's discussions on self-tracking technologies as extensions. Tracking devices are extensions because "we undertake such measuring already naturally without technological extensions." (2014, 167) For example, "people tend to keep track of their physical (and mental) condition in a more or less

intensive degree. We all feel, notice, and perceive things going on in and with our body. Of these general capacities for experiencing things in our internal environment, self-tracking technologies could be said to be extensions or enhancements". It is significant that Van Den Eede outlines this but arguably it is even more important that they also mention that "if they enhance our in-born tracking abilities, one can also expect them to numb those very abilities to a certain extent." In other words, the "way in which tracking devices gather, collect, analyze, and finally display data, may perhaps partially stunt our more intuitive habits of feeling our way around the world." Furthermore "the numerically imposed coercion of the desired heartbeat rate, amount of burnt calories, or number of steps taken can lead us to disregard other signals in our body that are not – for the moment at least – trackable through sensors and algorithms." Van Den Eede forcibly suggests "surely, in this regard, the wider cultural setting in which one deploys these extensions of oneself should be taken into account as well." (Van Den Eede 2014, 167) Our article builds on this to conceptualise both the extending abilities of technology but also the vulnerabilities it also induces as highlighted in this example.

III. Technology and Vulnerability

In this section we move beyond discussions of extension to focus on the accompanying vulnerabilities associated with technology use. We focus on the work of Mark Coeckelbergh (2013) as the premises of his work align with ours on several levels. Coeckelbergh argues "humans have always tried to reduce their vulnerability by developing and using technologies." (2013, 3) Humans resist being vulnerable, for example "we use all kinds of safety and security technologies to decrease our vulnerability. We clothe ourselves against the storms of misfortune. We protect and insure." (Coeckelbergh 2013, 4) Humans create technology as it "is our vulnerability guardian, and it is in the guardian's house that we live as technological, risk-phobic beings." Coeckelbergh highlights that

> "some people want to go one step further (or so it seems) and use technology not only to improve their individual condition or that of particular others but to enhance the human, to make us better-than-human. They consider the human malleable and improvable. They hope that human enhancement will make us less vulnerable. Some of them even desire to become completely invulnerable. Maybe they want the human to be immortal. But is this desirable? Is it possible?" (Coeckelbergh 2013, 4)

Coeckelbergh's work is important because he persuasively argues that "human enhancement creates more risks and vulnerabilities than it helps to mitigate," which connects to our earlier work on genetic enhancement (Gildersleeve and Crowden 2025).

Coeckelbergh adds that "technology is at the same time the problem and the solution, the disease and the remedy: it helps us in our struggle against risk and vulnerability, but at the same time, technology also creates new risks." (2013, 5)

Throughout this article we have highlighted several examples of this extending/vulnerability feature of technology. For example, "we have created technologies for oil production and for nuclear energy, but these technologies turned out to be sources of risk for humans as well as for the environment." Coeckelbergh clarifies this paradoxical duality by noting that new technology "always create new risks and vulnerabilities, thus transforming human vulnerability rather than substantially reducing it." As technology extends our possibilities it concurrently increases our vulnerability. For example, "one hundred years ago, there was no risk of nuclear disaster; 50 years ago, there was no risk of computer viruses, let alone cybercrime; and 10 years ago, you could not be killed by a drone." This highlights that rather than removing vulnerability, technological developments just change our vulnerabilities depending on the technology. Coeckelbergh shows his Heideggerian allegiance when he states the "human being is always already at risk since we always already stand in relation and are engaged in the world." (2013, 8) In the next section build on this to outline our Heideggerian influenced philosophy of place in relation to technology. Specifically, we discuss being-at-home or not-at-home-in-the-world which can be linked to Coeckelbergh's claim "that being-in-the-world is always a being-at-risk." (2013, 8)

As mentioned in the section on extension, we discussed Lacan's view that humans are always a fundamentally lacking being (Gildersleeve and Crowden 2020). It is important to juxtapose this with posthumanists who do not consider this barred/lacking subjectivity of humans as they have a persistent fantasy to overcome 'fundamental human limitations'. Although noble in aim, transhumanists need to balance this ambition with humility in their "wish to eradicate, or at least radically diminish, human vulnerability." (Coeckelbergh 2013, 10) These insights from Lacan and Coeckelbergh are fundamental to realistically inform their transhumanist belief "that by using technologies ranging from artificial intelligence to genetic engineering, we will reach this aim" (Coeckelbergh 2013, 10).

