

The Inhuman Overhang: On Differential Heterogenesis and Multi-Scalar Modeling

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Abstract

As a philosophical paradigm, differential heterogenesis offers us a novel descriptive vantage with which to inscribe Deleuze's virtuality within the terrain of "differential becoming," conjugating "pure saliences" so as to parse economies, microhistories, insurgencies, and epistemological evolutionary processes that can be conceived of independently from their representational form. Unlike Gestalt theory's oppositional constructions, the advantage of this aperture is that it posits a dynamic context to both media and its analysis, rendering them functionally tractable and set in relation to other objects, rather than as sedentary identities. Surveying the genealogy of differential heterogenesis with particular interest in the legacy of Lautman's dialectic, I make the case for a reading of the Deleuzian virtual that departs from an event-oriented approach, galvanizing Sarti and Citti's dynamic *a priori* vis-à-vis Deleuze's philosophy of difference. Specifically, I posit differential heterogenesis as frame with which to examine our contemporaneous epistemic shift as it relates to multi-scalar computational modeling while paying particular attention to neuro-inferential modes of inductive learning and homologous cognitive architecture. Carving a bricolage between Mark Wilson's work on the "greediness of scales" and Deleuze's "scales of reality", this project threads between static ecologies and active externalism vis-à-vis endocentric frames of reference and syntactical scaffolding.

Introduction: Inheriting Lautman's Differential

Twentieth-century French philosopher of mathematics Albert Lautman (1908–1944) contended that topology, class field theory, abstract algebra, and analytic number theory had a philosophical backdrop that revealed a latent dialectical structure of which previous mathematical developments were bereft. Lautman's dialectical interest in comprehending the passage from essence to existence concerns ordering the logical reconstruction of genesis within mathematics, where there is an "intimate bond between the transcendence of ideas and the immanence of the logical structure of the solution to a problem within" (Lautman 2011: 206). Invoking Heidegger's concept of disclosure (*Erschlossenheit*), Lautman's "synthesis of the real" accords the extra-propositional meaning of mathematics within the processual unfolding of its imperative "attachment" to metaphysics (2011: 31-42, 200). Thus, the determination of Lautman's Platonism is that of the superordinate dialectic, where couplets (e.g., unity/multiplicity, local/global, continuity/discontinuity) comprise that which is

eternally inaccessible to us by making Ideas “incarnate”. Following Lautman, the ontological anteriority of the “physical real” is transcribed through mathematical life and nurtured via a series of “gestures”—material reality as inchoate matter is shaped and surpassed through non-material forms. According to Lautman’s Platonism, “ideal reality” is not found in the *objects* of mathematical theories but the *notions* that the development of these theories invoke. These ideas translate a “non-sensible reality” from which mathematical theories are taken in order to “describe and duplicate an ideal reality” (Reynolds 2010: 226). With Lautman’s dialectic construction we see the edifice of two limit conditions: (i) *the time of the real*, where we can have physical processes which are generated (and, thus, are akin to chronologies); (ii) *Platonic Ideas outside of time*, which flow in an immanent mode.¹

Lautman was somewhat dissatisfied with Plato’s dialectical conception of relation between Ideas and the material reality through which they are realized, augmenting Plato via Heidegger. Lautman’s ultimate claim is that a mathematical entity’s ontological status does not depend upon the existence of “apparently arbitrary decisions to explore some sets of axioms but not others”—rather, it is the case that “mathematicians create new mathematical structures in the course of answering questions latent in the underlying extra-mathematical dialectical order” (Larvor 2011: 199). Thus, a kind of *primordial* mathematical creation emerges through the dialectical division and definition of differences, the unfolding of the ontological vis-à-vis the concrete (or ontic).²

Upending the hierarchical relationship of the infinitesimal dialectic as a dyadic relationship that directly determines the contingency between form and matter (or local and global), Deleuze’s renderings of Lautman’s dialectic repurpose this relation as a scalar problem. Thus, this demonstrates the legacy and influence of Lautman’s asymptotic approximation upon Deleuze’s conception of undetermined differentials, or “infinitesimals”. Akin to the Heideggerian interpretation of *Aletheia* (ἀλήθεια), or “unconcealedness”—whereby the revealing of Being is a dynamic differential process—Lautman’s rejection of truth as end-osis (final resemblance), in refusing the adequacy of the Idea to the real, engages in a process of de-substantialization. Thus and so, displacement becomes the foundational metaphysical relationship to binding multiplicitous of form with matter; Lautman’s diagrammatic “phase space” of rigorous structural appropriation, where energetic possibilities govern collective behavior, portends Deleuze’s fully immanent “virtual multiplicities”.

¹ These Platonic Ideas are conditions for the genesis of temporal processes, which we can say *process* mathematics but are determined by Ideas *outside of history*.

² Lautman refers to Heidegger’s 1928 treatise on ontological distinction, *On the Essence of Ground* (originally published in 1929), in order to articulate an interest in the difference between the “ontic” concepts employed in the sciences and the underlying “ontological” concepts disclosed by phenomenology. That is, “Lautman appeals to Heidegger in order to explain the relation between dialectics and mathematics. The whole point of *On the Essence of Ground* is to insist on the ontological difference, that is, on the distinction between the ontological and the ontic. The division of labour between the scientist and the philosopher depends on this distinction. The scientist uses ontic concepts to establish ontic truths; the philosopher reveals the corresponding ontology” (Larvor 2011: 199).

As perhaps made most explicitly clear by Deleuze’s disjunctive synthesis, this “phase space” invokes the possibilities of a system that cannot be reduced to its “vector field”.³ That is, these “virtual multiplicities” are akin to *concrete universals* rather than the Aristotelian scenography of “essences” (i.e., abstract archetypes). Just as it is incorrect to reduce “virtual multiplicities” to the “possible”, so too the “virtual”:

[...] can be distinguished from the ‘possible’ from at least two points of view. From a certain point of view, in fact, the possible is the opposite of the real, it is opposed to the real; but, in quite a different opposition, the virtual is opposed to the actual [...]. The possible has no reality (although it may have an actuality); conversely, the virtual is not actual, but *as such possesses a reality* [...]. Here again Proust’s formula best defines the states of virtuality: ‘real without being actual, ideal without being abstract.’ (Deleuze 1991: 96)

Deleuze thus distinguishes the virtual from the possible as what is irreducible to the actual but, nonetheless, is granted the privileged status of “immateriality” while, simultaneously, being fully real. These virtual multiplicities are crucial to our conception of differential heterogenesis, shining a light on the non-observable relation between differential elements, a relation signifying lines of individuation. These singularities serve as points of attraction for a system, which are themselves never actualized—as ideal singularities, they “enjoy an ‘immaterial’ status insofar as they define the tendencies composing a vector field without being themselves ever actualized, functioning thus as the intensive ‘differentiator’ responsible for spatio-temporal individuation” (Sacilotto 2020: 38). The “attractive” facet of these singularities serves as warning to not confuse Deleuze’s disjunctive synthesis with Heraclitean eternal flux, where world-order (*kosmos*) is caught in constant and significant change. Further distinguishing Deleuze’s virtual as a twofold of body and desire, we see that it is immersed within the active unity of *interior change*, with its unconscious “factory” steeped in the (dialectical) process of both *being the ground for generation* and *being generated, itself* (Deleuze 1990: 90).⁴ However, considering the aforementioned gradient of difference between possibility and actuality, there is a necessary active difference in kind between virtuality and

³ This disjunctive synthesis, which follows the connective synthesis and is followed by the conjunctive synthesis (or the “third synthesis”), illuminates “recording”, “registration”, and “inscription”.

⁴ We ought to be very prudent with how we attribute the use of the term “dialectical” to Deleuze. While the virtual can be bifurcated within a twofold dialectic logic qua its relational structure, this can not be extended to Deleuze’s machine ontology. Consider, for instance, Deleuze’s fundamental assertion in *Two Regimes of Madness*—that everything is a machine, whether it is “real, contrived or imaginary” (Deleuze 2006a: 17). This demonstrates that the machinic assemblage is infrastructural—wherefore it does not exercise a hierarchical circuitry of linealities and supervenience—but here we must note that Deleuze’s invocation of “mechanic” *does not* describe a mechanical domain that is set in opposition to an “organic” (or “non-mechanical”) domain. Similarly, when considering Deleuze’s machine ontology, the “organic” domain ought not be set within a dialectic relation to the “non-organic” machine. Thus, the Deleuzian machine ontology is one set within immanent “univocity, meaning that there is no biosphere or noosphere but everywhere the same Mechanosphere” (Deleuze & Guattari 2005: 69).

actuality. Therefore, any machine encounter's "plurality of forces acting and being affected" occurs at a "distance, distance being the *differential* element included in each force and by which each is related to others" (Deleuze 2006b: 208).

Such is the foundational semblance of differential heterogenesis, where the becoming of the *a priori* is linked to a pluralized mathematical description of the emergence and creation of forms. Without any need for stabilization, differential heterogenesis offers a "first referring system" for heterogenic flow that, in turn, allows the emergence of the semiotic function from dynamic evolution without the need of any stabilization; as applied to fields such as semantics, this allows for a methodology opposite to the classical case of structural morphodynamics (Sarti et al. 2018: 2-3). Accordingly, conditions are not given, *a priori*, within a definitive set of possibilities, allowing for us to take account of the historical variation of "phase space" and the set of all possible trajectories. Rather than being limited to mapping already possible trajectories, all machines-cum-rhizomes are irreducible entities where any "*homogenous system*" is necessarily "*already affected by a regulated, continuous, immanent process of variation*" that, in the last instance, contracts virtuality into a differential relation of manifestation (Deleuze and Guattari 1983: 103).

The Differential's Processual Development

Lautman's dialectic is extended in two-part form via the concrete genesis of reality and immanent Ideas according to Levi R. Bryant's externality thesis, as, for Deleuze, "[e]very object is double without it being the case that the two halves resemble one another" (Bryant 2011: 66). Exacting a further partition, for Arjen Kleinherenbrink, this "double" is, itself, "doubled" once more, resulting in a "fourfold". Accordingly, this "fourfold" world consists of a twofold virtual *depth* and a twofold *actual surface*, where distinction is carved along "unity of the multiple" in the "objective sense" and, on the other end, a "multiplicity 'of' one and a unity 'of' the multiple, but now in a subjective sense" (Deleuze 1994: 145). The virtual, irreducible, or "objective" aspect of every entity is, thus, one and multiple at the same time; contra the ontological structure of the actual, the (two) aspects of the virtual concern themselves with the non-relational being of a machine. If it is from Spinoza that Deleuze inherits Oneness (albeit sans Spinoza's divine connection) and from Leibniz that Deleuze becomes heir to the thesis of the multiple, then it is by way of Husserl that Deleuze finds himself working with qualitative distinction re: objects that are demarcated from their semblance via subjective, relational, or actual encounters, events, or experiences (i.e., "distinguishing *this* from *that*"; Kleinherenbrink 2019: 39).

