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Intra-action as a Materialist Ontology of the Virtual: From the Analytical Engine to Analog/Digital Intra-objectivity

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ABSTRACT

This article provides a theoretical contribution based on Sadie Plant's critiques of the notion of virtuality as pure immateriality. Plant uses Ada Lovelace's logic of the 'Analytical Engine' as a base, reinterpreting it as a feminine practice associated with the act of weaving, which has been repressed by official cyberculture. From this perspective, the article examines how Remedios Zafra identifies a continuity of this logic in domestic 'prosumption' practices, emphasizing their potential to achieve subjective autonomy, albeit subordinated to being captured by the neoliberal digital economy. Finally, Karen Barad's concept of intra-action is introduced as a materialist ontology of the virtual, complementing Plant's critiques and addressing the ambiguity of prosumption as discussed by Zafra. This ontology challenges techno-libertarian immaterialism by interpreting 'digital objects' as co-productive or intra-objective relations between the analog and the digital.

Keywords

techno-libertarianism
prosumption
digital objects
transindividual
cyberculture

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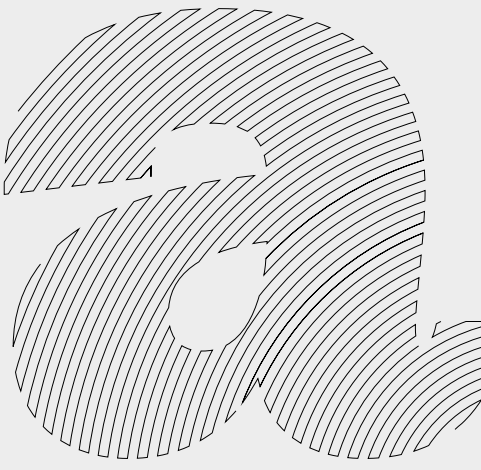

Intra-action as a Materialist Ontology of the Virtual: From the Analytical Engine to Analog/Digital Intra-objectivity

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WEAVING AS COMPUTATIONAL LOGIC: A GRID FILLED WITH VOIDS

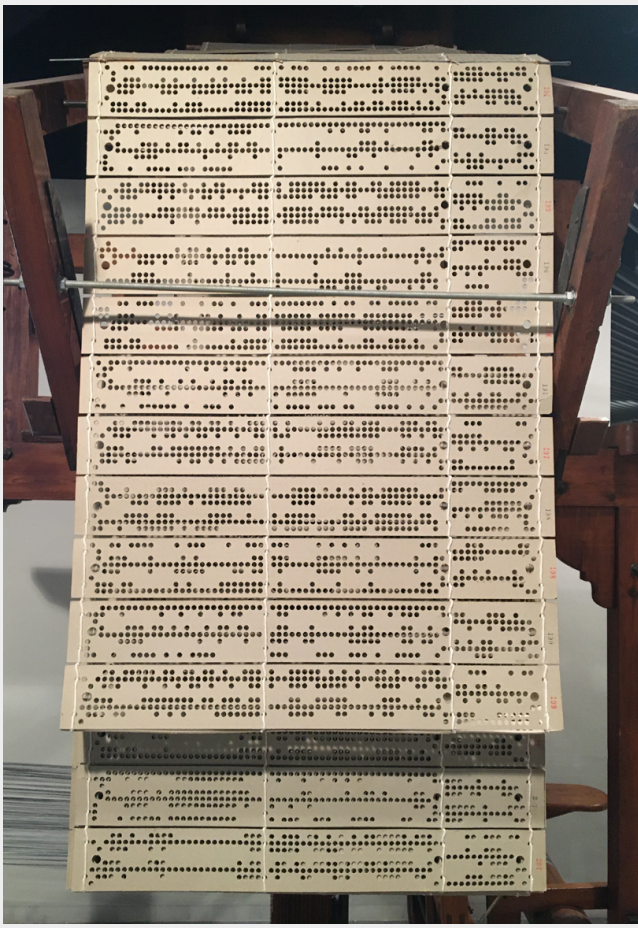
The woman brushed aside her veil, with a swift gesture of habit, and Mallory caught his first proper glimpse of her face. She was Ada Byron, the daughter of the Prime Minister. Lady Ada Byron, the Queen of Engines.