Coeckelbergh argues development and use of new technologies transform "vulnerability and therefore change what we are" which leads him to "conclude that we have not diminished but transformed human vulnerability." With this insight, Coeckelbergh suggests we should "engage in an ethics of vulnerability." (2013, 12) He suggests when considering the development of new technologies "we first need to analyse the precise ways in which our vulnerability is transformed by technology, the ways in which we are at risk today. Then we can try to evaluate these transformations." Fundamentally, our position aligns to Coeckelbergh's when he argues "that the transhumanist project must necessarily fail in so far as it aims to eradicate vulnerability and risk: if we were to become posthuman at all, we would still be vulnerable—albeit in different ways than now." We argue that the attachment to the transhumanist fantasy needs to be traversed and agree that "proponents of human enhancement should acknowledge that

human enhancement technologies will not diminish vulnerability but create new vulnerabilities. Instead of dismissing opposition to their vision in terms of bias (Bostrom and Ord 2006), they should enter into a discussion about what kind of vulnerabilities are acceptable and what kind of vulnerable life we want to live." (Coeckelbergh 2013, 14) Coeckelbergh empathically rejects the transhumanist aim of reaching absolute invulnerability. This is clear when he says, "even if we had full control over the human and could fully design the human and enhance ourselves, become cyborgs, or upload our minds into virtual worlds or into machines, we would remain highly vulnerable entities." (Coeckelbergh 2013, 22)

Coeckelbergh uses the word vulnerability to emphasise "the subject (its capability to be wounded), whereas using the term risk emphasises the object (and the possibility that it wounds us)." (2013, 43) He claims it is important to use both "in order to capture these different dimensions." This is another way to appreciate Heidegger's influence on Coeckelbergh's work as he states "being-vulnerable and being-at-risk are both subjective and objective, or better, it is neither entirely subjective nor entirely objective. We are at risk. Vulnerability and risk emerge from or within a relation between subject and object, and in this being-vulnerable and being-at-risk, the strict separation between subject and object made by dualistic modern thinking disappears." (2013, 44)

This highlights how vulnerability arises and is shaped by technology. In other words, an object might not be a risk and cause the subject to be vulnerable until a specific form of technology opens the human to this risk where "the possibility that I will be violated is neither entirely in me nor entirely in the world . The possibility arises from my standing in relation to the world, in my openness to the world, and in my engagement with the world." (Coeckelbergh 2013, 44) For example, there is a risk that personal data can be gained from reading brain signals. However, the subject is not vulnerable to this until they use technology such as brain-computer interfaces. This highlights that being vulnerable "needs to be understood in an active way." In other words, "we make ourselves vulnerable; we put ourselves at risk, by our mental and physical actions. We eat, we travel, we work, we love, we hope, and these actions make us vulnerable. Vulnerability, therefore, is not a property of the human person but a feature of the relation between us and the world." Vulnerability is "not an objective feature that can be known separated from our subjectivity." (Coeckelbergh 2013, 54) In the context of this article, vulnerability is shaped and created by the technology we engage with. As we use technology to extend our possibilities for being-in-the-world and to "cope with our environment, we put ourselves at risk and we render ourselves vulnerable". (Coeckelbergh 2013, 54)

In summary, technology has this dual character of extension and vulnerability where it may at first appear that technology diminishes our vulnerability however "we discover new vulnerabilities, or, rather, we experience that our vulnerability has not diminished but is merely modified, transformed – if not increased." (Coeckelbergh 2013, 81) These insights have "important

implications for ethics of risk and the evaluation of new technologies. We need a normative anthropology of vulnerability which does not ask which objective risks are acceptable but what the human should become – that is, which vulnerability transformations we want." (Coeckelbergh 2013, 87) This ethics of technology or ethics of vulnerability "starts with a descriptive stage: how does a specific technology alter our vulnerability? Then one must evaluate whether that transformation contributes to the good life, to human flourishing." (Coeckelbergh 2013, 93)

Coeckelbergh refers to the ancient Greek myth of Achilles and argues that "if and in so far as posthuman heroes and their creators try to transcend vulnerable existence, they are bound to fail because they have – and always will have – heels." (2013, 204) He uses this metaphor to argue "as we create and use new technologies, new heels are created." Instead of making "a choice between vulnerable humans and invulnerable posthumans, or between vulnerability and invulnerability" he suggests ethics should focus on a choice between different forms of vulnerability. His work and ours is important to unveil and criticise the ideology (Gildersleeve et al. 2025) of "transhumanist proposals for human enhancement." (Coeckelbergh 2013, 204) As this section has shown, "we cannot fully control future vulnerability transformations," however "it is important that we evaluate what we are doing in the light of current and expected future vulnerability-technology configurations" (Coeckelbergh 2013, 204). Moreover, such evaluations should be undertaken with contextual ethical sensitivity to each situation including each individual's subjective experiences and choices. This will facilitate being-at-home where decisions are made consistent with a person's preferences and/or their best interests.