Grounding individual entities within processes, for Deleuze these processes are not determined as continuous universals or understood via an underlying event existing "in addition to machines" (40). Deleuze's conception of process is tripartite: first, there is no

transcendent factor that connects machines and, second, there is no distinction between man and nature; what both these factors demonstrate is that “process” evinces how machinic being “happens everywhere”; the most important aspect of the Deleuzian machinic process is that the process, itself, is not an “end in itself, nor must it be confused with an infinite perpetuation of itself” (Deleuze & Guattari 1983: 15). This evidences that the schizo-process is not a continuous, universal, or underlying event that exists *in addition to machinology*. In both Bryant and Kleinherenbrink’s formulation, Deleuze’s externality thesis states that all entities have an extra-relational aspect, a residue of excess and superfluity. Devoid of a universal background, externality is necessarily composed of a processes that consists of breaks and stops/cuts, whereby permanence, emergence, production, generation, and change emerge as passive syntheses of time:

[t]hey describe how one entity relates to another (connection), how it manages to do so while remaining irreducible (disjunction), and how new entities are created (conjunction). They are ‘temporal’ because they account for how things happen; ‘passive’ because they are independent of memory, understanding will, recognition and consciousness; ‘productive’ because they account for the forging of relations; ‘registrative’ because they account for the alteration of individual essences; and ‘consumptive because they account for the birth and death of entities. These syntheses are not successive, but always ‘overlap’[...] A human spotting a friend is a case of the three syntheses, but so is a meteor striking the moon, or my finger striking my keyboard. (Kleinherenbrink 2019: 41)

Recall that, according to Deleuze’s philosophical system, the “actual” indicates assemblages as they are experienced by other machines while, conversely, the “virtual” denotes the extra-relational (or non-relational) reality of machines. Kleinherenbrink’s fourfold system is *the result of a further qualification resulting from the bifurcation of the actual/virtual with the One/multiple*; as it concerns the non-relational unity of what Deleuze calls “the body”, we are thus particularly interested in what remains *external to relations between machines*. Accordingly, “[a]s everything is a machine, so everything is a body” (Kleinherenbrink 2019: 87). That is, we are not to understand bodies *as* physical, biological, psychic, social, or verbal machines (despite these systems do all *have* bodies) but, instead, understand that externality demands that all entities are formally identical in their having a body, where by “body” we mean “a transcendental unity, irreducible to relational dimensions such as history, possibilities, composition, empirical qualities, users, and functions” (87). It is precisely due to the impossibility of full integration that these machines are “bodies without organs” (BwO). This guarantees that no machine can become fully integrated in any one relation but that every machine, instead, is a site of protest, or “anti-production” (Deleuze and Guattari 1983: 19). As Jacques Rancière comments on Deleuze’s machinic process, it is by isolating the figure that we prevent it from becoming networked as an element within a circuit or

serving as an idempotent and indexical resemblance of something other than an object (Rancière 1998: 525-536).

The virtual body, for Deleuze, is never pronounced in actual relations, which is to say that it cannot be integrated into manifestations qua relations and, therefore, it is the virtual that is *enveloped* by its relations. Despite bodies are irreducible to relational manifestations, these relations, nevertheless, transpire vis-à-vis appearance. Therefore, despite being a “closed vessel”, the virtual twofold is not immune to the eventual nature of the world (Kleinherenbrink 2019: 97). Thus, on the one hand there are the “the virtuals that define the immanence of the transcendental field” and, on the other, “the possible forms that actualize them and transform them into something transcendent” (Deleuze 2005: 32). The process of differential actualization thus follows the plane of the virtual, which gives assemblages their particular reality.

Deleuze plucks genetic encoding for his case study whereby such “differential relations” unfold and through which virtual multiplicities are subsequently composed into unique actualities. Accordingly, the axes of the non-algebraic differential tensors “are incarnated at once in a species and the organic parts of which it [morphogenesis] is composed” (Deleuze 1994: 206). Similarly, Sarti and Citti’s model of differential heterogenesis provides us with a mathematical description of the emergence and creation of (particular) forms, whereby *a priori* conditions are not definitively predetermined but, instead, akin to the interference of two wave packet “colliding” during quantum superposition.⁵ Hence, differential heterogenesis allows us to consider the *becoming* process of the *a priori* without committing to the Kantian transcendental decision which contends that substance is a stable but uncontended and unreachable *a priori* category of mind that is imposed on the chaotic manifold of movement into form. Instead, while differential morphogenesis does, indeed, retain the “boundary concept” of the Kantian noumena—after all, we must infer the pre-conceptual differential space’s existence and, thus, it remains as a “thought-object” (*ens rationis*)—it is freed from Kant’s apophatic/negative and regulative use. This is akin to protein encoding in DNA, where DNA and RNA nucleotide sequences “translate” the amino acids that they represent. Like the possibility space of genetic encoding, differential heterogenic composition grants lays the conditions for immanent fixity, the dynamic space of possibility producing “the differential

⁵ According to the superposition state of quantum theory constituent particles exist in different states simultaneously and are thus superposed (as intact/decayed) at the same time. This is reified in the Schrödinger’s cat thought experiment and the Everett many-worlds interpretation of quantum theory, which posits the real existence of parallel physical worlds (therein suggesting that there exists an innumerable and unlimited multiverse). Accordingly, as soon as a quantum system is observed, there is a reduction of the wave packet and this quantum system performs a measurement-induced reduction—i.e., decoherence of the “superposition”. This operation is invoked by Sarti and Citti’s description of the Deleuzean assemblage’s evolution in relation to the emergence of the semiotic function by way of E/C and heterogenetic flow without the need of any stabilization: “[t]ogether with a morphogenesis in the space, we have also a morphogenesis of the space, since assemblages are continuously evolving” (Sarti et al. 2019: 3). François Laruelle’s recent literature is also privy to conceiving of the real qua quantum superposition.

constraints [that] determine the universality of laws and the nomological character of differential models” in antecedent fashion (Sarti et al. 2019: 6).

The Differential's Processual Relations

For Deleuze, the transcendental illusion is generated in the behaviour through which objects relate to one another and, consequentially, how “the states ‘experienced’ by a system are treated as other objects themselves, rather than system-specific entities generated by the organization of the object itself” (Bryant 2011: 102). According to this construction, entities “have their manifestations in relations to others, plus their non-relational interior constitution” (42). This relation, which Bryant terms an “onto-cartography”, is formulated around the relational appearance of entities vis-à-vis other relations, as opposed to their private (virtual) being (Bryant 2008). Bryant’s reading of Deleuze emphasizes Deleuze’s critique of *presence*—the belief that the experience of an entity is identical to its Being—by showing how Deleuze disentangles *presentist* (or event-oriented) philosophical positions that reduce reality to the thoughts concerning it.

Following Lautman, Kleinherenbrink, and Bryant, we can contextualize Deleuze’s differential entity as a means of characterizing machinic manifestation while prioritizing relation, itself.⁶ By invoking Sarti and Citti, we can further note that differential heterogenesis as such does not position or present the “thing-in-manifestation” as reducible to subject-object internal conditions (e.g., the perceptual experience of an object and its qualities). Rather, the manifestation of an entity is never a single, homogenous milieu or phenomenon but (differentially) split between qualitative rhythms/processes—nested within its agentive material dimension—and the content of its experience (Bryant 2014: 96). This bifurcation delineates “the qualities characterizing an experience on the one hand, and on the other hand the unified thing—immanent to the relation—of which they are qualities” (Kleinherenbrink 2019: 45).

What then, is to be said of the non-relational or private interior of entities? In accordance with Deleuze’s terms, the interior being of a machine is necessarily unified with its multiplicity, preventing continuity. The diverse world of experience is thus regarded not as a single, continuous, or homogenous mass but an *antecedent*. In short, externality evinces a strict discontinuity between interior being qua immediacy and interior being qua exigency.

⁶ As of 2016, Bryant has renounced the object-oriented externality thesis where entities are withdrawn from each other and considered as irreducible to relations. As he remarks in “For an Ethics of the Fold”, the “folding-transformation” affirms that that which is discrete is but a “fold” within a wider field; here, Bryant now underscores *knots of locality* along a single integrated continuum (i.e., the dynamic dimension and the ongoing activity of the “pleat”). Bryant thus remarks that “[b]odies are not discrete, but continuous with their worlds” which shows that, if the externality holds, “then entities are split between relational manifestations and their private being” (Kleinherenbrink 2019: 47).

Deleuze's model of differential virtuality upturns causal relations as lateral or horizontal processes between objects whereby actual terms can be reduced to an apparent *transcendental illusion*. As Bryant remarks, the "virtual works vertically from the implicate to the explicate" (2011: 64). Similarly, Deleuze's conceptualization of genes, which are linked together in interdependent and complex reticulations and interdependencies—an "endo-structure"—underscores how virtuality shapes the conditions that the form of the organism of becoming will take, where differential "becoming" in no way resembles the organism (with organism as a metonym for "actualization").

As Deleuze remarks in *Difference and Repetition*, "[t]he virtual is opposed not to the real but to the actual. The virtual is fully real in so far as it is virtual" (1994: 208). This fundamental tenant of virtuality demonstrates that the differential is coordinated by a manifold of points and nodes, channeled within processes "yielding a variety of actual entities with very different metric properties" (De Landa, in Duffy 2006: 246).⁷ Moving beyond topology, we can also note that rather than the macro-political rigid terrain (of Marx and Durkheim), Deleuze's differential micro-sociology probes insurrectional political zones of indiscernibly, such as the "subrepresentative" realm of the "masses and the quantum flows of belief" and the "desire and fear that govern them" (Holland, in Somers-Hall et al. 2018: 173). In short, Deleuze's "body without organs" denotes the non-relational unity of a machine, whether it concerns surface structure or sociologically-considered political behavior.

If, then, it is not actualities that figure into distinction, how do we distinguish *this* body from *that* body? This "desire" is what renders relational manifestations and, therefore, it is defined in terms of power; "desire" is the virtual latent content empowering the manifest content of actuality—thus, Deleuze's conception of the machine is as a "desiring-machine" (Deleuze 1977: 132). The machine's "desire" is its private reality, which cannot be directly experienced by anything else and is not empirically available; nor is it encountered and, therefore, it is *transcendental*—machinic desire is what gives actuality to a machine without, itself, being such an actuality.