WILLIAM GIBSON AND BRUCE STERLING
The Difference Engine

Ada Lovelace, referred to as Ada Byron by Gibson and Sterling in *The Difference Engine*, serves as the emblematic figure through whom Sadie Plant (2019) seeks to reestablish the displaced and submerged connection between femininity and the digital realm. According to Plant, Lovelace represents the first encounter between women and computers, though its roots trace back to mythical origins linked to the practice of weaving. Plant recounts that in 1833, when English mathematician Charles Babbage publicly demonstrated his adding machine, the so-called 'Difference Engine', Ada was profoundly captivated. Thanks to her extraordinary mathematical prowess, she eagerly proposed to Babbage their joint collaboration on creating the 'Analytical Engine': a device capable of performing all kinds of operations with the ambitious aim of bequeathing "to future generations a *Calculus of the Nervous System*," as she wrote in 1844 (as cited in Plant, 1995, p. 48).[1]

1 *Trans. N.*: A source different than the source quoted in the Spanish original version is used for all textual citations to the work of S. Plant: "The Future Looms: Weaving Women and Cybernetics." *Body & Society, 1*(3-4): 45-64.

Unlike the earlier version, this new machine drew its primary inspiration from the logic of punched cards used by Joseph-Marie Jacquard in his mechanical loom. As Ada noted, "We may say most aptly that the Analytical Engine weaves Algebraical patterns, just as the Jacquard loom weaves flowers and leaves" (as cited in Plant, 1995, p. 50).



↑ **Figure 1**: Jacquard mechanical loom. Museu Tèxtil, Terrassa, Spain. Photograph: The author.

↗ **Figure 2**: Punched cards used by the Jacquard mechanical loom. Museu Tèxtil, Terrassa, Spain. Photograph: The author.

Thus, the art of weaving represents, in a sense, a disruptive presence—an unsettling void at the foundational core of software science. As Plant asserts:

> The loom is a fatal innovation, which weaves its way from squared paper to the data net. It seems that weaving is always already entangled with the question of female identity, and its mechanization an inevitable disruption of the scene in which woman appears as the weaver. (Plant, 1995, p. 56)

Plant explains that Freud had already identified the feminine strategy of concealing the *hyštéra* or *matrix* (the womb) behind the veil of the weaving: "Woman weaves in imitation of the hairs of her pubis criss-crossing the void" (Plant, 1995, p. 60). Men would insist on this concealment because it symbolizes their escape from the materiality that has underpinned their technology and culture. After escaping from the mother, "looking back on his origins, man sees only the flaw, the incompletion, the wound, a void" (Plant, 1995, p. 61). While the *matrix* is the site of life, reproduction, and materiality, it is also "horrible and empty, the great embarrassment, the unforgivable slash across an otherwise perfect canvas" (Plant, 1995, p. 61).

Viewed in this way, for the official culture of computer science, weaving constitutes a kind of hindrance that results from the introjection of the female body—that of the weaver—into the very logic of machinic functioning. It is a materialist logic that has not ceased to be transmitted from the dawn of the Analytical Engine to the present day, when the Allies' military interest in the work of Lovelace and Babbage sparked the great drive in computer manufacturing. Let us not forget that Howard Aiken, a pioneer in computer science, based his ideas on their work to create the first electromechanical computer, the Mark 1, which was manufactured by IBM in 1944.

Initially, this original materialism was fought by official cyberculture, albeit without an explicit declaration of war. Plant identifies the symptoms of this underground struggle in the way contemporary culture understands digitalization: as a movement of departure from the terrestrial through a transition from darkness to the light of intellect. This interpretation aligns with traditional metaphysics—inseparable, moreover, from the Christian narrative—which envisions the figure of 'man' as a historical subject striving to transcend nature in order to attain the "omnipotence and omnipresence of God, his image of abstraction and authority" (Plant, 1995, p. 57). Indeed, "Mother Nature may have been his material origin, but it is God the Father to whom he must be faithful," since "the matter, the womb, is merely an encumbrance; either too inert or dangerously active:" what man "sees as the passive materiality of the feminine has to be overcome by his spiritual action" (Plant, 1995, pp. 57-58).

Like women, software has served both as the medium through which masculinity seeks transcendence and as a potential threat of insubordination. For this reason, to dispel that danger, cyberculture has remained loyal to the masculine narrative of spiritual liberation, obliterating the material logic of weaving by framing virtual reality "as a cerebral escape from the mysteries of matter" (Plant, 1995, p. 60). However, once the weaver's body enters the machine, "There is no escape from the meat, the flesh, and cyberspace is nothing transcendent" (Plant, 1995, p. 60). This sheds light on both the euphorias and paranoias of the "post-or-

ganic man" (Sibilia, 2006) who views the digital matrix as an opportunity to overcome corporeality, which represents nothing more than projections "of the same desires which have guided his dream of technological authority and now become the collective nightmare of a soulless integration" (Plant, 1995, p. 60).

