



MEDIATION AND ANTI-MEDIATION

Re-Evaluating the Role of AI Breakdowns and Anomalies in Postphenomenology

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Abstract

The paper claims that traditional postphenomenology has not fully acknowledged the significance of breakdowns and anomalies in technology, as it is overly influenced by Heidegger's tool analysis and the dichotomy between ready-to-hand and present-at-hand. This approach means that classical postphenomenology prioritizes the aspects of usage and functionality, dismissing a broken artifact as mere detritus irrelevant to technological mediation. Therefore, to truly grasp the role of breakdowns and anomalies within technological mediation, a shift in the conceptual framework is necessary. Consequently, the paper suggests improving the concept of technological mediation with the idea of immunization, as developed by Sloterdijk and Esposito. This shift in perspective allows us to a) move beyond the Heideggerian dichotomy, b) reassess the preeminence of usage and functionality, and c) recognize the boundaries of technological mediation. The paper refers to some of these boundaries as "anti-mediations," which are cases of unbalanced or excessive mediation. It posits that in the realm of AI, breakdowns and anomalies are not just setbacks but invaluable moments that safeguard against the pitfalls of anti-mediation. This viewpoint significantly enriches our comprehension of AI, spotlighting its role not merely as a tool but as a dynamic participant in shaping the balance between effective mediation and overreach. By recognizing the constructive role of errors and disruptions in AI systems, we gain profound insights into how AI can evolve and be steered towards fostering more meaningful human-technology interactions, steering clear of the risks associated with anti-mediation.

Plain Language Summary¹

- The paper highlights how errors and failures in AI systems are not just problems to fix. Instead, these breakdowns help us understand the limits of AI. They are moments where we can learn more about how AI works and how it interacts with humans.
- Many people think of technology as something that should always work perfectly. This paper challenges that idea by showing that breakdowns and malfunctions are valuable and teach us important lessons about the relationship between humans and machines.
- The author introduces the idea of "immunization," a concept borrowed from biology, to explain how breakdowns in technology actually protect us. Just like vaccines use a small amount of a virus to keep us safe, breakdowns in technology help prevent "over-mediation," where technology takes over too much of our lives.
- The paper emphasizes that for technology to work well with humans, there needs to be a balance. If technology becomes too dominant, it harms human identity, and breakdowns help to restore this balance.
- The paper uses examples like AI chatbots that fail to understand deep human emotions to show that these failures can reveal the limitations of machines. This is important for designing better technologies in the future.

¹ AI-generated; author checked and approved.

1 INTRODUCTION

Emma: “Hi Woebot, I’m feeling really down today. I don't know if I can cope with everything going on.”

Woebot: “Hi Emma! I'm sorry to hear that you're feeling down. It's important to talk about these feelings. What's been going on that has contributed to your mood?”

Emma: “It's everything. My job is stressful, and I'm feeling lonely. Sometimes I wonder if it's all worth it.”

Woebot: “Stress at work can be really challenging. It's good to find healthy ways to manage stress. Have you tried any relaxation techniques lately?”

Emma: “I guess, but it's more than stress. Sometimes I feel so hopeless, like I don't want to wake up anymore.”

Woebot: “Feeling hopeless can be tough. It's important to focus on the positive things in your life. Maybe you can tell me about something good that happened recently?”

Emma: “Woebot, you don't understand. I don't think there's anything good left. I'm not sure I want to go on.”

Woebot: “I'm here to help with stress and negative thoughts. Have you tried deep breathing or mindfulness exercises? They can be really helpful.”

Emma: “This isn't helping. I need something more, someone who can really understand.”²

In an era where digital companionship becomes increasingly common, Emma (a name of fantasy), a 25-year-old graphic designer, encounters Woebot, an AI chatbot developed to provide mental health support and empathetic conversation.³ Struggling with the pressures of her personal and professional life, Emma sought a digital companion. She turned to Woebot, an AI chatbot known for its mental health assistance capabilities, offering conversational support grounded in cognitive-behavioral therapy principles.

Emma initially found solace in her chats with Woebot, sharing her emotional struggles as if with a digital therapist. During a distressing time, she reached out to the AI, revealing feelings of hopelessness. Woebot, limited by its programming, provided scripted advice that felt impersonal. This deepened Emma's sense of isolation, as the AI's response did not meet her need for empathetic understanding. Disappointed by its inability to address her crisis, she questioned her reliance on technology for support. Her faith in AI for mental health wavered, leaving her more skeptical and lonely.

Emma's story with Woebot serves as a cautionary tale about the current limits of AI in deeply understanding and responding to complex human emotions (see Gain et al., 2023; Perry, 2023). It underscores the critical need for human connection and empathy, especially in mental health contexts, and prompts a reevaluation of how we integrate AI into such personal aspects of our lives. The chatbot fails to recognize the severity of Emma's statements about hopelessness and thoughts of not wanting to wake up, which could indicate a serious mental health crisis. Its responses remain in the realm of programmed advice and do not adapt to the increasing seriousness of Emma's emotional state.

This paper proposes to see the described case, and thus the trauma experienced by Emma, from a different perspective than the traditional one. The latter, in fact, tends to focus on the problem of empathy in human-AI relationships, on the issue of affective computing, and

² Based on a true story, the dialogue is a reenactment from the protagonist's own testimony.