This conception of "desire", much like the body without organs, belongs to the virtual aspect of entities and indexes the unconscious relation of physics/physical relations through the aperture of *internal matter* (Deleuze 1994: 106). For, if the externality thesis holds, it means that there is necessarily something about entities *outside* of such relations—i.e., an internality, which Deleuze defines as "[s]ubmolecular, unformed matter" (Deleuze & Guattari 2005: 503). The virtual corresponds to *puissance*, a particular articulation of power that is non-relational and can be experienced and described indirectly—for Aristotle, this comprised a (secondary) understanding of the potentiality of the many which, unlike the

⁷ Culling visual instantiations of such distributed topological nodes of singularity, Manuel de Landa harvests images of dynamic curvature: "soap bubbles, crystals of a variety of shapes, light rays and, indeed, certain mathematical objects", such as those comprising Poincaré's non-linear geometry—dips, nodes, focal points, centres (de Landa, in Duffy 2006: 240, 246).

potentiality of the one, comprises internal diversity as well as being at the heart of the entire spectrum of its actualizations. Drawing from Gilbert Simondon's notion of pre-individuality, which is neither reducible to chronology nor history—though not disparate from either—and directing this study towards topological space, rather than extensive space, Deleuze's differential conception of the virtual is necessarily as it is set in relation to the entity in-itself, or as a meta-stable system of non-personal and a-conceptual singularities (Kleinherenbrink 2019: 156). That is, "desire" is pre-individual because it is populated with intensive "singularities", "code", "desire", or an "Idea", rather than with the objects of experience. In particular, when Deleuze calls this potentiality the "Idea"—a pure virtuality that does not resemble its own actualizations—it is because he is describing "*the real with becoming actual, differentiated without being differentiated, and complete without being entire*" (Deleuze 1994: 214). Due to this externality thesis, relations are external to terms and every machine has an excess that seeks, or "desires", an extra-relational "beyond"—therefore, excess is differentiated, as Deleuze's system is not one of machinic univocity but one where every machine *is a multiplicity*: "singular without being a unit of something and diverse without being a diversity of things [...] Desire is the private reality of entities and in this sense [...] internal reality is a machine's matter, its substance, and its essence" (Kleinherenbrink 2019: 165).

As Deleuze's virtual is necessarily defined as a strict *part* of the real object, its "desire" stitches together essence, substance, and matter.⁸ For Deleuze, following Husserl once more, essence refers not to a simple object of experience but to the body's internal reality, distinct from "sensible things" and, thus, is "morphological", "nomadic", and "vagabond" (Deleuze & Guattari 1983: 167).

Much like the non-localizable nature of observation as it relates to differential heterogenesis, there is a peculiar vagabond nature to the virtual's twofold property of "being *and* not being where they are, wherever they go" (Deleuze 1997: 126). It is designated as such because the virtual is *intensive*, while an actuality is always *extensive* and, thus, articulated through precisely *where and when it is*, encountered in relations and nowhere else—"[m]y keyboard is beneath my hand and on my desk. A song is in a room. An organ is in an organism. Soldiers fight in wars and drones hover over weddings" (Kleinherenbrink 2019: 169-170). Drawing from Deleuze, our transcendental (i.e., the transcendental of differential

⁸ Here, we significantly depart from Manuel de Landa's assertion that Deleuze is not a realist about essences. As we shall show, in some sense de Landa takes Kleinherenbrink's reading of Deleuze to the extreme; Kleinherenbrink, reading Deleuze as an object-oriented philosopher, makes the case that we should avoid designating Deleuze's ontology (or, more specifically, circumscribing the virtual) from the perspective of the metaphysics proposed in *Difference and Repetition* because Deleuze, rather than "positing supra-individual virtual structures" migrates essences "into the interior of machines and shows why essence is malleable rather than fixed", which is how Deleuze unburdens himself from the "classical" conception of eternal essences (Kleinherenbrink 2019:179). As we shall show, however, de Landa takes this logic even further, overdetermining the "pre-patterning of a possible successive stratification", such that de Landa's assemblage theory is no longer compatible with differential heterogenesis, as it disrobes the externality thesis for the full tyranny of internality, rendering correlative compatibility impossible (Sarti et al. 2019: 18).

heterogenesis) is not that of the Kantian subject or the Husserlian ego but understood as the virtual aspect of a machine, itself.

Thus, no relation, human or non-human—including perception, description, art, science, myth, or mathematics—can attain the complex internal distribution of singularities or flow of desire that is immanent to a machine. Instead, these relations solely produce that which “generates a machine, that which a machine generates, or the actual qualities that it manifests” (Kleinherenbrink 2019: 173). This is all to say that the schizophrenia of reality is that everything is a machine that has its own internal reality (that is, an “essence”) irreducible to its manifestations in relations, an extra-relational non-being that is indexed by the machine’s having a body (otherwise termed a “problem”, “figure”, or “vessel”) with powers (“desire”, “singularities”, “Idea”, or “code”). Notably, while the “technical” and “social” aspect of machines concerns their actuality, “desire” is “molecular” and, therefore, it is opposed to social and technical machines, which are “molar”. Due to the diffracted partiality of machinization, every machine is a “desiring-machine in one sense”, but, also, an organic, technical, or social machine in another sense; in turn, “these are the same machines under determinate conditions” (Deleuze & Guattari 1983: 387).

Differential Heterogenesis vs. de Landa’s Internalist Ontology

With “[l]anguage as [necessarily] situated” and a product of the intensive dimension of becoming, the Deleuze of differential heterogenesis is posed along the fulcrum of interactivity (Sarti et al. 2019: 7). How does the Deleuze of differential heterogenesis depart from the Deleuze utilized by contemporary Deleuzeans, or “post-Deleuzeans”, a ragtag amalgam of philosophers whom we will soon unravel?

First and foremost, despite we retain a naturalized internal reference system and, thus, sail with a zephyr of scientific rationalism, our Deleuze is, indeed, quite alien from how Manuel de Landa’s “assemblage theory” renders Deleuze. De Landa *outpouches essence* and denies that assemblages are reducible to their parts and environments, such that entities are always external to their relations (de Landa 2013: 4, 10). De Landa denies that internal essences (or the virtual) exist(s) while insisting upon irreducible individual entities (or assemblages) that exist at all scales of reality. Emphasizing “dispositions”, or the fully real, albeit contingent, “tendencies” and “capacities” of an assemblage, de Landa’s realist and internalist ontology seeks to determine how no entity can be reduced to its virtual relations (or “diagram”) with other beings, as the “ontological status of any assemblage, inorganic, organic, or social, is that of a unique, singular, historically contingent individual” (10, 40). Purely nominal in difference, by “tendencies”, de Landa means that which allows an assemblage to change what it is doing (e.g., water freezing into ice as temperature drops) and by “capacities”, he is referring to that which allows for novel actualization (e.g. a plant’s leaves

becoming poisonous after one chews them). By reducing the virtual to structure, de Landa's system hinges on the critical threshold of finite spaces of possibilities or material "tendencies", prodding the once indeterminate "phase space" (of Lautman) towards various modes of stability ("steady, cyclic, turbulent"); for example, the virtual, as such, gives direction to:

[...] critical thresholds of melting and vaporisation, which has a reality beyond the actual. These critical thresholds are one example of a distribution of singularities, the term 'singular' meaning remarkable or non-ordinary, a special event in which a change in quantity becomes a change in quality. (de Landa 2015: 19)

Antithetical to any type of essentialism, de Landa counters the Aristotelian taxonomy that essentializes species and genera as, for de Landa, an assemblage is defined by the full history of all that has featured its constitution, with a species understood as an "individual entity as unique and singular as the organisms that compose it, but larger in spatiotemporal scale [...] individual organisms are the component parts of a larger individual whole, not the particular members of a general category or natural kind" (de Landa 2013: 28). For de Landa, the "diagram" is never actualized and there is nothing that makes one "diagram" distinct from another aside from the part-to-whole relations, for the "diagram" is comprised of universal singularities that we can scale up or down as we see fit (i.e., from the small local bodega to the transnational circuits of trade). De Landa's conception of the "diagram" is a stable virtual structure and, thus, there are solely sets of universal singularities that (over)determine all possibilities. This is why, for de Landa, there can never truly be bodies without organs—bodies are always already tethered to their organs, this just takes some measuring, testing, and experimenting to reveal. This is also why Kleinherenbrink is rather justified in his charge that de Landa conflates epistemological heuristics for ontological realities, inadvertently reintroducing a "Platonic heaven" of essences through the ideally continuous cosmic virtual plane that breaks into segments, despite being deprived of any theory of identity or origination. As Kleinherenbrink notes:

De Landa also claims that, for example, hunter-gatherer societies always already contained a prefigured state in their possibility space. But if the cosmic plane already contains all possibilities *and* if it is how the world 'first' begins, then why did everything not just come into existence from the get-go? Or why in this order and not in another? And why is it experiencing itself *as if* it is discrete identities? (Kleinherenbrink 2019: 181)

Admittedly, de Landa's assemblage posits a realism for all entities regardless of type/scale, grants assemblages an initial and real causal efficacy, roots assemblages in historical production (rather than transcendent structures), retains that assemblages have mind-independent reality, and regards human-object relations as ontologically equal to object-object relations (de Landa 2016). However, in order to avoid conceiving of assemblages

as illusory perspectives produced by and located on an intensive virtual realm that exists in a wholly unified and continuous form, which is, itself, further situated within a supervenient and immanent eternal present, we must rectify our externality thesis. This is what differential heterogenesis qua Deleuze's machine ontology grants us, which de Landa's internalist ontology of continuity *vide* the assemblage does not.