For Plant, instead,

> Entering the matrix is no assertion of masculinity, but a loss of humanity; to jack into cyberspace is not to penetrate, but to be invaded (...) Cyberspace is the matrix not as absence, void, the whole of the womb, but perhaps even the place of woman's affirmation. This would not be the affirmation of her own patriarchal past, but what she is in a future which has yet to arrive but can nevertheless already be felt. (Plant, 1995, p. 60)

Plant seeks to disavow the idea of cyberspace as an irremovable path to dematerialization by assuming that "this fabric and its fabrication, is the virtual materiality of the feminine" and that "the passage into the virtual is nevertheless not a return to the void" (Plant, 1995, p. 60):

> The virtual is the abstract machine from which the actual emerges; nature is already the camouflage of matter, the veils which conceal its operations. There is indeed nothing there, underneath or behind this disguise, or at least nothing actual, nothing formed. Perhaps this is nature as the machinic phylum, the virtual synthesizer; matter as a simulation machine, and nature as its actualization. What man sees is nature as extension and form, but this sense of nature is simply the camouflage, the veil again, which conceals its virtuality. (1995, p. 61)

Indeed, beneath this veil—or rather, between its strands—there is not the void, but the formless, the matrix from which everything originates. Or at least, it is not the void understood as the mere absence of being, but the limitless, that which is inconsistent or unpresentable but which, nevertheless, *is*: as both an abstract and material machine; thus, virtuality is nothing but the *ἄπειρον* (*apeiron*, indeterminate) of the pre-individual, the non-place from which all individuation begins (Simondon, 2014). If the repression of that "machinic *phylum*" is part of the flight from matter as the *telos* of human history, then "the cybernetic systems which bring it into human history are equally the consequences of this drive for escape and domination" (Plant, 1995, p. 61).

This would explain the alignment between this anti-materialist tendency and the vocation for control, security, and risk management, that has always been maintained since its inception by the science initiated by Norbert Wiener, as the dominant paradigm of the digital. However, while fulfilling the mascu-

line aspiration of this flight, cybernetic systems also constitute his greatest nightmare by dragging, together with the Analytical Engine, the indelible feminine mark of the virtual, which now reveals its logic of *reticularity* as eminently *material*, thanks to the veil of cyberspace.

The sensation in the muscles, the vibration of the fingers, and the rhythm of the weaver constitute precisely that materiality which has been 'virtualized' in the punched cards of Jacquard's machine, and which would later inspire Lovelace's Analytical Engine. Therefore, we can say—with Plant—that the very binary logic of 0 and 1 should not be interpreted as disembodied 'words' secretly scheming things (Rodríguez, 2019), but as the knotting of the presentable and the unpresentable, between the fullness and the inconsistency of that *ἄπειρον* which makes the materiality of that card a grid 'filled' with voids. To put it briefly in Gilbert Simondon's terms: in every individuation, that is, in every consistent being, there is always an irreducible margin of pre-individuality or inconsistency that is immanent to its own constitution (Simondon, 2014). While the masculine conception of the void behaves as the simple 'non-being', its feminine version, on the other hand, is the *being* itself, that unpresentable element that makes all presentation possible, just as Jacquard cards owe their structure to their perforations.

Today, cyberspace seems to offer us a productive *reticularity*, filled with that material void of the *ἄπειρον*, a manifestation that now threatens to displace the androcentric interpretation of cybernetics, which has focused on control, security, and risk management. Its nature is none other than its original logic of weaving, a logic that the masculine metaphysics of the digital seems no longer able to repress.

WEAVING AS A CULTURAL EXPERIENCE. THE EMANCIPATORY AMBIGUITY OF DIGITAL PROSUMPTION

Sewing machine and computer. The same extremes with which Sadie Plant envisions a future of cyberspace beyond the military origins of cybernetics are used by Remedios Zafra (2013) to ponder on the inventiveness of *com-posing* in networks. From the inaugural logic of weaving in the field of computing, we move to the cultural domain of its performance in the relational experience between the analog and the digital in domestic activities. Around each of these extremes, Zafra situates the story of two characters—two women whom the author visits in their intimacy through the narrative. Both accounts highlight, in italics, the various utensils with which the protagonists stitch, each in their own way, the warp and weft of their daily tasks. The names that Zafra has chosen for them are not incidental: they specifically reference the text by Plant that we have discussed: both Adela and A.D (or Apuntode) are a remembrance of Ada Lovelace.