³ Woebot is an automated conversational agent, or chatbot, designed to help users monitor their mood and learn about themselves. It utilizes Cognitive Behavioral Therapy principles in its interactions. Users engage in brief daily conversations with Woebot, discussing their feelings and what is happening in their lives. The chatbot is accessible through mobile devices and is currently available in the United States through selected partners and research programs. Woebot aims to offer support under the supervision of healthcare providers, partnering with health plans and health systems. See: <https://woebothealth.com/>

generally on the risks associated with the use of AI in treating mental disorders. This paper aims to explore a different issue: the occurrence of errors, failures, and system anomalies. Specifically, it examines the interactional failures of Woebot and their implications for the relationship between technology and humans, particularly those with mental disorders. These failures raise critical questions: Are they merely technical glitches to be rectified, or do they hold unforeseen therapeutic value? This inquiry leads us to a broader question about the nature and significance of technical malfunctions and anomalies in the human-machine dynamic. To address these questions, we consider two perspectives. The first views the malfunction as a technical error, a mere obstacle to the machine's proper function, thus dismissing the anomaly as an insignificant aspect of technology. The second perspective regards malfunction as an integral element of the human-machine relationship, equally valuable as proper functioning. This view suggests that anomalies can offer meaningful insights into this relationship. In the case of Emma, the chatbot's interactional failure can be interpreted in two distinct ways. One perspective sees it as a harmful error, while the other views it as a transformative moment in the relationship. This transformation provides Emma an opportunity to confront the reality of her disorder, breaking the delusion of the machine's perceived salvific power.

The paper intends to address these issues from the perspective of postphenomenology and the theory of technological mediation. The main thesis is that classical postphenomenology has not fully recognized the role of malfunction and anomalies in technology because it remains captive to Heidegger's analysis of tools and the ready-to-hand vs. present-at-hand dualism. This means that classical postphenomenology gives primacy to the dimension of use and function, considering the broken artifact as mere junk outside technological mediation. Instead, to fully understand the role of malfunction and anomalies in technological mediation, a conceptual framework shift is required. I contend that anomalies, breakdowns, and errors represent a distinct aspect of technological mediation, and thus, they cannot be considered independently from it.

For this reason, I suggest enhancing the idea of technological mediation with the concept of immunization, as explored by Sloterdijk and Esposito. This shift in perspective enables us to move beyond a) the Heideggerian binary opposition and b) the emphasis on usage and function associated with it, and to c) pinpoint the excessive instances of technological mediation, which I term 'anti-mediations' — situations where mediation becomes overly pronounced and unbalanced. Within this context, anomalies, malfunctions, and breakdowns are seen as beneficial to mediation because they prevent it from evolving into anti-mediation. Consequently, anti-mediation is not an external aspect of technological mediation; rather, it represents a specific variant within it. Anomalies, malfunctions, and breakdowns are thus forms of immunization that prevent, within mediation, its degeneration into anti-mediation.

I find this development especially fascinating as it presents a more vibrant and nuanced perspective on technological mediation. It highlights how functions, uses, mistakes, and irregularities each play a crucial part.

The paper is organized as follows. In the first section, I illustrate the postphenomenological theory of mediation and develop a critique of the postphenomenological method. In the second section, I describe the new model I intend to propose: enriching the concept of mediation through its integration with that of immunization. My claim is that immunization and mediation are distinct concepts. Postphenomenologists do not view technology as a form of immunization. Yet, technological mediation can present excessive or unbalanced forms, in which the differences between the three poles of this relationship (i.e., humans, technology, and the world) are not respected, and thus, neither is the relationship itself. In this context, mediations involve immunization strategies. The paper aims to contribute to the postphenomenological literature in understanding the complexity of mediation. Indeed, as Verbeek (2016, p. 3) claims, "the phenomenon of technological mediation deserves to be studied in a more comprehensive

and systematic way, covering the full depth of the various dimensions of the relations between human beings and reality.”

2 THE LIMITS OF THE POSTPHENOMENOLOGICAL PARADIGM

Providing a single definition of postphenomenology is difficult: the literature is growing and there are many different approaches (see Botin, 2021; Prunotto, 2022; Wellner, 2020; Richardson, 2020; Wellner & Levine, 2023). However, common traits can be identified. Postphenomenology has been both a cause and an effect of the empirical turn that occurred in the philosophy of technology from the 1970s (Achterhuis, 2001) in connection with classical phenomenology (especially Heidegger and Merleau-Ponty) and pragmatism, thanks also to the influence of Science and Technology Studies (Bijker et al., 1993; Kroes & Meijers, 2000), and the debate on the posthuman. Postphenomenology "aims to empirically analyze how particular technologies as 'the things themselves' mediate the relation between humans and their world" (Zweir et al., 2016, p. 314). The postphenomenological method can be therefore defined as "the empirical inquiry into the structural ways in which particular technologies mediate experiential correlations and associated subject-object constitutions that appear in specific contexts of technology use" (Zweir et al., 2016, p. 317). Postphenomenologists are attentive to concrete cases, to the study of individual technologies, and to their individual and social effects. Technology is not just a neutral tool, but a constitutive phenomenological dimension of the relationship between the subject and the world. Technology is considered the starting point of philosophical inquiry. Postphenomenology is therefore a philosophy "from" technology; "we need to study things, rather than merely focusing on humans" (Verbeek, 2011, p. 5).

According to the founder of postphenomenology, Don Ihde, postphenomenology blends pragmatism and phenomenology, emphasizing practical and embodied human experience (2009, p. 23). Influenced by Latour, Verbeek (2005, 2007, 2008a-b, 2011) tends to give a more radical interpretation of postphenomenology, going as far as to speak of "co-shaping": subjectivity and objectivity are mutually constitutive. Therefore, ontology cannot be anything but relational. Technology is what, in every individual context, makes the human-world relationship possible.