§ The Differential Further Considered

Parallel to Sarti and Citti, Simon Duffy, and Anna Longo is latticework of contemporary "speculative realist" philosophers—including but not limited to Bryant, Kleinherenbrink, and de Landa—who provide for the arachnean cast of Deleuze's differential shadow, the fixture of which prompts imploring Deleuze's oeuvre between functionalist and eliminativist foundations, or materialist and rationalist persuasions. For both Bryant and de Landa, for instance, discrete entities are designated as internal to larger continuous domains, whereby the virtual is relegated to purely productive forces—"chaos itself, or anything else" (Kleinherenbrink 2019: 295). We might add to this motley cast of post-Deleuzian thinkers David Lapoujade as well as neorationalists such as Ray Brassier and Reza Negarestani. Lapoujade's rendering of Deleuze's aberrant Bergsonianism endeavors to couple Deleuze's syntheses with memory (e.g., "contraction-memory" as the connective first synthesis, which is explained by "innumerable vibrations of matter"; "recollection-memory" alongside the disjunctive synthesis; "spirit-memory" as the vitalist rumble of the conjunctive synthesis; 2018). On the other hand, Negarestani's turn towards transcendental computationalism, emphasizing sapience and the logical inference of language, unwittingly reveals its hidden Deleuzian sympathies when describing anisotropic processes of collectivization and depathologization (as it applies to the environmentally embedded individual and AGI). In Ray Brassier's Sellarsian scientific formulation, reality exists independently from human experience and/or thought, despite it can be grasped through the application of privileged procedures (if this is indicated by kenotypic signs-cum-mathematics for Quentin Meillassoux, for Brassier it is relegated to the realm of natural sciences). Following another philosophical trail is Yuk Hui, who, as a student of Bernard Stiegler's, has significantly departed from Stiegler's Derridean influence, striking a balance between Deleuze's "transcendental empiricism", Leibniz' alignment of mathematics (with the mathematical infinitesimal), and Schelling's description of nature as a self-organizing system, adjudicating a tripartite mold of speculation, imagination, and integration.

Differential Deleuzianism's "overflowing becomings" have widespread implications: in biology, it points us towards phylogenetic evolutionary pathways and autopoiesis (Varela & Maturana 1992); in semiotics, it directs us towards the morphogenesis of being (Petitot 2004); in political life, it illuminates the cyclic emergence of insurrectional technical flows as

supervening upon proletarianization (Stiegler 2019); for new media theory and software studies, the differential provides us with a point of entry so as to examine newfound incomputable infinities, such as in the case of the Halting probability problem (Parisi 2013; Fazi 2018). In philosophy of physics, this conception of the differential allows us to examine the issue of multiscale analysis in modern computational modeling techniques, helping us recognize the distortions and vagaries in theory-as-approximation (i.e., describing materials that reveal large amounts of significant structure at intermediate size scales; Wilson 2018).

There are, indeed, a number of shared (albeit uniquely stratified) concerns by these contemporary posthumanist thinkers, wherein the goal of recasting aesthetic questions is conjured by the frame of epistemology while knowledge is subsumed under the category of speculative (and, often, non-human) naturalism.⁹ Stiegler's conception of exteriorized hypomnema (media mnemonics) and epiphylogenesis (the mutually constitutive relation between technics and organism) is circumscribed to the exteriorized interiority of the individual in an anthropic framework (exosomatization).¹⁰ Here, metastable distribution is lineally fielded across nested retentional hierarchies and mereological protentional resonances—Stiegler conceives of Deleuze's virtuality as the point of singularity (or a "minimum") through a manifold series of metric properties that unfold historically. Hui orients this in a unique direction, by demonstrating how Kant's *Critique of Judgment* (1790) is the first philosophical work to made the organism explicit and paradigmatic as, for Kant, mechanical laws are not sufficient to explain contingency and the teleology of nature. By co-opting Schelling's conception of freedom as the *improbable*, or absolute contingency, Hui recapitulates nature as neither something inside us nor outside of us but, instead, as it actively abolishes subject-

⁹ We will try to show how, as in Negarestani's computational transcendentalism, this "aesthetic question" is inextricably bound to the conditions of perception, whereby the tyranny of scalar optics is existentially determinate; thus, the "discrete" is an inflected ontological feature that recasts commitments to anti-materialism upon human finitude (recalling Gödel's notion of absolute truth). From Carnap's predictive interference learning machine to Solomonoff's low-level optical feature detectors, Marcus Flutter's compression of general intelligence, and Eliezer Yudkowsky's Bayesian program of rational AGI, inductivist models of ampliative intelligence do not account for truth-preserving and nondemonstrative inference. Insisting upon the fruits of the human experiential-cognitive terrain whereby, irrespective of their biases, all models of AGI are built on implicit models of rationality, Negarestani's project is to upend the post-human conception that extends Humean induction to AGI. This is pursued by way of the "geistig intelligence" of "possible worlds". Differential heterogenesis upholds the network-coherence of such non-linear architectures, which understand structure minimally via the explanatory function of elements and their relations (e.g., semantic structures).

¹⁰ By "interiority", we mean what Friedrich Kittler termed the "old thesis" of media theory, which, for Kittler, was circumscribed to McLuhan but also appears in André Leroi-Gourhan's concept of "exosomatization" and, consequently, in Stiegler. Kittler rejected this notion that media function as "extensions" of the "human senses" or as "prostheses" of organs (admittedly, for Leroi-Gourhan, as for Derrida, media also functioned as archival tools for memory). Kittler vigorously refused this "old thesis", which, according to him, "amounted to saying, in the beginning was the body, then came the glasses, then suddenly television, the computer"; Kittler preferred a more interventive relationship between media and organism, whereby "tools establish culture, because they participate in the rapport existing between hand and brain". (Kittler et al. 1996: 738; Kittler, in Ernst Kapp 2018: 111).

object dualism(s). Hui plucks Schelling's system to proffer recursivity as a "self-contained whole" (Hui 2019: 55). This marks the philosophical crux of *organicism* as a foundation for thinking of an open system through meta-scalar self-organization, anticipating biological models such as Ilya Prigogine's dissipative system and Francisco Varela and Humberto Maturana's autopoiesis. Schelling's philosophy of nature also informs Hui's *organismic* conception of spatiality, where each organism is understood as "self-contained" but also always "influenced by other organisms, so such an 'internal finality' affirms a structural 'external finality'" (163). Through Schelling, Hui destabilizes the conception of our world as a closed and static material system.¹¹

Hui has recently taken interest in the positive use of the Absolute in Meillassoux as articulated in the "inhuman" as an "affirmation of a nonhuman way of production of knowledge and systematization" through reiteration, with this reaching towards the potential of infinitude (as exemplified by mathematical practice; 263). For Meillassoux, the kenotype is pure identity and indexes that which is outside of the field of sensible repetition. Hui demonstrates how Meillassoux's reiteration—the ontology of empty signs—in fact affirms computationalism. Bolstered by Gödel, Hui's conception of the inhuman attempts to transcend systematization, rather than reaffirm it, with contradiction as the *undecidable* rather than that which is overcome in (historical-temporal) reality. It is with the looming overhang of preformation that the inhuman –Hui's cosmological arrangement–finds its collective closure with differential heterogenesis' abstract morphologies devoid of corporeal value, i.e., *pure saliences* (Sarti & Barbieri 2018: 56).

If Lautman's penetration of the real by intelligence diffused differential geometry as a cosmological vector, Jean Petitot's philosophical interest in mathematization vis-à-vis the critico-phenomenological tradition permits us to go beyond a biological understanding of morphogenesis. This is why Sarti, Citti, and Piotrowski, contra Saussure's initial impulse to dismiss "the sound" as "gnoseological obstruction", re-compose phenomenology into the becoming of meaning (Sarti et al. 2019: 15). Similarly, directing the real along mathematical

¹¹ If Schelling's *Naturphilosophie* is a precursor to biological organicism, for Hui it is Hegel's dialectical logic that anticipates the machinic organicism of cybernetics—second order cybernetics to be specific. Where Hegel's nature is an object of observing reason from the outset, for Schelling nature is pre-consciously sensed and detected prior to becoming an object of reflection. Unlike Schelling's emphasis on an external force's giving form to the nature's production, Hegel's departure from preformation towards immanent negativity re-introduces contingency into the system of nature. We can map this onto second-order cybernetics quite neatly as, for Hegel, there are two forms of recursion: 1) chaotic nature 2) the logical category (of being). Hui also illuminates the recursive relation between the whole and the reflective judgment through the subjective speculative process of reason. This "speculative whole" is critical to Kant's central methodology and directly influenced Georges Canguilhem, who coined the term "general organology". Reading Kant as a philosopher of technology, Canguilhem conceives of intelligence as the act of "geometrizing matter" that recursively constructs its artifactual scaffolding, stilted on "duration and extension" (160). Additionally, is through Bergson's work on integrative evolution that Canguilhem's "general organology" becomes that which infinitizes the finite and ecologically reintegrates the inorganic into an organized whole—the organic is irreducible to the mechanical, which is merely a particular instantiation of the organic.

morphogenesis, Petitot's work on the superimposition of receptive fields echoes reconceives of the differential as a media mnemonic with which we are allowed "to test" the real (1987: 20). Petitot's most recent work with eigenvalues uses Alan Turing's "reaction-diffusion differential equations" to parse Newtonian mechanics alongside kinetic chemical information; according to Petitot, scalar sets demystify the differential's ability to evoke the "breakdown of symmetry and homogeneity" (2012: 22). Petitot's writing on morphogenetic substances also demonstrates how there exist many homologies of organization between different biological species that are determined along histological patterns, fortifying Sarti and Citti's Simondonian-biological conception of organology-formation qua differential heterogenesis.

Fielding Sarti and Citti's terrain of becoming-differential and the computational linkages between geometries, symmetries, and geodesics central to understanding the physical world, one may consider Simondon's "intrapreceptive image", the pre-condition to perception, and Deleuze's "Aionic" temporality of the third synthesis of time.¹² Aside from self-touching haptic conceptions of the self, such differentials are also linked to self-reflective mental portraiture on the "infrapreceptive" scale, or that which is sensuously "seized within" (kinesthetic/proprioceptive), where the fold touches upon itself, providing the differential with a breakage point within the ubiquity of universality such that it can locate itself. From nano-technologies to the subjective experiences that emerge *out of* the differential, such linkages may provide an imprint of experience that pertain to making sense out of what were once regarded as provisional "invariances".¹³

¹² For Deleuze, the *Aion* is the continuous tense of becoming, pitted against the *Chronos* of the hegemonic political order. Thus, while this paper does not take aim at the political insurgencies of the differential, this could be a viable point of entry. Nonetheless, the operational logic of Deleuze's continuous tense of becoming is recalled in Citti's recent research on building a Poisson kernel that starts from the knowledge of a smooth fundamental solution so as to contract the problem of "whole space" while eliminating any use of the Fourier transform in the full rank case (Baldi et al. 2019).