Around the age of sixty, Adela carries out her labor through a set of low-tech artifacts. Using these, she weaves together food preparation, cleaning, and caring for her elderly father, in order to achieve the intangible product of sustaining life. On the other hand, there is A.D, Adela's granddaughter. While her grandmother's story takes place in 1983, A.D's unfolds in 2013. Unlike Adela, A.D's daily plot has other scopes, as some of the items she sews extend beyond the physical limits of her home when connecting to the digital universe. Each of these, or at least the ones she uses most, establish permanent ties with other knots, some of which may be other artifacts or softwares.

Despite the differences, there is something in common between the ways of weaving for both women, since the resources that intertwine their activities represent a consumption that is simultaneously a mode of production. Alvin Toffler (1980) defines this mode as 'prosumption' (from 'prosumer'), as the process by which the user participates in the generation of the goods or services she or he uses. For Zafra, the prosumption carried out by her characters is marked by the time invested in completing the product they use, linking high and low technology, thus being an activity devoid of the recognition typically associated with a craft or profession. Through her *smartphone*, *tv*, *laptop*, *inbox messages*, or responding to her *posts* and visiting *websites* she tries to access with her *résumé*, A.D certainly 'prosumes', albeit in a superlative sense compared to her grandmother, due to the high degree of personalization offered by the products of the digital universe.

Building on Virginia Woolf's (2004) concept of *a room of one's own*—the idea that both women's economic and spatial independence allow for female literary and intellectual exercise—Zafra coins the notion of *connected time of one's own*, a creative temporality that resists the time of production to which domestic tasks have historically been subordinated—a possibility opened by new information technologies. In this sense,

> A connected room of one's own today appears as a particular center of operations for our online life and time; consequently, it also functions as a laboratory and a place of (hyper)visibilization, training, and work. Moreover, outside the disciplinary yoke of spaces, companies, and institutions, the connected room of one's own would serve as an ideal place for motivation and attention without renouncing sociality (Zafra, 2013, p. 188).

This is precisely the universe of A.D's everyday prosumption. However, unlike Woolf and the activities of her grandmother, Adela, her *connected room of one's own* does not refer solely to the physical space of the home, but to any place occupied by her body: thanks to digital portability, this very space can become a 'room of one's own'. While acknowledging Woolf's emancipatory legacy

in digital prosumption, Zafra also warns of its potential danger: it could become the exact opposite. Along with offering higher degrees of user personalization, the neoliberal digital economy, based on data management, exerts an intensive entrepreneurial modeling of subjectivity—a phenomenon some authors have described as a new form of behavioral governance under the name of algorithmic governmentality (Rouvroy & Berns, 2016).

Therefore, to address this 'ambiguity of digital prosumption' caught between the conquest of autonomy and the subjugation of the informationally-constituted subject, a debate is necessary. This debate must connect both the technical-political origins of digitization and its cultural effects to the material—and virtual—sphere of design. In our view, this point of articulation must be developed through an ontological reflection.

INTRA-ACTION AS A MATERIALIST ONTOLOGY OF THE VOID

Our hypothesis can be summarized as follows: the emancipatory nature that Zafra attributes to prosumption as an inheritance of Woolf's room of one's own, can only survive if the origin of the digital universe is reimagined beyond the lineage of Wiener's cybernetics, as Sadie Plant does by situating it in the invention of Lovelace's Analytical Engine. This shift entails a fundamental and decisive issue, as it offers an alternative to the cyber-masculine and post-organic version of cyberspace, which equates its 'virtual' nature to the notion of immateriality. In contrast, for Plant, the logic of weaving as the origin of informatics represents "the virtual materiality of the feminine," where "the passage into the virtual is nevertheless not a return to the void" (Plant, 1995, p. 60). This last sentence is crucial, as the understanding of the void becomes central to the debate on the nature of the virtual—an issue that, as we will see, is essential not only for addressing its relation with the analog, but also for grappling with what we have termed, following Zafra (2013), 'the ambiguity of digital prosumption'.

In the metaphysical tradition, the void is defined by two fundamental conditions. On the one hand, it is synonymous with absolute absence or 'non-being', representing the impossibility of any production, as articulated in the Parmenidean principle of *ex nihilo nihil fit* (nothing comes from nothing). Thus, the distinction between absence (nothingness) and presence (being) is sealed as an unbridgeable dichotomy, which, in turn, reinforces the separation between emptiness and fullness.