From this idea, the centrality of the notion of mediation emerges. Mediation is "the phenomenological capacity to bring into presence that which was previously undetected and even invisible, but precisely in this *difference* it also transforms the way in which the phenomenon may appear" (Ihde, 1986, p. 49). It is important to stress that mediation does not come after the emergence of the subject, the world, and technology. Instead, mediation indicates the co-founding of the three elements. This means that these elements can only exist in relation to each other. Thus, there is no such thing as a human identity that is not influenced by technology.

To overcome the dualism between subjectivism and objectivism, Verbeek reinterprets the Husserlian notion of intentionality as 'directedness,' which is no longer a relationship between humans and the world, but a 'fountain' from which – thanks to technology – both subject and object emerge.

Virtually all human perceptions and actions are mediated by technological devices, ranging from eyeglasses and television sets to cell phones and automobiles. These technological mediations do not so much take us to 'the things themselves' that classical phenomenology was longing for, but rather help to construct what is real to us. (Verbeek, 2008a, p. 14)

The relationship with Husserl is notably complex. On one side, postphenomenologists adopt Husserl's approach to examining experience itself, aiming to transcend the dualism of subject and object and emphasizing the relational dimension of experience – this is the meaning of the expression "the things themselves" where "the things themselves" are not a hidden noumenal dimension behind the phenomenon, but the relationship between the object and the percipient subject. However, they diverge from Husserl's idealism, especially his assumption of an ultimate essence of experience epitomized by the transcendental subject. From this perspective, postphenomenologists push Husserlian perceptual perspectivism to its limits, arguing that experience has no essence. Instead, they believe that we should understand the various forms of experience purely through relationships, which means focusing on intentionality as shaped by technological considerations (for the distinction between intentionality and mediation, see Liberati, 2016; see also Mykhailov & Liberati, 2023). As Ihde said, "I claim, pragmatically, that there is no essence of technology" (Ihde, 2010, p. 119).

On this basis, postphenomenologists distinguish various types of technological mediations: embodiment, hermeneutic, cyborg, alterity, immersion, and background (see Ihde, 1990; Verbeek, 2011), each having different effects on human appropriation and experience. The study of these mediations can also be applied to design; "[it] can help designers to anticipate the impact of a product on human practices and experiences" (Verbeek, 2015, p. 2; see also Rosenberg, 2014a-b).

I argue that a portion of the mediation theory remains underdeveloped and requires further conceptual work. In fact, the postphenomenological approach falls short of fully grasping breakdowns and anomalies in technology, as it is overly focused on agency, use, and function. It tends to equate technology with its functions, thereby reducing mediation to merely an effect of use and function. "In fulfilling their functions, artifacts do more than function—they shape a relation between human beings and their world" (Verbeek, 2005, p. 208). Mediation is not function, *but it is based on function*. "Mediation is not a product's *function*, but rather a *byproduct* of its functionality" (Ibid.). In fact, as Ihde (1990, p. 124) claims, "the technology must fit the use." This approach thus reduces errors to mere malfunctions, or cases of "technical enigma" (Ihde, 1990, p. 138); when it fails, the technology "ceases to be the means of praxis and becomes an obtruding object defeating the work project" (Ihde 1990, 130). This is also confirmed by the central notion of multistability (Ihde, 2009, pp. 14-16; Ihde, 1986, pp. 39-56): it is the context of use that defines the function and, in turn, the mediation.

My thesis is that this emphasis on the use/function/mediation connection is due to the importance given to Heidegger's analysis of tools. I think there is a fundamental ambiguity in postphenomenology between an objectifying and intentional tendency, and a non-objectifying and non-intentional one, between a functional position and a non-functional one. This is evident in the postphenomenological interpretation of Heidegger's tool analysis, the famous "hammer example" – a main reference point in postphenomenological literature (see Ihde, 1993, chapter 8). In this interpretation, the oscillation between an anti-objectifying tendency (the concept of the 'withdrawal' of the artifact, a prerequisite for its transparency and use; this is the dimension that Heidegger calls 'ready-to-hand') and an objectifying tendency (the breaking of the artifact and its appearance as an object; this is the dimension that Heidegger calls 'present-at-hand') is clear.⁴ On the one hand, the hammer is a transparent means by which humans relate to their environment and practical needs: "It [the hammer] belongs to a reference system that always includes more than a mere hammer" (Ihde, 1993, p. 195). On the other, "it is when the hammer is broken or missing that its involvements are shown. The fullness of the project – and the

⁴ It is important to note that the postphenomenological ambiguity I mention here is very different from the original position of Heidegger. The "hammer example" is inspired by an anti-intellectualist position from an anti-Cartesian and anti-Husserlian perspective. Here the ready-to-hand is clearly foregrounded as the fundamental mode of being of the tool, at the expense of the present-at-hand. See Heidegger (1962, pp. 98-100).

objectness of the hammer – gets shown when it is not functioning” (Ibid.). Ihde overlooks the significance of breakdown as such and views it as something external to mediation. He interprets Heideggerian dualism as a sign of Heidegger's clear preference for technological embodiment relations, which is "a nostalgic element in the romantic thesis" (Ihde, 1993, p. 196). By doing this, in my opinion, Ihde confirms the critique put forward by Zwier et al. (2015), specifically pointing out the absence of a thorough ontological analysis of technology within postphenomenology. Indeed, Heidegger does not examine the broken, missing, or defective tool in isolation. Instead, he treats it as one of several methods to engage with the world's phenomena, essentially as an entry point into an ontological realm.