IV. Place and Technology

As noted in the previous section, the human being is not split from its world in a subject/object duality. Instead, "when Dasein directs itself towards something and grasps it, it does not somehow first get out of an inner sphere in which it has been proximally encapsulated, but its primary kind of Being is such that it is always 'outside' alongside entities which it encounters and which belong to a world already discovered." (Heidegger 1996, 58) This quote from Heidegger is important as it allows a transition to this next section on place which we argue is transformed through technology. Place is the human beings' position in the world where we are shaped by and shape our world. This fundamental immersion in the world is articulated by Jung in his autobiography when he says: "at times I feel as if I am spread out over the landscape and inside things, and am myself living in every tree, in the plashing of the waves, in the clouds and the animals that come and go, in the procession of the seasons. There is nothing in the Tower that has not grown into its own form over the decades, nothing with which I am not linked." (Jung [1961] 2011, 225)

Just as Coeckelbergh noted that it is wrong to split subject and object, our views on place suggest that postphenomenological analysis of technology needs to "be viewed both with regard to the objective characteristics of location and in terms of subjective experiences." (Douglas et al. 2002) To present an ontologically sound analysis of technological mediated experience, humans need to be understood in the context of place. For example, Relph states that "To be human is to have and to know your place. In a sense this is about putting down roots and feeling secure." (Barnes 2018, 12) Following from the previous sections on extension and vulnerability, we argue that technology can change our place or home-in-the-world, understood "as a safe, secure, intimate and personal space, private as opposed to public, and offering control and freedom over what happens within it." (Barnes 2018, 12) In this section, we elaborate how technology affects our place in the world and how it potentially allows one to feel 'at home' to enable this freedom, autonomy, and control.

Throughout our book on *Philosophy of Place* (Gildersleeve and Crowden, 2022) we elaborate the importance of understanding place from a dynamic perspective which "focuses on people's ongoing, evolving relationships with places." (Smaldone et al 2005, 400) Here we show that technology has a role in changing our place in the world which is important to move beyond understandings of technology "as simply 'here' – local, fixed, bounded, and, frequently, ahistorical." (Kemp 2011, 3) Instead, we want this article to highlight a relational view of technology through place which "conceptualizes it as process rather than entity – a fluid, dynamic field of constantly interacting elements, within and beyond itself." (Kemp 2011, 3) Place is fundamentally connected to experiencing the world as a home or not a home. For example, from "Heidegger's phenomenological perspective, we are not located in space-time. Instead, we are always somewhere more or less familiar. The existentially near place is somewhere Dasein understands through its disclosing of the place as place, and the existentially far space is somewhere that Dasein is unfamiliar with due to the character of its involvement with the other entities in that place." (Evans 2015, 45) This has important implications for linking to technology which shapes our being 'at-home' or 'not-at-home.'

Dovey (1985, 35) explains "Being at home is a mode of being whereby we are oriented within a spatial, temporal, and sociocultural order that we understand." Furthermore, "home is a sacred place, a secure place, a place of certainty and of stability. It is a principle by which we order our existence in space. Home is demarcated territory with both physical and symbolic boundaries that ensure that dwellers can control access and behavior within." We argue that technology can extend but also make being-at-home-in-the-world vulnerable. Technology can facilitate being-at-home-in-the-world which means "to know where you are; it means to inhabit a secure center and to be oriented in space." When an individual finds themselves at home-in-the-world they experience "a center of security, of possessed territory, a place of freedom where our own order

can become manifest, secure from the impositions of others. This aspect of home as a place of autonomy is also fundamentally linked to home as identity." Being-at-home also "suggests a certain dynamic adaptability. It allows for both the representation and the growth of identity." (Dovey 1985, 35) This means being-at-home is not a static phenomenon and immersion in technology changes our place and identity.