¹³ For Robert Nozick, consciousness functions as a sort of "zoom lens" with which an organism can attune its behavior with its environment (Nozick 2003: 180-190). Such "zooming(s)" supplements Deleuze's "passive synthesis" qua Simondon's unconscious process of becoming-produced through multi-generational assemblages and circuits, facilitating transindividuation (which is societal and intergenerational). According to Stiegler and Yuk Hui, who build on such a conception of synthesis, media objects supplement transindividual memory with "invariance" (and, according to Hui's cosmotechnics, "human freedom") as it transits across generational attenuation, engaging within the cross-generational social sphere of non-verbal/non-graspable recursive encoding (to accomplish this, Hui recalls Gödel's criticism of materialism; Hui 2019: 236). Musing on the non-graspable, one may consider Thomas Nagel's oft-quoted paper on "bat consciousness", which asserts subjectivity's ambient spectral vagaries of "unknowingness", where simply *knowing* a theory doesn't make the theory true of or for the knower. Nagel's epiphenomenalist argument asserts that, no matter how well we describe the bat's use of echolocation extrinsically/informationally, we are still barred access from "the notion of what it is *like* to be a bat" (Nagel 1974: 438; emphasis added). In response, Paul Churchland notes that "[t]he proper *test* of that scientific/physical/objective theory of bat-style cognition is whether, when that theory happens to be genuinely *true* of some given creature, then the creature actually *has* the subjective experiences of a bat" (2011: 19). Churchland's criticism of Nagel's use of "qualitative simples" is that it confounds *what it is to know something* with *what it is to actually be something* (ontology), such that this problem is one of translation. Bringing this back to Hui's idealism, one may say that the "positive inhuman" is only out of comprehensive reach insofar as it is not translated properly.

Anisotropic Materials & Multi-Scalar Media Modeling

The infinitesimal is not simply a topological question of division in Euclidean space, perception, and observation but, as Sarti and Citti note, concerns how neurogeometries—such as Petitot’s sub-Riemannian geometry— demonstrate “differential constraints” that are not necessarily deduced from more sophisticated structures (2019: 11).¹⁴ Just as semantic meaning is always produced as a pragmatic experimentation of singular transformation but never *given*, differential neurogeometry enumerates how a mathematical description for the emergence and creation of conditional forms is not configured as an *a priori given* within a set (Sauvagnargues 2018: 17). Petitot’s work on vision and image processing, which builds upon David Mumford’s geometrical formatting of visual input, exhibits how neurogeometry testifies that “phase space” is a “pure intuition” that is non-conceptual, antepredicative, and a prejudicative. Homologous to how Sarti and Citti’s differential heterogenesis provides us with a mathematical description of the dynamic production of *a priori* “phase space”, neurogeometries are specified by a cognitive corollary to virtual-actual becoming, where the key role is that of *scale*:

Perceptual geometry results from the integration of local detections by receptive fields which have a certain width and so occurs at a certain *scale*, i.e. with a certain resolution. Perceptual differential geometry must therefore be multiscale, while conventional differential geometry corresponds to the idealization of infinite resolution. (Petitot 2008: 13; emphasis added)

To best articulate this problem, let us take into consideration a simple steel beam. At the highest size scales—following Hookean first-order linear approximation—steel *stretches* and *compresses* down to approximately 10 μ m. At 10 μ m, the grain structure within steel becomes highly pertinent, as these grain structures and their components begin to stretch and compress according to a more complex set of rules than larger-scale steel. Within each of these component grains there are a number of “laminar layers which rub against one another in complicated ways [...] until we reach the tiny crystal lattices of the molecular level, whose orderly patterns are interrupted by higher-scale-irregularities called dislocations” (Wilson 2018: 202-203). It is here that the differential equations that regulate behaviors nominally occurring in the “infinitesimal” level become central. The specifications relevant for the differential equations within physics are generally obtained by scaling higher-level behaviors downwards, until some simpler infinitesimal level is reached.¹⁵ Steel, however, presents a problem to such benchmark scaling assumptions, as its behaviours stop scaling at

¹⁴ The illusory contours of sub-Riemannian geometry, defined along planar curves, demonstrates how spatial representations have neural origins related to wavelet analysis and are immanent to visual perception (Petitot 2017: 304).

¹⁵ This is well codified by the apothegm that “physics is simpler in the small”.

the cutoff of $\sim 10\mu\text{m}$. While small sections of steel behave more or less identically at all scale lengths above this level, to capture the component grain behaviours after $10\mu\text{m}$ accurately, we are required to model it in a more laminate-based manner.

What, exactly, then is the “greediness of scales”? While Representative Volume Element (RVE)¹⁶ sub-models *can be examined* on account of contemporary scientific observational-measurement tools (and, in particular, advances in computer simulation that attempt to overcome descriptive clashes), it is the problem of *data amalgamation* that prevents “practitioners from profiting from this collective knowledge in a straightforward way” (203)¹⁷. This is because, using RVE scale-focused modelling via differential equations in bottom-down fashion (i.e., reaching towards the infinitesimal), amalgamation presents a conflict regarding the direct descriptive incompatibilities that arise when we use the same vocabulary with respects to properties that a material (such as steel) displays on small-scale levels.¹⁸

The “greediness of scales” summons the central concerns of differential heterogenesis, producing a collective closure between the semantic and the topological concerns that Sarti and Citti elude to. The central problem arises on the differential terrain: differential equations that are appropriate to two levels of sub-modelling necessitate that the narrowly-constrained rules concerning stretching and compression *must remain applicable down to the zero-length scale*. Hence, the “greediness of scales” conflict is born due to syntactic disharmony: the differential equation model must account for all the lower-size scales available to reach the infinitesimal level, which is where differential equations articulate their stipulations. However, due to the syntactical discordance concerning the material’s behaviour beyond a cutoff level, we have to content with inconsistent claims concerning the very same part of a material, media, or object. This may remind the reader of Sellars’ “pink cube” problem, where an ice cube’s colour is observed as ultimately homogenous because its “manifest image” presents itself to us as a “pink continuum” in “all the regions of which, however small, are pink” (Sellars 1966: 26). The concept of “pink”, however, demands that its applications *scale continuously downwards* to the infinitesimal level, wherein this “manifest image”, or the image of as it is plainly conceived of to the naked eye, is set in contrast to what we know through scientific measurement or, in Sellars’ parlance, “the scientific image”. Despite Wilson

¹⁶ Representative Volume Element (RVE) denotes the descriptive depiction linked to a set of target-events in terms of the characteristic size-scale of an object during which those events unfold.

¹⁷ This means that two scientists who model different select scale levels (of steel) can not simply posit their combined research results because it will result in syntactic inconsistencies where differential equation requirements overlap.

¹⁸ With crystalline materials, for example, at *low-level scales* we observe segments of perfect lattice configurations bonded together around arbitrarily oriented boundaries. At *scale levels above this point* ($10\mu\text{m}$), RVE behaviours around the level of conglomerations are generally *isotropic* (the material responds to the same rules regardless of which direction it is being pulled). Higher-scale responses support modelling where compression and stretching behaviours are governed by Young’s modulus of elasticity (E or Y) with the shear modulus $0\mu\text{m}$; however the small slivers of crystal within these conglomerates *do not stretch and compress in this simple manner*. Thus, RVE modellings “appropriate to these tiny structures require five or six elastic modalities to capture their *anisotropic behaviors*” (Wilson: 203; emphasis added).

is concerned with continuum physics and the stipulations behind a scale's executing a bottom-down monopoly—specifically as it concerns requirements of mass and stress—there is a homology here with Sellars' "clash between images".¹⁹

Engineer J.T. Oden has described this *tyranny of scales* problem by remarking that all simulation methods produced until the beginning of the twenty-first century were valid solely for:

[L]imited ranges of spatial and temporal scales. Those conventional methods, however, cannot cope with physical phenomena operating across large ranges of scale—12 orders of magnitude in time scales, such as in the modelling of protein folding or 10 orders of magnitude in spatial scales, such as in the design of advanced materials. At those ranges, the power of the tyranny of scales renders useless virtually all conventional methods. (Oden 2006: §3.1)

As eluded to earlier, in the last two decades we have developed advanced modelling schemes to resolve such discrepancies by allowing RVE sub-modelling layers to circumscribe their descriptive agenda to localized and semi-autonomous "strata", or what Robert Batterman (co-opting the term from physicist Robert Laughlin) calls a "protectorate".²⁰ These semi-enclosed strata/protectorates are set into communication with one-another through those "coded messages" called *homogenizations*, dividing linguistic labour and moulding novel explanatory architecture. Such a homogenization policy shows an internally linked equilibrium by aping the physical manner in which "relatively simple forms of dominating behaviour, characterized by a limited set of descriptive parameters, emerge at higher scales from their large, lower-scale underpinning" (Wilson 2018: 219). Differential heterogenesis can, thus, be used as a technical tool to produce equilibrium homogeneity.

Given the standard tools of Euclidean geometry, there are considerable difficulties in capturing the "natural" notion of a dominant behaviour in precise terms that we have attempted to counteract. What of the semantic terrain? Like syntactical structure, the topological charge of any gradient field is a problem of scales, but in both examples a crucial consideration is

¹⁹ For Sellars, this "relocation story" is not "simply a solution to the problem posed by mathematical physics. It is also an account of how we could come to be able to think about sense impressions in the first place. We come to be able to think about sense-impressions of pink cubes by first thinking about volumes of pink that we seem to see, and then recasting the manifest pinkness as properties of perceptual states of ourselves" (Rosenthal 2016: 153). Sellars' relocation picture necessitates that we conceive of sense-impressions as automatically conscious, whereby mental states' being conscious is distinct from the individual's being conscious. For Sellars, the central question of the "grain problem" was whether it could, in principle, be possible without a neurophysiological conceptual framework that defines states according to intrinsic character but proffers to epiphenomena. Wilson, on the other hand, is not interested in the homogeneity constraints satisfied by conscious presentational content but syntactical overdetermination.

²⁰ "The crystalline state is the simplest known example of a quantum protectorate, a stable state of matter whose generic low-energy properties are determined by a higher organizing principle and nothing else" (Laughlin & Pines 2000: 29). The "protectorate" is a domain of physics where behaviour is independent of the microdetails found at small size scales (Batterman 2010).

the problem of modelling. As elaborated in “the greediness of scales” problem, scale-focused modelling must utilize differential equations while contending with the descriptive demands of reaching down to the infinitesimal level. A differential equation model must monopolize all of the lower-size scales available to reach the infinitesimal level at which these equations articulate their stipulations. This description of differential equations gets to the core of Deleuzian heterogeneity and the difficulty of applying an ontology to amalgamation.²¹ Instead, we need a hybrid category that articulates the compossibility of passive synthesis (microstates and their microeffects) and differential retention (mnemonic integration and redistribution).