Conceived as the foundation of digitization, this separation is precisely what characterizes the binary constitution of 0 and 1: absent/present, void/full. But this constitution is none other than that of Jacquard's punched cards, which inspired Lovelace's Analytical Engine, the origin of the computer. If Plant

suggests that, in these cards, the materiality of weaving has been virtualized—the vibration of the fingers, the bodily rhythm of the weaver, and so forth—then it becomes imperative not only to understand virtuality as something material, in opposition to the cyber-masculine idealism, but also to rethink the notion of void (the 0, the perforation) beyond the metaphysical idea of an 'unproductive nothingness'. In other words, the vindication of the feminine origin of digital culture and its consequent materialist understanding of the virtual, as suggested by Plant, requires an ontological redefinition of the concept of the void.

In this sense, the work of American philosopher, Doctor of Physics, and feminist theorist Karen Barad offers a conception of the void that is entirely distinct from the metaphysical tradition of unproductive nothingness. In her 2012 text entitled *What Is the Measure of Nothingness: Infinity, Virtuality, Justice*, written specifically for Documenta 13 in Kassel, we find an outstanding exploration of this issue. Her proposal is grounded in the premise of 'quantum ontology', which contradicts classical ontology: in nature, there are no individual objects with boundaries and properties that exist prior to their interactions with other objects. On the contrary, "determinate boundaries and properties of objects-within *phenomena*, and determinate contingent meanings, are enacted through specific intra-actions, where phenomena are the ontological inseparability of intra-acting agencies" (Barad, 2012, p. 7).

Thus, there are no interactions between pre-constituted individuals that later establish relations; rather, these individuals are constituted—or acquire their boundaries and properties—precisely *in* and *through* the relations they establish. This is why Barad uses the term *intra*-action to describe the formation of phenomena, rather than the traditional concept of *inter*-action. Thus, by asserting the constitutive nature of relations—and, consequently, the absence of properties in phenomena prior to their relations—Barad seeks to emphasize a certain ontological *indeterminacy* that would be inherent to the core of quantum physics: "determinacy, as materially enacted in the very constitution of a phenomenon, always entails constitutive exclusions (that which must remain indeterminate)" (2012, p. 7).

In Simondonian terms: in every individuation—that is, in every constituted entity—there is a margin of pre-individuality or indeterminacy that is irreducible to its own constitution (Simondon, 2014). This means that every 'individuation' is the permanent acquisition of consistency through an indeterminacy residue that never fully crystallizes; an acquisition always achieved through the relations that this individual weaves with others. For this reason, "individuals do not pre-exist as such; rather, they materialize in intra-actions (...) they only exist within phenomena (particular materialized and materializing relations) through their iterative intra-active reconfiguration" (Barad, 2023, p. 11).

This makes *indeterminacy* and *relation* fundamental ontological aspects of intra-action. Barad conceives *indeterminacy* as the primary feature of the void, which would not be the 'other' external to the consistent, but rather its fundamental core. According to quantum field theory (QTF, which is the framework of her thesis), the vacuum cannot be determinately 'nothing' or mere 'non-being', since the indeterminacy principle always allows for fluctuations of the quantum vacuum (Barad, 2012, p. 9). If there are fluctuations, there are necessarily indeterminate vibrations of the vacuum or zero-energy state.

Complementarily, and viewed from particle physics, this fluctuation would imply the singular existence of 'virtual particles', which are quanta of vacuum fluctuations or quantized indeterminacies in action (Barad, 2012, p. 11):

> Virtual particles are not in the void but *of* the void. They are on the razor edge of non/being. The void is a lively tension, a desiring orientation toward being/becoming. The vacuum is flush with yearning, bursting with innumerable imaginings of what could be. (...) The blank page teeming with the desires of would-be traces of every symbol, equation, word, book, library, punctuation mark, vowel, diagram, scribble, inscription, graphic, letter, inkblot, as they yearn toward expression. A jubilation of emptiness (Barad, 2012, p. 13).

Apparently, the use of the term 'particles' would make it difficult to understand the matter from the outset, as it suggests a degree of consistency that would prevent us from considering them as 'pure nothingness'. However, the notion of consistency is immediately undermined by the use of the adjective 'virtual', which signifies precisely the opposite—pure inconsistency. In this sense, the combination of these terms inevitably compels a rethinking of the concept of the void. On the one hand, asserting that such particles are not in the void but, on the contrary, are *of* the void itself, forces us to abandon the traditional metaphysical conception of the void as synonymous with nothingness or the absolute absence of being. On the other hand, their virtual nature nullifies any attempt to view them as consistencies with specific and determinable properties. Within this new framework, the void is dissociated from the notion of absolute nothingness; instead, it is understood as a *multiple inconsistency* that, far from being the 'other' of matter, is its internal indeterminacy, productive of new individuations:

> Ontological indeterminacy, a radical openness, an infinity of possibilities, is at the core of mattering. How strange that indeterminacy, in its infinite openness, is the condition for the possibility of all structures in their dynamically reconfiguring in/stabilities. Matter in its iterative materialization is a dynamic play of in/determinacy. Matter is never a settled matter. It is always already radically open. Closure can't be

> secured when the conditions of im/possibilities and lived indeterminacies are integral, not supplementary, to what matter is. Nothingness is not absence, but the infinite plentitude of openness (Barad, 2012, p. 16).