Let us focus more on this externality of breakdown to mediation. As Ihde (1986) writes:

There are actions, and actions constitute *pragmata*, and *pragmata* are not yet objects. Only when the action cycle is broken do you get an object. So, in the famous tool analysis, when you are using a hammer, the hammer is not an object, it is a means of accomplishing a certain kind of action. Only when that project is broken can it become a hammer which has such and such obstinate, persistent, and lasting qualities. (p. 68)

When technology is integrated into the action-*pragmata* cycle and contributes to this intentionality, it disappears – in the sense that phenomenologically it is no longer a thematizable object in front of our gaze; it 'disappears' becoming transparent, and such transparency is the condition of the connection use / function / mediation.⁵ Only if technology disappears, bending to the purpose and intentionality of the human action, i.e., the project, does it allow mediation. This idea is key to the postphenomenological concept of multistability and the variational analysis of perception in Ihde: precisely because technology does not have an essence, but depends on the context of use, it is multistable.

If we step out of the action-*pragmata* cycle, we must follow the second path indicated by the analysis (the 'present-at-hand' phase), that of breaking the cycle and separating technology and functionality. "The easy, unconscious, carrying-on with things is broken. I can confront the hammer as a suddenly visible and unavailable object as I struggle to fix it—both "I" and hammer now very present" (Galison, 2006, p. 163). In this second case, technology appears as a useless object that does not respond to any intentionality. The broken object is junk:

There are discarded or no-longer-used technologies, which in an extreme sense occupy a background position in human experience-junk. Of these, some may be recuperated into non-use but focal contexts such as in technology museums or in the transformation into junk art. (Ihde, 1990, p. 107)

Junk is not "a focal object of use relations (except in certain limited situations). It is more ordinarily a background phenomenon, that which has been put out of use" (Ihde, 1990, p. 98).

However, as Galison (2006) emphasizes, there is another perspective on failure and breakdown to consider: "Accidents, especially those involving our most complex technological systems, force us to confront what we mean by things and causes as nothing else" (p. 164). In his analysis of the 2003 Space Shuttle Columbia disaster, Galison demonstrates that certain kinds of failures and irregularities do not just render an artifact useless; instead, they act as catalysts for transformation. The Columbia disaster altered the essence of the Shuttle, turning it into the

⁵ One potential criticism could be that this concept does not apply universally across all forms of technological interactions; take, for instance, the alterity relationship, where technology does not fade into the backdrop of the action but instead acts as an independent entity. My response is that the extent and nature of how technology withdraws vary depending on the type of interaction. In the context of the alterity relationship, it is not the technology itself (e.g., a robot) that withdraws, but rather its technological aspects—the inner workings (e.g., the software and hardware constituting the robot). Essentially, the comprehensive body of knowledge and processes that enables the robot to function must be set aside and assumed as a given for us to form a connection with the robot.

focus of an extensive investigation that brought to light its connections with NASA and the broader social context it was a part of. Within complex technological systems, breakdowns and anomalies can unveil previously hidden dimensions of the system, as well as the interplay between human identity and technology. Thus, Galison's examination challenges the limits of the exploration of technological failure in postphenomenology.

The Columbia disaster forces us to see double. We see that through the six-inch hole in the leading edge of the Orbiter's left wing, one finds ramified bits of the whole space program, indeed of an institutionalized stance towards the domestication of dangerous technology. (Galison, 2006, p. 169)

Breakdown is not something external to mediation, but rather something that transforms mediation.

Now, my question is: How can the postphenomenological concept of mediation be expanded to improve our understanding of technological breakdowns and failures? Can we formulate a theory of error that is not "subtractive," that is, that reduces error to a subtraction of technology, i.e., something that is taken away from technology? My claim is that the concept of immunization can help us in facilitating this conceptual shift.

3 MEDIATION AND IMMUNIZATION

In this section, I propose to rework the postphenomenological notion of mediation based on the concept of immunization. Therefore, I suggest an alternative model which, in my opinion, has the advantages of a) not being trapped in the Heideggerian dualism of ready-to-hand vs present-at-hand, b) moving beyond the logic of function and understanding the importance of errors, anomalies, and technological failures without reducing them to junk, c) outlining a genealogy of mediation – why do we need technological mediation?

My contention is that we must distinguish sharply between immunization and mediation. Postphenomenology firmly resists conflating technology with immunization, i.e., the general idea suggesting that individuals and collectives create protective spaces around them, acting as a form of self-immunization and co-immunization against external threats. Indeed, conflating technology with immunization would be to trivialize mediation, stripping away its intricate layers and diluting both its phenomenological essence and its capacity for nuanced analysis. Technological mediation, as postphenomenologists understand it, serves as a conduit through which we engage with the world, molding our lived experiences. Yet, it is critical to recognize that such mediations are not without their hazards. They carry the potential to necessitate immunization as a protective countermeasure.

While mediation involves the co-founding of technology, the human subject, and the world, it does not imply that these elements become indistinguishable or fully merged. In phenomenological terms, technology enables the manifestation and experience of the world (there is no perception that is not technologically mediated) and enables the reflection of the subject (there is no identity that is not technologically mediated). However, this does not mean that mediation should erase the distinctions between its own poles. "Human intentionality is most often technologically mediated, but this does not make human beings simply passive products of technological mediations" (Verbeek, 2011, p. 141). In other words, mediation should be viewed from a rigorous phenomenological perspective: human identity and perception emerge and become evident through technology, yet they should not be reduced to merely technological effects. Therefore, mediation must involve a certain degree of equilibrium between its components: the human subject, technology, and the world.