Wilson’s project, broadly speaking, outlines the working architectures of modern multi-scalar modelling techniques to help us recognize the distortions and vagaries in “Theory T thinking”, or theory-as-approximation. Moving forward, we will focus upon the difficulties involved in describing materials that reveal large amounts of significant structure at intermediate size-scales (e.g., the structural features that distinguish one igneous rock from another, or the out-of-equilibrium formations that blacksmiths fold and beat into steels). Consider, for instance, the diamond’s long-lasting range of “frozen order”, wherein there exist strong energetic barriers within the diamond that prevent it from returning to low-pressure graphite, such that it has a long relaxation time. Similarly, most solid materials display very little inclination for maximizing their entropies.

If cognitive architecture involves tacit adjustments in contextual registers, what does this mean for the representational structure of the syntactic demands in question? Sarti and Citti give us an answer concerning the co-constitution of assembly via meaning and sensibility, but we very well might consider another approach, beginning with the question of compressive schemas. Let us take the example of two standard pictorial modes—TIFF and JPEG formats—wherein the JPEG image is comprised of far less data-points than the TIFF image. With the TIFF image, we see that data is encoded on a pixel-by-pixel basis (with each pixel encoded independently of one another). In the JPEG image, every pixel’s front-end registration governs a fixed span of back-end determinacy, as if the individual pixels of the TIFF had dissolved, forming an assemblage based on large-scale (colour-determinate) hierarchies. Parsing the mold of the JPEG image’s compressive scheme, we can construct an enactive scaffolding by exploiting contextual registers; this begins with a broad metric, Q_1 , followed up by finer grained metrics, Q_2 , which rely upon the response to Q_1 . This process follows through a nested array of further queries, Q_3 , Q_4 , and so on. Such interdependencies unfold within a segregated front-end register (Q_1, Q_2, Q_3, \dots), followed by an enumeration on their respective

²¹ This has traditionally been framed by mathematicians such as Errico Presutti so as to inadvertently prod the problem into the realm of epistemological constraints by focusing on the phenomenology of perception/awareness, suggesting that the hierarchies that emerge in characteristic scales reflects epistemic limitations regarding our representational capacities. Wilson rejects this by stressing “the direct correspondence of dominant behaviours to objective issues of energetic transfer and degradation”, thus making this an ontological issue concerning Quinean commitments (Wilson 2018: 213).

answers (A_1, A_2, A_3, \dots). These representational tactics are termed *multiple register schemes*, where syntactic complexity is reduced through scope restrictions via policies of contextual localization.

Thus, Wilson remarks that “[p]resent-day philosophy of language could become more supple if its practitioners more warmly appreciated the substantive reductions in syntactic complexity achievable through various policies of contextual localization” (9). A conception of computational pragmatics as such is privy to responses to the registrations of linguistic capacities with respect to data and reasoning qua compression.

The “greediness of scales” problem demonstrates that hysteresis, the microscopic migration of dislocations that eventually results in material cracks (i.e., lower-scale damage inflicted by upper-scale punishment), can not be illustrated with conventional computational modelling through single-level descriptive methods. While we cannot give an account of hysteresis by working upwards from the molecular scale in this mode, the multi-scalar model evades such computational barriers by enforcing a cooperative division of descriptive labour amongst a hierarchy of RVE-centred sub-models, each of which is tasked with capturing dominant behaviours that arise within its purview. Thus and so, “each local RVE sub-model directly responds only to its local environment, rather than to events that arise within distant sectors or upon alternative size scales” (Wilson 2018: 222); by stepping through the mathematical filter of homogenization, we readjust local parameters within each RVE unit until the cascade of inter-scalar reports is rendered self-consistent.

Wilson’s adaptive approach also emphasizes how the use of “wandering words” such as “force” or “use” precede firm referential semantics; only after applicational enclosures are set can they attach to moorings suited for novel modelling environments (Wilson 2006). Thus, Wilson does not agree with Jerry Fodor’s anti-pragmatic approach to meaning (Fodor’s *a priori* assurance suppresses adaptive behaviours by compounding variegated facets of language-learning). Fodor and fellow anti-pragmatists such as Susan Stebbing argue that semantic scenarios inherently anticipate altered adjustments, claiming that terms such as “force” are “first assigned, strong, referentially determinate core meanings before the pragmatic influences of applicational context can begin their work” (Wilson 2018: 30).

Terms such as “force”, “temperature”, or “cause” are granted enlarged descriptive utilities and, therefore, coherence strategies when they are developed within local adaptations, whereby such arrangements are protected by “homogenization barriers”. Within the multiscale model, structural portioning into segregated patching abets swift processes of adaptation— “[t]he homogenization barriers that block direct cross-scalar syntactic amalgamation in a multiscale scheme serve as essential ingredients within the remarkable descriptive efficiencies they offer” (Wilson 2018: 195). It is precisely the “ready reprogrammability” of any multiple-register language’s format that facilitates the adaptive plasticity of its conceptual practice. Thus, the descriptive focus of terms such as “force”, “temperature”, “strain energy”,

etc. is contingent upon scale-level application, where “arrangements facilitate the *reassignment* of old computational routines to novel applicational purposes” (30; emphasis added).²²

Deleuze and Scales

According to Deleuze, the assemblage has “only itself, in connection with other assemblages and in relation to other bodies without organs” (Deleuze and Guattari 1983: 4). Despite the relations that any media object may have with its semblance, for instance, these relations are demanded by externality and no such connections to other entities fully designate its “being”. This is a theme that we may term poetically term “solitude”, which becomes pellucid in Deleuze’s books on cinema—such “solitude” is manifest when we consider the structuration of cinematic moving images. In the “movement-image”, or the pre-World War II cinematic image, “vehicles or moving bodies” are understood as thoroughly relational—that is, they include actions, perceptions, and affections that hint at externality (or autonomy and materiality) but do not embrace it fully (Deleuze 1986: 23). In the works of Hitchcock, for example, Deleuze recognizes that relations are always designated along external terms that constantly refuse their full implication. In the post-war “time-image”, we see the enveloping of incompatible images, disjunct sounds, and, consequently, impossible worlds that are—through editing—brought in-common, suggesting the possibly of “an outside more distant than an exterior, and that of an inside deeper than any interior” (Deleuze 1989; Kleinherenbrink 2019: 54). It is this very incommensurability, the inextricable Outside from which emerges cinematic malaise, that we see inaugurated the possibility of the impossible, the “false image” which makes manifest a “private reality” or the “virtuality of time” (Galloway 2016: 68). In Deleuze’s work on cinema, the screen’s moving images are but metonyms for exocentric frames of visual reference, evincing that perception, which is indivisible, offers time in a “pure state” (Deleuze 1983: 21; Deleuze 2005: 96).²³

²² There is a curious parallel between Wilson’s cyclic description of our regenerative linguistic formulations, “condemned to wobble between seasons of brash inferential extension and epochs of qualified retrenchment later on” and André Leroi-Gourhan’s notion of the evolutionary *chaîne opératoire* (Wilson 2018: 32). According to Leroi-Gourhan, “[f]or each species a cycle is established between its technical ability (its body) and its ability to organize itself (its brain). Within this cycle, through economy of design, a way opens up toward increasingly pertinent selective adaptation” (Leroi-Gourhan 1993: 60).

²³ Thus, the differential can also be identified with the *process* of watching cinema, whereby Bergson’s *élan vital* is reproduced during a medial becoming that, phenomenologically, cannot be infinitely divided or regarded as an aggregation; a “differential difference” emerges between the temporality inscribed on a film reel (the material artefact of recorded time) and its perceptual undertaking. For Deleuze, perception’s schematic hold foments the central category with which to understanding moving images, not as a representation but as an epiphenomenal account of time understood in the manner of Bergson’s conception of (pure) duration. As we see in Deleuze’s Bergsonian account of cinema, moving images are not “images of movement” or “images of any thing, object, or model” but, instead, “movement-images grasped as blocks of sensation that free the image from its dependence on the archetype or the eternal pose” (Baumbach 2018: 133). In *Difference and Repetition*, *Cinema 1: The Movement Image*, and *Cinema 2: The Time-Image*, Deleuze

This inextricable Outside, as a functor of the externality thesis, transpires most markedly in observations from lived experience, where the relation of signs-to-denotata is processed through the “sensory motor schema” as something akin to the causally-connected filmic script of the movement-image, or “cine-thinking” (Alliez 2000). To inscribe this lesson once more, we can turn to those examples in visual art that actively engage with the plane of presentation and exigent construction as, for example, in Marcel Duchamp’s “Fountain” readymade, which:

does not need its ‘R. Mutt’ signature in order to exist, nor does L.H/O.O.Q. need the moustache added to Mona Lisa. The parts of an entity are always somewhat redundant, a complex notion [..., which] reveal(s) that objects have no natural place, function, or meaning. There is nothing external constituting their essence. (Kleinherenbrink 2019: 57)

What does this have to do with multi-scalar modelling? Deleuze’s overall theory of machines is fundamentally flat, discontinuous, and infrastructural, as Deleuzian externality is premised upon irreducibility. Similarly, Wilson demonstrates the tyranny of reduction, whether it be an ontology (“Theory T thinking”), modelling (the hyperbolic notions of evolutionary modelling), or semantics (the inferential expectations moored to words like “cause”). In opposition to Platonism, or internalism—which results from the private depth of machines being irreducible to and unique in kind from their actualizations—our fundamental error of thinking, according to Deleuze, is to conflate the contiguity, identity, and resemblance characterizing actuality as also characterizing “things-in-themselves”. Therefore, “every entity is itself a machine, in the sense of being a causally effective agent that makes its own difference in the world” where each entity has its own unique “complex inner working” (Kleinherenbrink 2019: 7).

For Deleuze, machines can have actualizations that are not themselves machines but instead translations or scalar measurements of the *being* of a machine into the experiential content of another machine. Consider, for instance, how Duchamp’s readymade teaches us that entities are obstinate assemblages and that all entities are, consequently, irreducible machines that can function smoothly with others (if the proper operations are exacted). That is, the “natural condition”, which is pre-observational, is that of the straited space; it is the necessity imposition of a scientific system and/or systematic scale/measurement that mends any and all aforementioned entities together within scientific unity. Nonetheless, this irreducibility does not necessitate an ultimate hierarchy or end-point—for were this the case, all entities would be self-identical and, thus, reducible to themselves. Deleuze’s ecology of the assemblage, a synonym for “machine”, designates how any system emerges from relations between heterogenous parts. Deleuze’s world of externality is one in which “no two

instates Bergson’s account of “emotion”, which configures the central logic of Deleuze’s differential aesthetics of representation. Deleuze’s differential aesthetics develops an image of thought that attempts to overcome the binary separation between matter and spirit, or mind and body.

grains of dust are absolutely identical, no two hands have the same distinctive points, no two typewriters have the same strike, no two revolvers score their bullets in the same manner” (Deleuze 1994: 26). This absolute refusal of internality necessitates that there be no principle frontier of passage between universal and particulars (Deleuze 1990: 132). This also necessitates that there be a difference in kind between metaphysical surfaces and physical surfaces of each entity, such that all entities are spatially, temporally, and mereologically irreducible. Therefore, primary and secondary qualities, parts, functions, wholes, and predicates are brought into an ecology of relational aspect-hood, which always implies other entities’ necessity.