Therefore, the void is neither nothingness nor unproductivity, but rather a blank page brimming with desire that, inscribed in matter as a ghostly existence, secretly breathes as a 'material virtuality'.

Through the second central aspect of her ontology, *relation*, Barad seeks to explain how individuals acquire consistency. Indeed, they 'individuate' themselves through intra-actions, that is, through the relations they establish with other individuals undergoing the same trance of constitution. However, we have asserted that it is *indeterminacy*—or the void—that underpins all productivity. Well, the way this productivity operates is precisely through *relation*. This means that the *indeterminacy* that resides internally in all individuals is also the relation that binds them and makes them possible. This reinforces the idea that the void, now understood as relation, does not represent an unproductive nothingness or the simple hiatus or 'between' that connects and separates individuals weaving a linkage, but rather the *matrix* that produces them. In summary, intra-action owes its productivity fundamentally to the void that resides at the heart of matter, whether as *indeterminacy* and/or as *relation*. Barad makes this double characterization of the void more explicit through a quotation to Derrida that she includes near the end of her text:

> Identity (...) can only affirm itself as identity to itself by opening itself to the hospitality of a difference from itself or of a difference with itself. Condition of the self, such a difference *from* and *with* itself would then be its very thing (...) the stranger at home (Derrida, 1998, as cited in Barad, 2012, p. 15).

Beyond the technical specificity and the context of the quotation (from the text *Aporias*), what is important is Barad's use of it to explain intra-action, which can be explained as follows: every phenomenal *determination* maintains a *relation* of difference with itself with respect to an alterity that is immanent to it—the *indeterminate* interior. Lacan uses a precise concept to explain this unique topology: the *extimacy* (Eidelsztein, 2006). Indeed, the void—or the indeterminate—is nothing other than *extimacy* or the outside-included, the 'stranger at home', an exteriority that intimately resides within every phenomenological determination, making it something always open to exteriority. Thus, the indeterminate void is the source of productivity because it operates within the relations that each phenomenon maintains both with itself and with other phenomena, enabling them to achieve their respective consistencies and determinations.

TOWARD A MATERIALIST DEFINITION OF THE VIRTUAL: PROSUMPTION AND ANALOG/DIGITAL INTRA-OBJECTIVITY

After presenting this condensed exposition of Barad's ontology of the void, we can now offer, by way of conclusion, some insights into a possible conception of virtuality that embraces the feminist claim regarding the origin of computation in Lovelace's Analytical Engine, in order to enable the emancipatory path of prosumption proposed by Zafra. Operationalizing this hypothesis is essential for addressing a fundamental challenge in contemporary design: the entanglement of the analog universe with digital objects, moving beyond the immaterialism of the virtual as defended by cyber-masculine post-organic perspectives.

As we have seen with Plant, weaving—serving as the inspiring logic behind the Analytical Engine—embodies a materialistic understanding of the virtual, one that has been obliterated by the hegemony of cybernetics. However, it is precisely this understanding that we can see ontologically confirmed in Barad's redefinition of the void: far from being mere nothingness, the void is a *relational indeterminacy* that lies at the core of matter, with intra-action being the mode through which this *material virtuality* enables all individuation. Therefore, the possibility of thinking of the virtual as an eminently material condition has not only theoretical and technical consequences for computer science, but also cultural implications, particularly in practices characterized by the permanent link between the analog and the digital, as clearly represented by Zafra's idea of prosumption through Adela and A.D, respectively.

However, it is most notably Zafra, through A.D, who provides evidence of the emancipatory virtue of this practice through the idea of a *connected room of one's own* (2013). In this regard, we believe that this path is already emerging in the way the Chinese philosopher Yuk Hui (2023) problematizes the understanding of *digital objects*: offering a profound critique of the traditional metaphysical understanding of current informatics interpretations, which treat them as mere logical abstractions detached from the bodily experience of the users who engage with them.