Being-at-home-in-the-world is about feeling ontologically secure, which is elucidated by Dupuis and Thorns (1998, 29), who state that ontological security is experienced in the home when the following four conditions are met:

i) home is a site of constancy in the social and material environment (security)

ii) home is a spatial context in which day-to-day routines of human existence are performed (security)

iii) home is a site where people feel most in control of their lives (stimulation) because they feel free from the surveillance that is part of the contemporary world (security)

iv) home is a secure base around which identities are constructed (security and identity).

These features should be considered alongside technology to evaluate when it has the effect of shaping an experience of being at home. Alternatively, technology may also create vulnerability when one or more of these features are not met.

To better understand the meaning of home in relation to technology it is important to recognise that it is often discussed "in the language of plants, especially in terms of roots. To have a strong sense of home and belonging is to have roots; to be forced to move is to be uprooted. This organic language is scarcely incidental. It implies that to have a home place is natural; it is metaphorically to belong to the earth." (Douglas et al., 2002) In other words, technology may create an experience of being extended into the world and belonging when roots are established in a place. Alternatively, technology may create a feeling of vulnerability, being uprooted and not-at-home-in-the-world.

A key figure in the philosophy of place is Bachelard, who suggests that being at "home is a way of finding a certain world comportment, of finding one's own way of being-in-the-world. To be at-home is to have a developed and familiar way of engaging with and in one's surroundings. Rather than an objective place, then, home is a style of being that one possesses." (Jacobson 2010, 221) This style is something that technology can extend to being-in-the-world. To properly conceptualise how technology facilitates being-at-home-in-the-world, it is necessary to recognize that home "is about belonging: a deep and often unnoticed familiarity that binds one to kin and community." (Dolezal 2017, 104) One way this occurs is when technology allows us to be "more grounded, safe, secure, and in tune with our surroundings." Thus, home through technology "is the site where one can realize oneself as a subject, not an object" (Dolezal 2017, 104). Everyone

has their unique home-in-the-world given or 'thrown' to them and being-at-home requires the knowledge of "how to position ourselves in the worlds we inhabit and how to find our way around them. Skills in navigating human worlds are primary requirements for successful human being." (Benson 2002, 4) In other words, some technologies (eyeglasses) are required by certain people to feel at-home-in-the-world, whereas those who have good eyesight but hearing difficulties will require different technology. Again, recognising the individual place-based nature of 'being-at-home' allows for the diversity of different individual experiences and choices to be best captured.

V. Technology and Being-at-Home

Dolezal (2017, 105) explains that being-at-home "both literally and figuratively, invokes this feeling of security, ease, comfort, and privacy." To not be at-home would then suggest the opposite of this and we argue this provides a phenomenological description of vulnerability. Although technology can extend some of our possibilities for being-in-the-world, it can also create a vulnerable situation where we experience a "displacement that alters a person's sense of self, place, and belonging." (Vandermark 2007, 243) Where technology creates this vulnerability, we experience not-being-at-home which can produce "anxiety and depression and diminishes social and functional abilities necessary for a healthy and meaningful life." Being-not-at-home due to vulnerabilities opened through technology can place us 'outside' of home, which "can incite emotions of anxiety, dread, terror, and panic amongst humans, because it violates our elemental need for place predicated on experience, and leads to the existential predicament of place-bereft individuals." (Price 2013, 125) Technology can have this effect "when the bond between person and place is threatened, the significance of place identity becomes apparent." (Durrheim, et al. 2005, 185)

When neurotechnology disrupts being-at-home-in-the-world through issues such as invasions of privacy and data security, bias and discrimination or concerns regarding a lack of transparency, there can be "a profound sense of disorientation, as individuals are forced to adjust to alien surroundings or to return to a place that has been profoundly altered." (Durrheim, et al. 2005, 185) When this vulnerable experience is introduced into our world there is a "bodily confusion as the corporeal routines, gestures and orientations that once gave meaning to life-in-place have been eradicated." This being-not-at-home through technology can also issue a "sense of alienation from a place that has been violated, degraded, or appropriated by others." (Durrheim et al. 2005, 185)

Alternatively, being-at-home-in-the-world is important to read alongside technology as it highlights "the notion of home and horizons-of-reach." (Cox and Holmes 2000, 68) Home and reach are "like breathing in and out: breathing in represents 'bringing home', breathing out represents a reaching out to beyond the home." As a result, reach "may be considered in terms of movement in and out of a place to regions beyond" (Cox and Holmes 2000, 68) and this is how the

extension relation extends our place and being-at-home-in-the-world. Achieving at-homeness and an expansion of world through technology develops a stronger connection with place and "can diminish experiences of the 'existential vacuum,' a world devoid of meaning, and replace them with stories of interconnection, improved health, and individual and collective well-being." (Cox and Holmes 2000, 68) Therefore, it is fundamental to understand that technology is a response to the surrounding environment as "the catalyst, the challenge, the inspiration, the solace, and the reward that generates a greater sense of belonging that connects people to place." (Harper et al. 2012, 1)