As Sarti and Barbieri comment on sensory cortices’ receptive profiles, signification processes are grouped by conditioning and reinforced value systems, hereby holding a candle to how we articulate the progressive construction between seeing, feeling, knowing, and signifying as the relational capture of elastic moduli. Similarly, as seen in the corrective process of homogenization—neither purely bottom-up nor top-down in its descriptive policies—multiscalar modelling commits to running through successive stages (macroscopic estimation→microscopic correction) as needed until an overall descriptive accord is reached. Bringing Wilson’s description of scalar overdetermination together with Deleuze’s demonstrates that the simple descriptive modelling assignment of “togetherness” is insufficient when relying on empirical observation, i.e., when describing generative disharmony at the level of the differential.

Conclusion: Our Place in the World

How does Deleuze’s thought concern the human, which it would evidently appear to never privilege beyond the machinic “greediness of scales” and conjunctive synthesis? Deleuze’s machine ontology accords a method of transcendental empiricism. This system begins with a recollection of the Kantian “boundary concept” of rationality’s regulative use; according to Deleuze’s account of “empiricism”, human finitude designates encounters as a sign or manifestation of other entities and not such entities in and of themselves. The “transcendental” portion is what allows us to assume that there is also a virtual side to machines, which can allow us to move beyond the pretention of negative use. In his early account of “transcendental empiricism”, Deleuze’s materialist transvaluation of the Kantian account of transcendental subjectivity imparts how impersonal, inhuman thinking does not merely represent the natural world but is directly productive of forms (e.g., space and time). Distinguishing reiterative subtraction vis-à-vis the body qua belonging from the formula of the dialectic, in an early essay concerning *Difference and Repetition*, my mentor Reza Negarestani notes that ontology is “ultimately a differential between these two forms of cruelty”, i.e. binding the living to the dead, or sadism, and mandating reconsummation, or masochism, “with the void,

each with its own mechanisms of torture, atrocious creativities, rules and problems” (Negarestani 2009: 78). However, as Deleuze’s system matures, it further accounts for a supplementary account of subjectification, wherein an appeal to the “encounter” ensures the “measure of fit” between transcendental empiricism as a constructivist mathematism of concepts and the world of intensive, actual difference.

Deleuze’s transcendental empiricism of inscribed difference thus offers a *positive* value, rather than abiding by the earlier “law of the negative”, or “negative determination of the body qua belonging which is imposed by the Ideal” (Negarestani 2009: 78-79). It frees difference from its (historical) subordination to the indeterminate homogeneity of the Platonic composition of identity, whereby the parts of a whole are established and identified as the whole, itself, *a priori*. Thus, the Deleuzian differential is based on difference “in itself” (Deleuze 1994: 28).

Consequently, the Deleuzian correlative of the *a priori* of form and substance becomes phenomenologically cross-constituted by the envisages of a body and its embedded world. As a result, both respond to the uncertain solicitations of a milieu that instructs its rhythms, behaviors, and sensitive qualities. Following Deleuze, the co-constitution of sensible qualities are, by construction, not those of sensation (as affect theory would have us believe) but intrinsic signification.²⁴ The sensible, from the very beginning, is provided with a meaning, which is assigned by the corporeal matrix which institutes it (rather than its specific sign).

Beyond navigating the differential qua coherence vis-à-vis behavioural fidelity to layer orientation and interface-limited hierarchical behavioural dependencies, by gleaning Wilson we have surreptitiously also tried to create a bricolage with Deleuze’s machine ontology and ontological commitments of the Quinean ilk which are also demarcated by the possibility of re-alignment. I argue that this is not a misreading of Deleuze’s machine ontology, for Deleuze denies the possibility of an ultimate Mechanosphere that captures all relations; Deleuze’s externality necessarily cannot be reduced into exhaustive organic or biological relations, as external entities are not self-caused or reducible to anything else. Deleuzian externality is premised upon irreducibility. Wilson’s ontology contends with the Quinean thesis that our “ontological commitments” should be determined by assembling our various worldly claims into a unified *theory* (much like the machine ontology) but surveys any amalgamated corpus for varied existential claims—sentences of the form $(\exists x)\alpha$ —that, meanwhile, relationally adapts.

Let us briefly remark on relational adaptation of media and behavioral use. Stiegler’s work on technics and time introduces the tertiary retention to Husserlian phenomenology by remarking upon how the media artefact bears a transcendental responsibility within our “general organology”. This “lost limb” is a supplement in the Derridean sense: both an

²⁴ Jean-Louis Schefer, whose writing (on cinema, in particular) greatly influenced Deleuze, describes such affects as “urgently invisible, non-represented, and unformulated”, producing a “criminal pleasure”, whereby “signification, words and images no longer represent anyone” (Schefer 2016: 196).

enhancement and a substitute, irreducibly redistributed along the materiality of supplementation and inclusion (bi-directional, cyclic). Stiegler here recalls Simondon's allagmatic architecture of technical operation, which is also scalar—individuation is bound up in both the individual and their milieu, with technesis forming part of an individual and their transductive reality. Neither a substantial being nor an element in a rapport, the individual is first and foremost the reality of a "metastable relation" (Simondon 2006: 79-80). Media and man are caught within a constructive process, as the individual is bound up in a progressively conditioned and supra-organic artefactual *technosphere* of recomposition; the *a priori* is revealed not as absolute, but relative to the local process of compromise between organism and world (i.e., "absolute movement"; Deleuze 1989: 40).

As the description of topological stimuli-responsiveness demonstrates, technicity is also a cognitive process that begins with cephalization and neuralization, climbing a naturalized scaffold with the evolution of tool-use and language, inaugurating new cognitive technologies. This is precisely why in Stanley Kubrick's *2001: A Space Odyssey*, the black monolith appears at every new level of technicity, indexing historical change ineliminable to the development of mankind. As Negarestani remarks in *Intelligence and Spirit*, our cognitive scaffolding is bolstered by two poles, each dealing with significant problems of computation: i) the qualitative compression and stabilization of information necessary for the communal establishment of knowledge and its augmentation (e.g., the bone-wielding ape); ii) the coordination for understanding and action (e.g., the apes shrieking in unison, suggesting the eventual construction of language; Negarestani 2018: 491).

In turn, the teleologically determined nature of Intelligence is revealed: how, absent a contrasting index for differentiating itself (from its food, environment, or technics) does the organism (which risks autophagy) differentiate itself from space? One answer has been historically tethered to the development and extension of our (central and autonomic) nervous system, which provides us with the prowess to designate spatial differentiation through "perspectival pure positional awareness of items-in-relation-to-one-another" (Rosenberg 1993: 111; Moynihan 2019). Another is with language. Both deal with the making-discrete in cyclical logic.

Deleuze's introduction of dynamicity foregrounds the intermilieux and transobjective process of virtualization as a presignifying rhythm, a faculty of *transcoding* that has become integral for considering discretization (as it applies to both technics and language). This, too, has dialectical roots: Lautman's dialectic instantiation of analysis subordinated to topology involved structural schemas designated along a striated hierarchy in which there was an inscribed "upper" logical level consisting of a "more simple and universal" assembly: "local/global, intrinsic/extrinsic, discrete/continuous" (Lautman 2006: xxvii). It is from Lautman that Deleuze inherits the conception of the eternal return of the "not-yet-present"

and “passive synthesis” as a topographic genesis of environmental embedding (which lies *in between* environment and context, thus existing as a differential marker).²⁵

As perhaps best demarcated in Carl Boyer’s *The History of the Calculus and its Conceptual Development*, the differential can be understood as a “point of view”, or as perceptually-navigating infinitesimal difference between the consecutive values of a continuously diminishing quantity, as in Zeno’s paradox (Boyer 1939: 2). Simon Duffy describes the becoming-derivative as an infinite process of determining the “vanishing quantity” (Duffy 2016: 119). In Deleuze’s work on aesthetics and Francis Bacon’s paintings, we see the finitude of individuality understood through the framework of this “vanishing point” (*point de fuite*), the “second direction of exchange” that orients the virtual’s dissipation into material (and thus “functioning as a prosthesis-organ”; Deleuze 1987: 17-18).

Lautman work on the transfinite proved to be the historical nexus for differential heterogenesis as a theoretical fulcrum and marks the beginning of Deleuze’s mereological awakening, whereby “[t]he concept of the infinitely small as vanishing quantities allows the determination of relations independently of their terms” (Duffy 2006: 120). Following Lautman, the penetration of topological methods into differential geometry responds to relations between the “local and the global”, or “the whole and the part”, where the outlining of schemata involves the passage between material realizations through a formal system (Cavaillès and Lautman 1939). Therefore, our Deleuzian study of differential heterogenesis is invariably concerned with the reduction of the extrinsic properties of a situation to intrinsic structural properties: this calculus of variation determines the existence of meta-linguistic artefact-wielding beings who, ourselves, are entangled within the evolutionary development of becoming-discrete. Lautman’s dialectic, which concerns the transformative prowess of inverse reciprocity, thus infects the vagaries of Intelligence, whether it be the description of objects or our boot-strapping.

§ Appendix (On Causality)

However we approach it, the kinematics informing Deleuzian differential heterogenesis define the virtual as strictly a part of the real object—virtuality is necessarily relational. What else, then, is to be said of our differential positioning, caught in virtual-actual objective becoming(s)? If the endocentric (or egocentric) frame of self-centered reference allows for differentiation between environment, object, language, and self, it is the *exocentric* dynamicity of the differential frame that challenges the ego’s fixity by suggesting post-anthropocentric spatial relations (i.e., contracting into larger assemblages and becoming a language-speaker, tool-

²⁵ Accordingly, for Deleuze the first synthesis of time is the time of habitudes, the Humean time of materialized logical relations; the second synthesis of time is the active and passive synthesis of memory; the third synthesis of time is the repetition “by excess, the repetition of the future as eternal return” (Deleuze 1994: 90).

wielder, computer-programmer, and so on).²⁶ This always observationally *appears* to be causally construed. As René Thom’s work on topological structural stability indicates, we, as predators situatedness in space, are constrained to an allocentric view of embeddedness that we relate to through causality—“we believe in causality because we have been conditioned phylogenetically to do so by the regularity with which phenomena succeed one another in the physical world” (Thom 1990: 7).