According to Hui, digital objects constitute "a new form of industrial object that pervades every aspect of our lives (...) such as online videos, images, text files, Facebook profiles, and invitations" (2023, p. 20), the very objects A.D connects to the analog utensils that constitute her daily presuming practice. The defining characteristic of these objects is that they "take shape on a screen or hide in the back end of a computer program, composed of data and metadata regulated by structures or schemas" (Hui, 2023, p. 19).[2] Despite having an eminently logical configuration associated with the mental domain, these data

2 Examples of these objectualities are GML, SGML, HTML or XML encodings.

structures or metadata "now become material and can be manipulated according to certain algorithms" (Hui, 2023, p. 208).

What is interesting is that Hui considers that this progressive materialization of logical language, traditionally considered as a purely mental aspect, ultimately becomes embodied in digital objects: a process that can be observed in the development that goes "from Charles Babbage's Difference Engine and Analytical Engine to the 1946 Electronic Numerical Integrating Computer (ENIAC)" (Hui, 2023, p. 208). Babbage's mention is doubly relevant: first, it highlights the privilege granted to the figure of the British mathematician and scientist as the author of the Analytical Engine which, in turn, has led to the historical invisibility of Ada Lovelace as its primary creator. Second, Hui asserts that the materialization of logical language began precisely with this machine, as Plant also points out, serving as the foundational inspiration for both the Mark 1 and the ENIAC, both of which are considered the first computers.

To a large extent, Hui's entire approach is framed within this process of materialization, polemicizing with the metaphysical trends in current computer science that treat computation and its processes as a purely logical/mental matter, aligning closely with Plant's (2019) critique of the cyber-masculine interpretations of the virtual, which conceive it as an abstract universe disconnected from matter. The way Hui (2023) seeks to distance himself from these perspectives is by recognizing that this materialization is inseparable from the *relational*, an aspect as inherent to the logic of weaving as the origin of computation. By remaining primarily confined to the sphere of subjectivity, the philosophical logicism underlying current informational approaches prevents them from fully appreciating this process. As a counterpart, Hui introduces the concept of *interobjectivity*, which

> Refers to *materialization* of both the internal and external relations of objects. A trend in technology that involves the materialization of all sorts of relations, making *visible* and *measurable* what would otherwise be invisible elements or aspects (2023, p. 216).

Thus, in contrast to computational theories aligned with the metaphysics of the virtual as a progressive dematerialization, Hui asserts that "interobjectivity moves from the immaterial to the material, from the sacred to the profane, from the intangible to the tangible" (2023, p. 216). A second characteristic that Hui highlights in this regard is that "materialized interobjectivities create their own *milieux* that connect both nature and artifacts" insofar as "human beings build and use tools that prolong their sensibilities" and where, additionally, "tools become systems and create their own *milieux*" (2023, pp. 216-217).

In our view, conceptualizing *digital objects* as a materialization that operates relationally through *interobjectivity* aligns with several aspects we

have discussed previously. First, it involves acknowledging the *material inheritance* derived from Lovelace's Analytical Engine, as highlighted by Plant: a materiality implicit in the way Hui attempts to conceptualize digital objects, that is, by considering corporeality and user experience as inescapable. This perspective advocates precisely for a materialistic ontology of the virtual, in contrast to the idealistic logicism found in computational metaphysics or digital ontologies. Moreover, Hui's approach facilitates a dialogue with Barad's ontology of the void, where the *virtual* is not the opposite of matter, but rather its deep core.

Secondly, the *necessarily relational character* of digital objects also aligns with this ontology, given the central role that relationality plays in intra-action. Furthermore, if we re-signify the original meaning of Hui's concept of interobjectivity through Barad's intra-action, we could propose a possible analog/digital *intra*-objectivity. By this, we suggest that analog and digital objects, far from being opposing realities or locked in permanent conflict, actually *co-produce* each other through the multiple relations they weave in their different daily performances, insofar as *digital virtuality* can be understood as an eminently material dimension that cuts across both domains. If Barad points out that every phenomenon is inhabited by an irreducible *internal indeterminacy*, which renders *relations* productive in intra-action, we must also consider how this same condition is reproduced within the scale of technical objects, whether analog or digital.

The key to this issue lies in the way Simondon (2018) conceives the technical perfection of an object, which, contrary to progressive automation—as it is for cybernetics and AI—, consists in the persistence of a margin of *indeterminacy*. For Simondon, this indeterminacy, which is common to all technical objects—and also to subjects—is what allows the establishment of what he terms 'transindividuation', that is, the capacity of an individual to co-produce or individuate itself in relation with other individuals (2014). In this sense, intra-objectivity will be transindividual insofar as the margin of indeterminacy is a shared material plane for both analog and digital universes, with digital virtuality being the mode that intra-objectivity adopts specifically within the realm of digital objects. This characterization would lead to multiple theoretical and practical implications in the field of design, as it would provide the basis for a relation of permanent co-productivity between the analog and the digital.