Technology also opens "up new possibilities of being, new dimensions of self." (Persson 2007, 51) Technology extends our world "through which we appropriate aspects of the world as anchors for self-identity" which creates "the emergence of environmental meaning through interaction." (Dovey 1985, 46) Technology allows the submerging of "oneself in new environments, associations, and experiences, a person gains new perspectives on and an enlightened understanding of home. Away from home, human horizons expand, and an individual may discover new aspects of the self that result in an inevitable reordering of the intimate world." (Terkenli 1995, 328)

The technological extension relation also expands being in the world through an "initiative of the active body, embracing and assimilating a certain sphere of foreign reality to its own body." (Seamon and Mugerauer 1985, 202) This process of "incorporation is essentially the movement from the strange to the familiar." What was once unfamiliar can be incorporated into our home as it is "carved out of the anonymous, the alien. Everything has been transmuted in the home; things have truly become annexed to our body, and incorporated". (Seamon and Mugerauer 1985, 202) This highlights how technology transforms the relation to not-being-at-home "when I am bodily uneasy, when my habits do not fit, or when they do not yield the results I expect." (Donohoe 2014, 15) Technology does this by offering the potential to be at-home through the process of "appropriation and territoriality, involving notions of possession, control and protection." (Cox and Holmes 2000, 68) Alternatively, the extension relation turns to a vulnerability relation when we experience not-being-at-home where the "usual natural attitude becomes disturbed by the change and we are forced to consciously reflect on things." (Suvantola 2018, 42) In the words of "Heidegger, the environment is not ready-to-hand any more; it is experienced as present-at-hand instead." (Suvantola 2018, 43) Extending this Heideggerian analysis we can say that when technology extends our being-in-the-world, it is experienced as transparent and 'ready-to-hand.' Alternatively, when technology makes the user vulnerable, technology becomes present-at-hand when it is no longer smoothly usable when it breaks, malfunctions, or becomes an object of reflection.

What is important to grasp from this article is that of the mutual relatedness of the extension/vulnerability relation. This is an inherent aspect of technology. When extending our place in the world, we simultaneously travel to "an alien place

[where] we are vulnerable." (Suvantola 2018, 47) To further add to this, technology creates a concurrent insideness and outsideness of place. If technology is successfully incorporated into our being-in-the-world, this is experienced as insideness "characterized by feelings of rootedness in and positive mergence with one's world." (Seamon & Sowers 2008, 45) However, technology can also bring with it an experience of "existential outsideness: A self-conscious and reflective uninvolvement, an alienation from people and places, homelessness, a sense of the unreality of the world, and of not belonging." (Relph 1976, 51) Thus, technology has this dual character of extension and vulnerability, where moving from feeling inside or at-home can be constantly challenged when "people feel some sort of lived division or separation between themselves and world – for example, the feeling of homesickness in a new place." (Seamon and Sowers 2008, 45) Most importantly, we need to understand that "outsideness and insideness constitute a fundamental dialectic" (Seamon and Sowers 2008, 45) and being inside home can easily slide into outsideness if vulnerabilities associated with technology are overlooked.

Before illustrating our claims with some practical examples, we will next briefly discuss how technology can permit a better 'fit' between a subject and their world but also has the potential to dislodge this 'fit' through vulnerability. The concept of 'fit' comes from Matthew King's book which makes use of Heidegger's philosophy to argue that "human happiness consists in our dwelling in this fitting together of human being and the being of beings, this fitting-together." (2009, 4) We can understand this in relation to technology and place as finding at-homeness or insideness occurs through this 'fitting-together.' We see this in Heidegger when he says the task of human beings is to "find what is fitting in their essence, which corresponds with the destining of being." (King 2009, 5) To fit is to be at-home-in-the-world such as when brain-computer interfaces allow us to fit into the world of communication. In other words, technology can facilitate fittingness, and when a person fits to their world "we fit in, we say that we are at home." (King 2009, 5) Alternatively, vulnerability is responsible for not fitting because it can create an experience of not-being-at-home-in-the-world if the brain-computer interface gets 'hacked.'