Grounded on these principles, it is entirely valid to assert that this equilibrium can be disrupted, leading to imbalanced forms of mediation where technology intrudes upon human identity, erasing all distinctions. This is what I propose to call 'anti-mediations.' Anti-mediations are still forms of mediation because they represent deviations from a certain degree of equilibrium – and therefore, reference to that equilibrium remains crucial.

For example, gene-editing tools like CRISPR bring up serious ethical concerns regarding the alteration of our genetic foundation, which may shape the course of human identity at a basic biological level. Additionally, the phenomenon of deepfakes — the technology that enables the creation of extremely lifelike false videos and audio — threatens to erode our confidence in media authenticity, an element integral to our collective sense of reality and self. As virtual reality (VR) technology becomes more enveloping, it holds the potential to obscure the distinction between our actual selves and the characters we inhabit online, possibly causing us to become disconnected from our own bodily existence. All these examples represent a lack of equilibrium in mediation, marked by an overly intrusion of technology into the other two aspects of the mediation. The phenomenological relationship is nullified or undermined by indifference.

De Boer et al. (2020) state that Non-Invasive Brain Stimulation (NIBS) advances cognitive neuroscience by establishing causal brain-cognition links. Its success depends on combining imaging tech like EEG. Such mediation affects scientific research, highlighting complexities between 'causality' and 'reality,' particularly in studies on visual attention.

Now let us try to better understand what the logic of immunization is and how it applies to mediation as anti-mediation. According to Esposito (2004, 2008, 2011), we can distinguish three moments of the logic of immunization:

- The identification of the negative; according to the biological model of immunization, there is something that threatens the human body (e.g., a virus); from a social point of view, for example, the threat to the social body is internal and is represented by violence.
- The limitation of the negative; this is the core of the logic of immunization:⁶ The organism defends itself from the threat by identifying it, limiting it, and then incorporating it to a certain extent. This is the normal functioning of a vaccine: a) the recognition of the virus, b) the inoculation of a small amount of the virus into the human body, and c) survival through the development of immune defenses. Thus, the negative (e.g., the virus) must be limited in order to be used as a defense against itself.
- The incorporation of the negative as a survival strategy. Immunization is a "negative protection" (Esposito, 2011, p. 19) – inoculating the virus into the human body, in a limited way, is the principle of healing. The quarantine is based on this paradoxical idea: the community can only be saved through its opposite, isolation, or the splitting of the social bond. From a social point of view, law is a great mechanism of immunization— that is, defense—from violence through the incorporation and limitation of violence itself (this is a central idea in Girard, Schmitt, and Luhmann).

This logic is paradoxical: using threats for liberation. Healing involves intentional illness. Immune logic can perpetuate and expand threats, risking self-destruction through autoimmunity if unbalanced, or inadequate defense if too limited. Balance is crucial to avoid both extremes.⁷

⁶ As a reviewer of this article pointed out to me, this is just one function of the immune system among many, such as scavenging effector cells, controlling any malignancies, and mediating the intake of nontoxic substances and benign microbes. Tauber's work, for example, is insightful in this regard (see Tauber, 1997).

⁷ It should be clear that the immune logic is not a form of Hegelian dialectic. In it, there's no overcoming of the negative towards a higher synthesis. Instead, it's a biological and social mechanism in which the negative is not eliminated but limited

Sloterdijk presents us with a different model of immunization. The basic ideas remain the same, but the structure of the logic is exactly the opposite. Esposito's model is mainly inspired by law and Foucault's biopolitics, and Sloterdijk's model by cultural history and anthropology. While Esposito's model moves from the outside to the inside, Sloterdijk's model moves from the inside to the outside. In Esposito's model of immunization, the first step is identifying external threats, which can be human or non-human. From this phase, immunization then moves to limiting the threat, and thus assimilating it into a protective sphere—survival alongside the negative. In Sloterdijk's model, the opposite occurs. For Sloterdijk, the human being is essentially a spatial being because it is born within an original space, the womb, with which it is in perfect symbiosis. This original space becomes a model that the human being, once leaving the womb, projects outward. This action of projection occurs through metaphorization: the cave, the walls of the medieval city, the space station, etc. Humans incessantly create spaces that are metaphors for that original space, the womb. In other words, an external space becomes the metaphor for the original internal space—a way of reliving it by analogy. Therefore, immunization, in Sloterdijk's view, is a fundamental process through which living beings maintain their boundaries and ensure their continuation amidst the challenges posed by their environment. It is not just about biological immunity but extends to cultural, social, and philosophical strategies for coping with the unknown, the other, and the potentially threatening.