Finally, understanding the virtual as a *material* and *relational* phenomenon that affirms both continuity and the co-productive and intra-objective capacity of the analog and the digital, diverges significantly from the cybercultural perspective that equates digitalization with dematerialization. This alternative approach is precisely what best embraces that emancipatory nature that Zafra (2013) attributes to prosumption and her *connected room of one's own*, as it precisely allows reclaiming subjectivity, bodily experience, and localization through the

intra-objective interweaving of subjects and everyday artifacts across different technological levels. This path starkly contrasts with the dominant trends of the neoliberal digital economy, which celebrate the replacement of the subject with the profile, along with the disembodiment and immersive delocalization of individuals within the Big Data universe.

We refer to an emancipatory nature of prosumption because it stands in clear opposition to the authoritarian ideology currently upheld by significant sectors of big business that pioneered the ideology of the digital start-up and have now become faithful heirs to what Plant describes as a "cerebral escape from the mysteries of matter" (1995, p. 60). This reactionary movement, which some authors have termed the 'world siliconization' (Sadin, 2018), represents an openly regressive onslaught.

The name is intriguing, as it synthesizes two antagonistic positions. On the one hand, 'siliconization' refers to Silicon Valley, the southern region of the San Francisco Bay Area, a pioneer in the silicon chip industry—a reference that denotes both a specific locality and a particular natural resource. On the other hand, 'world siliconization' is understood as the suppression of all *locality* and *matter*, constituting a process of transnational *delocalization* and widespread *dematerialization*, which aligns with the rise of cybernetics as a hegemonic epistemic framework.

The main promise of this process is "that the economy of the present and future would be one of algorithmic accompaniment of life" (Sadin, 2018, p. 26), a form of accompaniment that consists of reducing life to data, down to its smallest details. This progressive digitalization of existence, which disregards the *Lebenswelt* (life-world), is a consequence of the global financialization of the economy, which makes "the liberal regime mutate into a techno-liberalism that fulfills its ultimate aspiration: to not be hindered by any limit and not be excluded from any field" (Sadin, 2018, p. 28).

This particular form of digital liberalism is not only at odds with the emancipatory aspirations of prosumption envisioned by Zafra (2013). Beyond the economic and technological spheres, techno-libertarians are now embarking on a conquest for political and media power to initiate what they view as a 'cultural battle', in which digitalization is defended as an open disdain for matter, spanning various spheres and scales: contempt for the corporeality and experience of workers and their factories; for traditions, economies, and local or native communities; and for the planet itself.

In this way, techno-libertarianism presents itself as the possibility of cloaking the most reactionary agendas with an aura of contemporaneity, gathering a range of positions such as classism, anti-feminism, homophobia, anti-politics, racism, denialism (both historical and climatic), and religious conservatism into a single future-oriented perspective.[3]

3 A symbol of the alliance between the global financialization of the economy and the digital business elite, along with their disdain for the corporeal, local, and earthly, is undoubtedly the convergence between Elon Musk and Donald Trump. Their ideologies encompass everything from a fascination for the abstract and deregulated fluidity of cryptocurrencies to the abandonment of the planet due to its inevitable ecological collapse, as outlined in SpaceX's Mars colonization program.

Therefore, a materialist ontology of the virtual is not only a rightful reclamation of the obliterated feminine origins in the emergence of information technologies, but, above all, adopting a stance in the face of this 'cultural battle' waged by digital and techno-libertarian neo-fascism. It is a position capable of confronting the epistemic hegemony of cybernetics, unlimited automation, and the unreflective, propagandistic enthusiasm for AI. Only a material virtuality rooted in the physical, organic, collective, and ecosystemic universe allows for an *intra-objectivity* that conceives and promotes not separation and dispute, but the co-productive and prosumer horizontality between subjects, objects, and algorithms. **D**

Figure 3: Untitled work by Ana Milena Gómez. 'Anudar anidar' Exhibition, Espai Zero, Centre de Documentació I Museu Tèxtil, Terrassa, Spain, 2024. Photograph: The author.

Figure 4: *Anudar el vacío* (Knotting the Void), by Ana Milena Gómez. Drawn threadwork and openwork on cotton fabric, 2020. 'Anudar anidar' Exhibition, Espai Zero, Centre de Documentació I Museu Tèxtil, Terrassa, Spain, 2024. Photograph: The author.

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