VI. Technology and Expanding Being-in-the-World

In an earlier article (Gildersleeve and Crowden 2019), we outlined a Heideggerian influenced view of consciousness expansion for psychoanalysis. Here we use this framework to argue technology can expand being-in-the-world when a person experiences a "psychological gridlock in their frustrated abilities to resolve a seemingly unsolvable problem. This stuck point is typically described as the patient feeling trapped, weighted down, in a state of crisis." (Gildersleeve and Crowden 2019, 131) We argue incorporating technology into our being-in-the-world can mark a significant shift "in consciousness, the result of a person having accessed, synthesized, and integrated 'vital' person specific information

concerning their natures [about their place in the world]." (Gildersleeve and Crowden 2019, 133) This occurs "at transition points where the 'me' and the 'not me' collide and form an expanded view of the self-resulting in an expansion of consciousness." (Gildersleeve and Crowden 2019, 133) In other words, expansion and extension of place and being-in-the-world begins with "a problem to be resolved that is initially experienced as unsolvable." (Gildersleeve and Crowden 2019, 133) Telehealth could be given as an example here where those located rurally faced a stuck point where they could not access healthcare before the invention and implementation of this technology. Once this technology became available, it could be argued there was an accompanying expansion of consciousness as new possibilities entered their being-in-the-world, creating a greater sense of being-at-home.

This extension of being-in-the-world is an 'event' which can be 'traumatic' to the causality of our symbolic universe. Here it is useful to quote de Klerk, who explains what Lacan means by the symbolic universe:

> Lacan calls the symbolic universe the 'aletheosphere,' (XVII, 1959-60; 161) thereby alluding to the fact that this is the realm in which meaning-as-truth is negotiated (the world is named), both subjectively and inter-subjectively. It is the sphere in which objects are given a 'reason for being' as Freire would put it; it implies the interrelationship of the subject and the symbolic net of relations that wraps itself around, and gives shape to, the world. (2009, 49)

It is clear this appears to be influenced by Heidegger's writings on *aletheia* as an unconcealment of truth. Thus, we argue incorporating technology into our being-in-the-world can cause remodelling to the symbolic universe through a new unconcealed place in the world. Technology is an event and a response to an event. When an event such as being unable to access healthcare "erupts for the first time it is experienced as a contingent trauma, as an intrusion of a certain nonsymbolized Real." (Žižek 1989, 64) When technology is interpreted with Žižek and Lacan, a new understanding is revealed. Technology is a response to "an intrusion of a certain nonsymbolized Real." Technology allows an intrusive event to find "its place in the symbolic network; it is realized in the symbolic order." (Žižek 1989, 64) Technology facilitates an event to be integrated into the causal symbolic order revealing a new understanding of our place in the world.

As a result, incorporation of technology into our being-in-the-world offers a "passage from a lawless series to a lawlike series." (Žižek 1989, 65) Technology mediates a transition from not understanding the meaning of an event (experienced through the Real) to understanding its meaning through the 'law' of the symbolic order. For a new understanding of place to occur through technology, we must achieve a "symbolic appropriation of a traumatic, non-symbolized event." (Žižek 1989, 65)

An event is experienced from outside the symbolic universe of cause and effect and is therefore not comprehended when initially encountered. When a person meaningfully connects the 'nonsymbolised Real' experience of an event

with technology, they can extend, expand, and alter their being-in-the-world. This is a growth process of (transcendence) expanding the symbolic universe of cause and effect to better understand their place in the world (see Figure 1, Gildersleeve, Crowden 2019). The referenced figure in our earlier paper represents a person's symbolic universe of cause and effect. The star signifies the event that is experienced as 'nonsymbolized Real' outside the symbolic. When we meaningfully connect and relate the event to our symbolic universe through technology, our symbolic universe can include a new connection(e.g., network node) that was previously misunderstood or misrecognised. This is how the technology expands an understanding of our place in the world (the symbolic universe or 'aletheosphere' enlarges to incorporate the event into the order of cause and effect).