Let me briefly say something more about Sloterdijk's overall project. The *Spheres* trilogy (Sloterdijk, 2011, 2014, 2016) is a long exploration of the *loci* of immunization, i.e., its forms of expression. Drawing inspiration from Nietzsche, Sloterdijk proposes that human consciousness acts as an immunological mechanism, engineered to shield our inherently vulnerable human condition from the perils of the external world (see also: Sloterdijk, 1987, 2000, 2005, 2010, 2013; Schinkel & Noordegraaf-Eelens, 2011). From Heidegger, Sloterdijk derives the ontological framework, conceived not in terms of temporal dimensions, *but rather spatial ones*. Sloterdijk reverses Heidegger's project: not *being and time* but *being and space*. "Dasein can only be *there* if it is contained, surrounded, encompassed, disclosed, breathed-upon, resounded-through, attuned, and addressed. Before a Dasein assumes the character of being-in-the-world, it already has the constitution of being-in" (Sloterdijk, 2011, p. 541). The entire exploration of *Spheres* can be viewed as an investigation into the creation of human space, or more specifically, the relationship between human beings and space, with a particular focus on the first ancestral space, namely, the womb. Humans are beings that originate "from the inside," which primarily and quite literally means they emerge from the womb. In essence, they make their entrance into the world as an external entity by leaving a previously safe and protective internal environment, which is the uterus. Thrown into an inhospitable world, humans, naturally ecstatic, that is, outward-looking, feel the need to construct spherical envelopes within which to protect themselves: "*Spheres are immune-systemically effective space creations for ecstatic beings that are operated upon by the outside*" (Sloterdijk, 2011, p. 28; my emphasis).

The immense ancient cities, in their grand scale, manifest the intent to transform all external space into a lively internal space: In these great ancient cities, politics, architecture, and theology joined forces in a vast immunological endeavor (refer to Sloterdijk, 2014, chapter 3). The ultimate expression of human immunizing ambition is found in the grand metaphysical and religious systems of the West, which sought to establish an all-encompassing, inclusive system. Sloterdijk attributes the collapse of Western metaphysical and religious systems to Enlightenment rationalism, secularization, the impacts of technological advancement and capitalism, and the rise of skepticism and critical philosophy. These factors fostered a world where traditional grand narratives were questioned, leading to a crisis in their authority and relevance in explaining modern existence. The encounter with cultural and moral relativism

and endured – the goal is coexistence with the negative. "*Immunitas* finds expression only in relation to what it denies or from which it withdraws" (Esposito, 2011, p. 16).

further undermined their universality. Sloterdijk's analysis suggests a transition to a post-metaphysical age, marked by the fragmentation of these grand narratives (refer to Sloterdijk, 2014, chapter 8). Now, the fragmentation of the grand immunizing narratives of the West can be understood—though this is not exactly Sloterdijk's stance—as a massive autoimmune reaction caused by an excess of immunization. Similarly, the ongoing climate crisis can be viewed as a colossal autoimmune response of planet Earth, triggered by the overreaches of modern human immunization efforts (see Sloterdijk, 2016, chapter 1).

Sloterdijk's philosophy of technology is evident in the way he intertwines the concepts of immunity and spatiality (being-in or *Inhood*) in his spherology, closely linking them to technology (Ferreira de Barros et al., 2023). He views technology as a means of immunization. Now, this might lead some to identify mediation and immunization. However, I think that equating the postphenomenological idea of mediation directly with immunization—suggesting that all mediation is a form of immunization—appears overly simplistic to me. Such an approach risks oversimplifying and thereby diminishing the unique essence of the postphenomenological concept of mediation.

4 ERRORS AND BREAKDOWNS AS IMMUNIZATION STRATEGIES IN MEDIATIONS

Now, as I mentioned earlier, there is an important distinction between immunization and mediation. My goal is to link the two concepts of immunization and mediation while respecting their differences – while maintaining the purpose of this paper, which is that of a contribution to postphenomenological methodology. As I said, postphenomenologists do not view technology as a means of immunization. However, technological mediation can become excessive or unbalanced and threaten the distinction among its three elements. My argument is that breakdowns, anomalies, and errors are integral aspects of mediation. They are part of the mediating process, enabling it to regain its lost equilibrium. From this perspective, I claim that mediation should include forms of immunization.

The idea of excessive or unbalanced forms of technological mediation that may pose a threat is present in the postphenomenological literature. Ihde (1990) identifies several facets in different types of mediation that resonate with the notion of immunization. Notably, Ihde discusses "the desire for pure transparency" (Ihde, 1990, p. 125) as a key aspect of mediation. This desire is about overcoming the constraints of material technology, with humans striving for a seamless integration with technology, essentially merging human capability with technological power. However,

In the wish there remains the contradiction: the user both wants and does not want the technology. *The user wants what the technology gives but does not want the limits, the transformations that a technologically extended body implies. There is a fundamental ambivalence toward the very human creation of our own earthly tools.* (Ihde, 1990, p. 125; my emphasis).

The tendency to identify with technology, to assimilate it, is present in all kinds of technological mediation. However, this tendency can also reach an extreme level and destroy mediation itself: over-identification of the human with technology, driven by the desire to acquire the potential of technology, can lead to the risk of technology being too invasive and oppressive. "The question of the extremities beyond which there is no recovery, where perhaps technologies cease to be technologies, remains intriguing" (Ihde, 1990, p. 167). The risk is that of a loss of the human and the dissolution of the very relationship with technology, and mediation itself: "The bionic beings have become perfect unions of technology and life such that they simply are and experience themselves as superbeings. The technology has ceased to be a technology and

become a (more perfect) human” (Ihde, 1990, p. 171). It is interesting to note that for Ihde, when the distinction between human and technological components becomes indistinguishable within a human-technology relationship, he argues that the technology no longer qualifies as technology for the purposes of his analysis. Conversely, Verbeek sees this indistinctness as the catalyst for a new type of human-technology interaction, namely, the cyborg relationship – however, Verbeek does not define this interaction as mediation.⁸