In Sarti and Citti’s work on the intersection on “non-vanishing sums”, matter is situated *outside the realm of knowledge*, “simply because knowledge is concerned only with the relations of ‘cohesion,’” while, simultaneously, “matter is nonetheless conceptualizable, for, being therefore liable to ‘receive’ forms, it must indeed have qualities that ensure its reception” (Sarti et al. 2019: 16-17).²⁷ As in cinema voyeurism and multiscale modelling, differential Deleuzianism allows us to readily conceive of that which is devoid of form or homogeneous reference in bottom-up or top-down direction, scaling its way not only out of knowledge but out of any referential/observational purview (i.e., “out of sight”) until homogenized. In turn, differential heterogenesis allows us to resituate the *contingent-becoming* of the *a priori*, which was provincially occluded by Kant’s understanding of the self-substantiating and already-present “at hand” analytic.

Sarti and Citti’s analysis of progressive polarization in heterogenetic flows invigorates a kind of dynamic evolution where a virtual *topos* is revealed to underly the configuration of the virtual. Thus, the virtual is abducted by the noumenal real, where it finds itself anchored by an ontogenetic identity-relation. No longer are we circumscribed to the province of real numbers and the stable conditions of cognition, as in Kant’s system of pure intuiting. Instead, differential heterogenesis galvanizes Solomon Maimon’s criticism of Kant for being unable to provide for any account of how genesis facilitates the conditions of knowledge.

Mathematicians such as Bernard Teissier, Giuseppe Longo and Jean Petitot have examined phylogenetically-conditioned causality as it concerns continuous computation (returning to the problems riddling Turing’s continuous state-machine). For instance, in Teissier’s work on “Protomathematics, Perception and the Meaning of Mathematical Objects” (1996), we see how it may be possible to claim that the evolution of our perceptual systems has created an isomorphism between the visual line and the vestibular line. This (geodesic) mark of the discrete demonstrates the stronghold of internalist-representationalist habituation, where functionally-unmoored causality seems to impart us with imagining the non-human, a terrain that creeps beyond “[t]he regularity with which phenomena succeed one another in

²⁶ Thus, the (central and autonomic) nervous system is inextricably bound to teleological activity, where media-prostheses and stimuli-responsiveness are affixed within a closed loop related to the problem of self-preservation.

²⁷ Sarti and Citti define an assemblage operator as based on the intersection of two sets: $(B_{p0}, F_{p0}) \cap (B_{p1}, F_{p1})$. The pair demonstrate that, much like a corollary to vibration, “differential becoming is the flow” of the solution’s integrate operator; the “axes of cohesion” produce a genesis of semiotic functioning where the plastic composition of assemblages reveals that “flux is at the base” of harmonic embedding (Sarti et al. 2019: 16-19).

the physical world” (Thom 1990: 7). We can create a bricolage here if, for instance, we do not accept that any phenomena’s “being caused” by certain stimuli is equipollent to constituting phenomenal characters (e.g., colour experiences).²⁸ What, then, if we apply differential heterogenesis to abduct the principles of human cognition and transmogrify them so as to produce a proto-perceptual theory of retroactive observation, considering what Ned Block terms “mental paint” in order to schematically imagine the differential in terms of quantum computing/computing in continua. Is there any relation, then, between the feed-forward adequation of deep learning and non-accessible (and non-phenomenal) properties behind externalism (i.e., what Ned Block terms “mental oil”)?²⁹ Such problems bear further consideration.

This differential consideration of truth-contingency gives us a computational corollary for challenging paradigms of causality. According to Lev Manovich, it is the causal narrative that, as a cultural object, foregrounds the logical perturbations underlying algorithms, web indexes, computer storage, CD-ROM’s, web sites, and other new media objects which are “organized as databases” (Manovich 1999: 85). Manovich’s model of causality considers the “storage-and-retrieval” modality as our epochal archetype, for “the computer age brought with it a new cultural algorithm: reality → media → data → database” (85). However, today’s machines are not characterized by linear causality but stochastic elasticity—consider Predictive Processing algorithms, approximate Bayes optimality, Markov chains, Hopfield Networks, Boltzmann machines, and so on.³⁰

A short survey of cybernetic history designates the classical Church-Turing thesis’ “computable reals” and first-order cybernetics’ treatment of information as stilted on the closed loop of “storage-and-retrieval”. In both instances, autopoiesis takes on a radical

²⁸ Consider the following description: “[t]he functionalist can appeal to temporary differences. Erisa will say ‘The wall is now the same color that adorned the table a second ago,’ and ‘For one second, the floor matched the sofa.’ But these beliefs are fleeting, so how can they constitute the abiding differences between the phenomenal character of her experience of red and green? The differences between these phenomenal characters stay the same (for us) from moment to moment, day to day, and there is no reason to suppose that the same cannot be true for Erisa. The point of the thought experiment is to make it plausible that color experiences can remain just as vivid and the differences between them just as permanent as they are for us even if the functional differences between them attenuate to nothing that could plausibly constitute those differences. Of course, there is one abiding difference in functional role between the experience of red and the experience of green—the properties of the stimuli. Since we are talking about internalist representationism, the stimuli will have to be, e.g. light hitting the retina rather than colored surfaces. But these differences in the stimuli are what cause the differences in the phenomenal character of experience, not what constitutes those phenomenal differences. I don’t expect diehard functionalists to recant in response to this point, but I really don’t see how anyone with an open mind could take the being caused by certain stimuli as constituting phenomenal characters of color experiences” (Block 2003: 168).

²⁹ That is, can we attend to the phenomenal character of experience so as to distinguish mental properties of experience? These properties are involved in orgasm-experience, pain, and other bodily sensations but might differential heterogenesis provide us a novel “border concept” with which to theorize the “mental oil” with which we “paint” the redness of the tomato?

³⁰ These are predicated, in their computative development, upon principles such as Helmholtzian interference, noise reduction, and the Shannon-Ashby Law of Requisite Variety.

constructivist rule (of perception), denying the existence of an externalist representational reality that affects a system vis-à-vis exocentric indices of “information”. However, a critical rift in physics and computation soon necessitated a critical revision, with newfound relativity and thermodynamics directing the “Church–Turing–Deutsch principle” to account for holographic boundaries and the entropic interference characterizing Boltzmann-Bekenstein limits. Following second-order cybernetics (or observer-oriented cybernetics), the reparameterization of the system and allocentric regulation took precedent over recursion.

Contemporaneous research in neural computation and theoretical computer science demonstrates that the heterogenetic flow of spatial differentiation in depositing of inference-based classification systems is by no means termed along the striated database’s “storage-and-retrieval” modality. Inductive neural network modelling stresses precise node-localization and statistical estimation techniques: from elastic bunch graph-matching in biometric protocol, such as facial recognition and fingerprint matching software, to derivative-free computational optimization in actuarial insurance AGIs and Unmanned Aerial Vehicles (UAVs), signal-to-noise azimuthal performance coordinates and multiple differential phase-of-arrival measures make use of filtering-and-tracking algorithms that account for the convergence of precision performance with complex coefficient wave-variation. Differential elasticity’s predictive processing power has outstripped the database model’s lamina, such that the causal network of computational states shows functional organization as multiply realizable; accordingly, there is a level of organization above the level of physiology (viz., “mental” or “computational”) that determines narrow intentional content.

Concomitant to convolutional “neural networking” and deep learning, our media paradigm-shift has divulged that machines are, in fact, agents determinately bound within a field of “pathologically distorted” techniques and part of a network of relations, indexing how economic calculations convert the machinic function “from mechanical-technical to perceptual-economic” as in the example of cinematic performance capture (which, much like in Andy Serkis’ infamous roles, uses predictive motion capture that infers to simulated digital environments in real-time; Koch 2019: 7; Erkan 2019: 228).

Traditionally, the causal terms of “machine learning” have not been adequate to describe exactly *how* organisms are world-models, themselves, as function-modelling research in cortical conductor-based generative neural networks delineates (Hinton et al. 2011; Mountcastle 1997; Jaeger 2001). As computer scientists such as Joscha Bach have demonstrated via “cortical conductor theory”, any notion of “organic” autozoetic cognition is a transcendental illusion, “a cavern within which an inverted image of the real holds sway, one that prevents us from penetrating to the imperceptible conditions of perception (the virtual)” (Brassier in Somers-Hall 2018: 264). Despite our experiences are *directed outwards*, they exist beforehand in a primordial dream-like assemblage—phenomenal consciousness “is the reconstruction of a dream generated [by] more than fifty brain areas, reflected in the protocol of a single region” (Bach 2018: 5). Our cognitive processes combine visual objects, para-linguistic

maps, and procedural dynamics into a “persistent dynamic simulation, which can be used to continuously predict perceptual patterns at our systemic interface to the environment” (Bach 2018: 4). As in Predictive Processing, the processing stream of bottom-up cuing of perceptual hypotheses (such as objects or situations) is matched by a “topdown verification” of these hypotheses (through the simulative capacity of the neocortex), where the “binding of the features” is cohesively modelled. Research concerning our neural cortical columns shows that it here that we model compositional approximation and reward distribution, as is the case with inductive machine learning, but our brain can still perform most of its functions without the presence of the conductor (Bodovitz 2008, Safavi 2014, Del Cul 2009).³¹ Severed from our cortical conductors, the functor between our neuroplasticity and machine learning’s processual input, “we are sleep walkers”, capable of coordinated perceptual and motor action, but without central coherence and reflection (Bach 2018: 4).

Bayesian interpretations of cognition suggest that, as we contract events and repetitions, we are simultaneously optimizing our predictive model; at the infinitesimal scale, Bach’s “cortical conductor theory” evinces that the formal-computational reformulation of inductive reasoning can persist *beyond* the stronghold of prior probability metrics. Differential heterogenesis thus provides us with a dialectical method to contract these ideas into virtual relation and a naturalized “scientific image”. Further considerations, which we do not possess the prolixity to attend to at this time but which my dear colleagues have prudently endeavored over with their incisive philosophical scalpels, are elaborately examined in this issue of *La Deleuziana*. For instance, one would be wise to turn to “Escaping the Network”, where Anna Longo takes up evolutionary game theory as a framework to move beyond the biological modelling of populations, considering the “network society” vide complexification through technologically-tethered normative schemes of action.

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³¹ In fact, cortical conductor’s “reward-based” mechanist modelling is exactly how Google Deepmind’s AlphaGo AI was constructed.

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