An event "acts in the interstices of the direct causal network. What Lacan has in mind here is specifically the working of the unconscious." (Žižek 2016, 125) Before the meaning of an event is incorporated into the symbolic order, its meaning is unconscious and is not understood. By understanding an event and technology in this manner, it paves the way for us to discuss "the old topic of 'causality and freedom': freedom is opposed to causality, but not to the cause." (Žižek 2009a, 289; see also Gullatz and Gildersleeve 2018) Technology can break the circuit of an obstructive event to provide freedom from the cause and effect of the preceding symbolic universe. Technological expansion of world can be understood further by noting "both Lacan and Badiou share the notion of a radical cut/rupture, 'event,' encounter with the Real, which opens up the space for the work of sublimation, of creating the new order." (Žižek 2002, lxxxiii) In other words, technology is a response to an event as a radical cut/rupture in the symbolic order. This opens the freedom for technology to provide a broadened and fresh understanding of our place in the world (bottom part of figure 1, Gildersleeve and Crowden 2019). Technology as a response to an event can provide the unique experience "of the complete symbolic alteration in which, although nothing has changed in reality, all of a sudden nothing remains the same." (Žižek 2002, lxxxiii)

Technology has this potential when we confront a "fundamental impasse of the symbolic order" (Žižek 2002, lxxxi) such as when brain-computer interfaces translate thoughts into voice output. Initially the loss of speech is presented as a traumatic event and the ability to communicate with the world is not initially understood because of the limits of our symbolic universe and understanding of our place in the world. However, when the meaning of this event is understood through technological innovation, we gain a new understanding of our place and our symbolic universe of possibilities expands (figure 1, Gildersleeve, Crowden 2019). When we encounter this new understanding, it can be described as "a brief traumatic encounter, or illuminating shock, in the midst of common reality." (Žižek 2002, lxxxi) This breakthrough provided by technology changes our understanding of self and place in the world where "the normal flow of things is

interrupted, another dimension breaks in." (Žižek 2014a) This highlights technology as an example of "a philosophical Event in the sense of a traumatic intrusion of something New which remains unacceptable for the predominant view." (Žižek 2014b) Žižek describes an event as "a sudden traumatic encounter with another, supra-sensible dimension which strikes us like lightning and shatters our entire life." This impact of technology is clear when we consider its effect on those who have lost their ability to speak or interact with the world and it opens and expands their ability to achieve this.

This highlights that technology can be described as a change in our 'pre-understanding' of our place in the world. Technology articulated in this way can be understood as a transcendental-hermeneutic "move towards this horizon of pre-understanding." (Žižek 2014a, 91) In other words, combining technology with Žižek we can better understand "what Heidegger means by the Event of the disclosure of being." Said differently, technology "at its most radical involves not a change in reality, but a shift in how things appear to us, in our fundamental pre-understanding of reality." This shift provided by technology "changes the basic mode of our relating to reality. As such, it is an event: at its most elementary, an event is not something that occurs within the world, but just such a change of the frame through which we perceive the world and engage in it." Therefore, incorporating a new technology into our being-in-the-world "designates the 'event' of a new epochal disclosure of Being, the emergence of a new 'world' (as the horizon of meaning within which all entities appear)." (Žižek 2014a, 93) Technology has this ability to shatter "the transcendental coordinates of a world" (Žižek 2012, 609) and this is necessary to expand our symbolic universe to better understand our place in the world.

VII. Practical Case Examples: Neurotechnology as Cyborg Intentionality

In this final section we apply our framework to neurotechnology case examples. Neurotechnologies can offer many extensions to being-in-the-world, such as medical treatment, including deep brain stimulation, restoring lost function through protheses, communication via thought (brain activity) and computer interfaces, or cochlear implants that allow for hearing. Neurotechnology can also identify and mitigate seizures or be used with neuromodulation for anxiety, depression, or OCD. An article by Zhang et al. (2024) outlines the many extensions that neurotechnologies can offer. However, as our article highlights, where there are extension relations, vulnerabilities also enter our being-in-the-world. Some of these vulnerabilities include breaches to privacy, autonomy, and consent. Alternatively, there may be a lack of transparency, equity, and fairness. Furthermore, there are many reports of neurotechnology impacting identity, safety, bias, and potential surveillance. Some of these are discussed in a recent article (Yuste et al. 2017).

As mentioned at the beginning of this article, Verbeek (2008) extends Ihde's earlier work where he outlines cyborg intentionality as another human-

technology relation that postphenomenology can investigate. However, what is unique about cyborg intentionality is that it is not a form of technologically mediated intentionality which "occurs when human intentionality takes place through technology." (Verbeek 2008, 387) Instead, cyborg intentionality has two components "hybrid intentionality occurs when the technological actually merges with the human; and composite intentionality is the addition of human intentionality and the intentionality of technological artifacts." (Verbeek 2008, 387) In this section we will outline how these forms of intentionality can both open being-in-the-world to the extension relation but also to a vulnerability relation.