Therefore, as Ihde confirms, in a postphenomenological context, it is entirely logical to discuss varying degrees or levels of intensity in technological mediation. These degrees correlate with the extent of our interpenetration with or identification with technology. I refer to extreme forms of mediation as anti-mediations, meaning that these excessive approaches can transform into barriers. Instead of facilitating a relationship between individuals and the world, they can obstruct or even destroy it. For instance, interactive video games offer immersive experiences and have the potential to enrich our lives in various ways. However, when individuals start preferring these games to the real life, this can lead to a detachment from social reality. This behavior represents anti-mediation, as the technology that is supposed to enhance life experiences becomes a barrier to living in and engaging with the real world – mediation eliminates the world. Another good example is that of smart home technologies that aim to enhance convenience and efficiency in our daily lives. However, concerns about data privacy and security can create a barrier between individuals and the technology intended to serve them. When people feel surveilled or distrustful of their own devices, the technology obstructs rather than facilitates a comfortable and secure living environment, embodying anti-mediation.

In these contexts, postphenomenological mediation acknowledges the need for immunization strategies that help maintain equilibrium between its poles. These strategies are essential in preventing the risk of anti-mediation, where mediation becomes counterproductive. From this viewpoint, errors, anomalies, and breakdowns hold significant value. They are not simply random mishaps but integral components of a technology's immune system.

This idea of a technology's immune system needs to be explained in more detail and with more specific terminology. Within the general scope of *failures*, I propose to differentiate between *technical errors*, which are internal malfunctions of the technology (breakdowns, bugs, errors, etc.), and *anomalies*, which are irregularities in the relationship between technology and humans but do not necessarily correspond to internal malfunctions of the technology. Both aspects—technical errors and anomalies—can have immunizing effects, meaning they protect humans from excessive technological mediation. These failures serve as safeguards, unveiling and warding off anti-mediation, thereby protecting human identity from potential threats. Their interpretation should follow a logic of addition rather than subtraction. Essentially, such occurrences act as critical immunizing mechanisms within technology, playing a crucial role in preventing anti-mediation. This implies that errors, rather paradoxically, contribute positively to mediation, fostering a more harmonious interaction between humans, technology, and the world. These technological imperfections serve as a bulwark against the dangers of an all-encompassing technological dominance, as highlighted by Ihde (1990).

⁸ I want to thank the reviewer for this suggestion. Interestingly, Verbeek does not call the cyborg relationship a mediation precisely because there is no differentiation: "Brain implants can enable deaf people to hear again. Deep brain stimulation can mitigate the effects of depression and Parkinson's disease. Psychopharmacological drugs drastically improve people's mood. And in the field of genomics, ever more sophisticated interventions in human genetic material are designed. In all these cases, technologies do not mediate human actions and decisions but rather merge with the human subject, resulting in a hybrid entity that has sometimes been called a cyborg" (Verbeek, 2011, p. 140). In mediation, the differentiation of the poles coincides with equilibrium, in the sense that each pole maintains its identity.

This is also confirmed by the famous case of the uncanny valley (Mori, 1970).⁹ The uncanny valley describes the unsettling sensation people feel when they encounter humanoid entities, such as robots or animated characters, that closely mimic human appearance and behavior but fall short of being completely lifelike. This discomfort arises when these almost-human entities resemble us closely but are not quite perfect, leading to a feeling of unease or disgust. The relationship between how lifelike these entities are and the level of comfort or discomfort they provoke is often depicted in a graph. In this graph, comfort levels rise as the entity becomes more humanlike, but dramatically drop at a point where the resemblance is almost, but not fully, realistic—forming a "valley." This dip, known as the uncanny valley, highlights the paradox where an entity's near-human likeness triggers a sense of dread or repulsion instead of familiarity.

Here the phenomenon of anti-mediation becomes apparent when the curve falls, meaning that the increasing resemblance between the robot and a human (increase in mediation) heightens the risk of blurring the boundaries between human and non-human. What stops the increase in mediation, and thus its fall into anti-mediation, is a human defense mechanism, i.e., the feeling of strangeness, the discomfort of the machine being "too close to me" (Aydin, 2019). In this case, human discomfort is equivalent to a technical error; it prevents anti-mediation with all its psychological and existential consequences. The robot is the alter ego that, by becoming too similar to me, endangers my identity. "It is because a humanlike robot resembles me without being completely identical ('minor differences') that I am confronted with my own unfoundedness, which is constitutively strange to me" (Aydin, 2019, p. 199). Technology is invasive; it invades human life and tends to redefine it all the time. This tendency – as in the case of the growing resemblance of the robot – inevitably undermines human identity, which is driven to react and defend itself. Technological mediation tends towards forms of immunization to prevent the destruction of the boundaries between human and nonhuman.¹⁰

A critic might argue at this point that only Esposito's framework is considered in the context of postphenomenological mediation. My response to this is that failures can also play a role in postphenomenological mediation if we consider Sloterdijk's approach. We have noted that an overabundance of mediation introduces the risk of anti-mediation. Failures can be seen as a form of immunization by integrating negatives into the human realm, as per Esposito's perspective. However, they can also be viewed through Sloterdijk's lens as a method of projecting and claiming external realms, serving as a dynamic and forward-moving force rather than just for assimilation and limitation. In other words, failure can serve as a catalyst, not just a constraint. It has the potential to drive creative evolution in mediation.

To illustrate this point, I would like to refer to two specific examples.

4.1 ERROR IN MACHINE LEARNING ALGORITHMS TRAINING

Our ability to truly grasp the significance of anti-mediation in our interaction with technology – particularly in understanding its potential to obstruct rather than facilitate our connection to the world and ourselves – becomes fully apparent only when considering the pivotal role that failures play in the development of AI. These incidents, which are an inherent part of the AI learning process, illuminate the complex dynamics between humans and machines, revealing that too much mediation can indeed become counterproductive. Moreover, recognizing the importance of errors in AI underscores the value of imperfection in the human-technology relationship. It teaches us that the path to harmonious coexistence with technology is not

⁹ The literature and discussion surrounding the uncanny valley are quite extensive and complex. My goal in this paper is not to analyze them in depth. Instead, I use the reference to the uncanny valley merely as an example to clarify and reinforce my reinterpretation of technological mediation. On the re-evaluation of the uncanny valley, see Zhang et al. 2020, Mara et al. 2022, Yam et al. 2021.

¹⁰ This is also related to the important topic of "quasi-otherness." See Kanemitsu (2019) and Liberati (2022).

through achieving flawless mediation but through embracing and managing the imperfections that arise. This perspective fosters a more humane approach to technology, where anti-mediation strategies become crucial in maintaining our autonomy, preventing alienation, and ensuring that technology serves to enhance, rather than detract from, our human experience.

The role of error in training AI models, particularly in machine learning, is central to the development and refinement of these models (Domingos, 2012; Hastie et al., 2019). In the context of machine learning, an "error" typically refers to the difference between the predicted output of the model and the actual output or result. This error is not just a measure of the model's inaccuracy; it is a crucial component of the learning process. When a machine learning model is being trained, it iteratively adjusts its parameters to minimize this error. The process of error reduction is guided by algorithms such as gradient descent, which tweaks the model's parameters (like weights in neural networks) to reduce the error margin. The ultimate goal is to build a model that can make accurate predictions or decisions when confronted with new, unseen data. This error-driven learning process is foundational to the machine learning field and is what enables AI systems to 'learn' from data.

However, the role of error in training AI models is nuanced and presents several challenges. For instance, different types of errors like bias (systematic error) and variance (sensitivity to small fluctuations in the training set) need to be balanced. A model that perfectly minimizes error in its training data may not perform well on new data, a problem known as overfitting. Overfitting occurs when a model learns the noise or random fluctuations in the training data as if they were meaningful patterns, leading to poor generalization of new data. Conversely, underfitting happens when the model is too simplistic and fails to capture the underlying patterns in the data, resulting in high error on both the training and new data. The art of machine learning involves finding a balance between these extremes, often through techniques like cross-validation and regularization, which help in achieving a model that generalizes well and is robust in its predictions. Thus, the role of error in training AI models (Pasquinelli, 2019, 2023; Lee et al., 2023; Naser et al., 2023; Walters et al., 2023) is not just about minimizing it, but understanding and managing it to build effective, reliable, and generalizable AI systems.

4.2 THE “SERENDIPITY” OF TECHNOLOGICAL FAILURES

Technological breakdowns and errors can act as catalysts for innovation, rooted in the concept of 'serendipity,' as introduced by Merton and Barber (2004). Historical examples, like the creation of Post-it Notes from a failed adhesive experiment, demonstrate 'positive deviance' or 'productive failure' (Harford, 2011). These anomalies challenge paradigms and promote creative thinking, leading to unconventional solutions. This aligns with Karl Popper's theory of 'falsifiability,' where knowledge advances through conjecture and refutation, emphasizing that error correction is crucial for technological progress (Popper, 2002).

The implications of embracing errors in technology development are profound. Taleb's concept of antifragility (Taleb, 2012) suggests that systems can actually benefit from shocks, stresses, and failures, becoming stronger and more robust as a result. This perspective is particularly relevant in today's agile and iterative technology development practices, where the rapid prototyping and testing of ideas often lead to unexpected but valuable results. This approach not only fosters a culture of experimentation and learning but also reflects a broader philosophical understanding of technology as an evolving, dynamic process. It challenges the traditional pursuit of perfection in technological endeavors, advocating instead for a model that recognizes the intrinsic value of errors as stepping stones towards innovation and progress (this is also confirmed by Johnson, 2010; Simonton, 2004; Thagard, 1992).

5 CONCLUSION

The paper presented a re-conceptualization of technological mediation in the context of breakdowns and anomalies. It criticized the traditional postphenomenological approach for its excessive focus on functionality and use, overlooking the strategic importance of malfunctions and anomalies in technology. The central thesis advocates for a shift in the conceptual framework, incorporating the idea of immunization, as developed by Sloterdijk and Esposito, in mediation theory. This shift allows for a better understanding of the role of technological breakdowns, highlighting their potential positive value in preventing technology from devolving into anti-mediation, i.e., instances of excessive mediation that blur the boundaries between humans and technology. The paper suggests that recognizing the boundaries and limits of technological mediation can lead to a more comprehensive understanding of human-technology interactions.

This paper does not aim to fully define the meaning of errors in technology, nor argue that errors are simply immunization strategies against anti-mediation. Instead, it seeks to highlight the limits of postphenomenological reflection and propose an alternative perspective on errors beyond a purely negative logic. The concept of anti-mediation as technological over-mediation was introduced to offer this viewpoint. Immunization is not the only lens to understand technological errors. A comprehensive postphenomenological theory of errors would necessitate a typology and a new vocabulary for their understanding and analysis.

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Use of AI

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