Firstly, hybrid intentionality is when "the human and the technological are merged into a new entity, rather than interrelated, as in Ihde's human–technology relations." (Verbeek 2008, 390) We argue that this is when the extension or vulnerability relations to our being-in-the-world become more intimate compared to mediated technological experiences. This hybrid experience can have a more profound effect on the user's identity compared to mediated technology. Examples of neurotechnology introducing this effect on identity are discussed by Müller and Rotter (2017).

Secondly, composite intentionality can also have a more intimate impact on the user; this is because "not only human beings have intentionality, but also the technological artifacts they are using." (Verbeek 2008, 390) This can have profound effects on many other ethical issues mentioned above such as autonomy, transparency, bias, and surveillance. When technological intentionality is merged with human intentionality it can affect the users' choices, the intentionality of the technology may also not be transparent to the user. Furthermore, the intentionality of the technology could be biased from the training data it was developed with and it could more closely invade privacy when its intentionality is directed at neuro-surveillance.

Verbeek briefly mentions some neurotechnology examples, but these are not conceptualised in relation to the ethics of neurotechnology, nor is it conceptualised with our place, extension, and vulnerability framework. Verbeek says, "when microchips are implanted to enhance the vision of visually impaired people" there "is no embodiment relation anymore – at least, not a relation which could compare to wearing eyeglasses or using a telephone." (Verbeek 2008, 391) With cyborg intentionality "a new entity comes about" and "this association physically alters the human." Verbeek explains technologies used "like telescopes and hearing aids, help to constitute us as different human beings, whereas technologies incorporated constitute a new, hybrid being – which could, in principle, also use technologies which help to constitute as different transhumans." (Verbeek 2008, 392) This link from cyborg intentionality to transhumanism is important to connect to our earlier section on vulnerability which notes that the transhumanist dream to extend our being-in-the-world will always be accompanied by new vulnerabilities. In other words, our work here is important

for highlighting the impact of both extension and vulnerability on posthumans. An example of this can be highlighted when considering the composite intentionality of a brain-computer interface. The name 'brain-computer interface' highlights the composite nature of this hybrid human being where some intentionality comes from the brain and some intentionality comes from the computer. This technology offers many extensions to being-in-the-world, such as allowing communication through thoughts or paralysed users to operate motorised wheelchairs or robotic arms. These extensions come about through a merging of human and machine where the intentionality of both contributes to the output.

Although these benefits are often discussed and are promoted through 'neurohype' and the 'injunction to enjoy' (Gildersleeve et al 2025), it is important to not forget that brain-computer interfaces are made of a composite intentionality that can affect autonomy. For example, incorporating neurotechnology into a new hybrid being may make it difficult to determine who is truly responsible for a decision or action. This technology could also potentially override user decision-making if it exploits vulnerable disabled users or those experiencing fatigue whom it judges do not have capacity. This merging of brain and computer through composite intentionality could also change the sense of self into a 'hybrid identity' (Babushkina and Votsis, 2022) which the user does not identify with. Babushkina and Votsis (2022, 611) discuss the "vulnerabilities that arise from hybrid identity, notably the asymmetric and asynchronous relationship between the human and artificial counterparts." This disruption to identity is also discussed by Yuste et al. (2017, 162), who report that a neurotechnology participant noted their identity "blurs to the point where I'm not sure frankly, who I am." These examples show that technological intentionality can be directed at specific aspects of reality that do not match the authenticity of the user. This composite intentionality is clearly described when Verbeek says it involves "a technologically generated representation of the world, which inevitably is the product of a specific technological directedness at the world." (Verbeek 2008, 393) Although this representation and directedness allows certain extensions for being-in-the-world such as controlling a computer via brain signals, this directedness opens humans to many vulnerabilities, including an invasion of neural privacy.

VIII. Summary

Our article provides a new framework to demonstrate how "technological development has reached a stage in which technology has started to interfere explicitly with the nature of human beings." (Verbeek 2008, 394) Specifically, we highlight both an extension relation and vulnerability relation that technology opens to being-in-the-world while also showing the difficulties with posthumanism ideals. We applied our framework to postphenomenology, place, and discussed cases on cyborg intentionality and from neurotechnology. This 'hybrid' of theoretical frameworks contributes to recognising the effects that

technology has on our being-in-the world and "to a better understanding of the posthuman or perhaps even transhuman beings we are becoming – and to the development of a better sense of the limits of humanity". (Verbeek 2008, 387)

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