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WHAT IS NEW MATERIALISM?

introduction

The increasing prominence of "new materialism" signals a growing cross-disciplinary effort to challenge longstanding assumptions about humans and the non- or other-than-human material world. This paper argues that there is currently no single definition of new materialism but at least three distinct and partly incompatible trajectories.[1] All three of these trajectories share at least one common theoretical commitment: to problematize the anthropocentric and constructivist orientations of most twentieth-century theory in a way that encourages closer attention to the sciences by the humanities.

The common motivation for this "materialist turn" is a perceived *neglect* or *diminishment* of matter in the dominant Euro-Western tradition as a passive substance intrinsically devoid of meaning. In what has become a kind of de facto motto, new materialists routinely emphasize how matter is "alive," "lively," "vibrant," "dynamic," "agentive," and thus *active*. As we will argue, however, while new materialist scholars tend to use them interchangeably,[2] such terms nevertheless take on sharply divergent meanings across the three approaches we identify. Likewise, as we examine below, this same divergence also underlies new materialist efforts to problematize anthropocentric binaries (e.g., "meaning and matter," "culture and nature," and "gender and sex").

Alongside the rise of new materialism, there have also been numerous critiques. For example, new materialism has been criticized for exaggerating the extent of earlier feminist scholarship's "biophobia" or neglect of matter;[3] for rejecting Marxism and cultural materialism on mistaken grounds;[4] for uncritically embracing and conflating the scientific study of matter with matter itself;[5] and for

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overstating its alleged "newness."[6] Unfortunately, however, these critiques have largely placed all new materialists under the same umbrella and thus have often misidentified their target. At least, this is what we hope to demonstrate.

This paper emerges from our desire to offer a response to such criticisms but *not in order to defend new materialism in general*. Instead, we hope to help redirect each arrow of critique toward its proper target, and on this basis to advocate for the approach we call "performative" or "pedetic" new materialism. We think this approach has the greatest value and potential for future development but has unfortunately been badly misunderstood and wrongly conflated with the other two types of emerging new materialism. We therefore aim to illuminate how "negative new materialism," "vital new materialism," and "performative" or "pedetic" new materialism are simply not compatible.[7] Even if their motivations are similar, their basic guiding premises are not.

More specifically, although each of the three types of materialism seeks to critique anthropocentrism's presumption of matter as inherently passive and devoid of meaning, we argue that only the performative new materialist approach radically undermines a discrete separation between humans and matter. In distinct ways, both negative and vital new materialism continue to foreclose an appreciation of the truly performative movements of matter. On one hand, negative new materialism embraces either a radical division between human thought and inorganic matter or a "withdrawn" essence, both of which we think persist due to its uncritical embrace of an external, human-observer perspective.[8] On the other hand, while vital materialism explicitly rejects any form of essentialism, we think it nevertheless manages to sneak back in through a metaphysics of life projected onto inorganic matter.[9] In these crucial ways, as we elaborate below, non-performative new materialist theories continue to implicate certain objectivist, non-relational and, thus, idealist assumptions or residuals.[10]

The performative approach to new materialism, however, successfully eschews discrete separation by refusing any presumption of something external to matter – including human meaning – that guides, structures or grants meaning to its behaviors. In such a view, matter simply "*is* […] a doing," as Karen Barad puts it.[11] Matter *is* what it does or "how it moves," as Thomas Nail puts it.[12] And since the performances of humans are not external to those of the rest of the material world, this view also leads, importantly, to a performative understanding of science in which every act of observing also constitutes, at once, a transformation of what is being observed. Such a view enables the following responses to the criticisms of new materialist work we mentioned above:

(1) *The neglect of matter*. While we agree that some new materialism work does unwittingly reinforce the binaries it seeks to problematize,[13] we believe this criticism does not apply to the performative approach. For example, when the latter speak of a prior "neglect" of matter they do not mean that previous theorists did not talk about matter but rather that those theorists neglected or discounted matter *as inherently dynamic and meaningful* (precisely due to the anthropocentric presumption that meaning, and whatever else might make humans exceptional, is immaterial).[14]

(2) *Science envy*. While we also agree that some new materialists have embraced science uncritically in ways that conflate its findings with matter as such, in a performative account scientific practices and discourses are just as productive of the very world they describe as is any other action, human or otherwise. Such an account therefore agrees with poststructuralism and science-and-technology studies that all human discourses are constitutive. The novel argument, however (at least within the dominant Euro-Western tradition), is that those discourses are themselves also – and *only* – particular configurations or performances *of matter*.

(3) *The fetish of novelty*. Although we fully embrace historically oriented work questioning the alleged newness of new materialism, we again do not agree that this critique applies to the performative approach. Matter always has been in motion. We have shown elsewhere how the creativity of this movement has been erased or excluded in the Western tradition.[15] Furthermore, arguably the most important historical Euro-Western precursor to performative materialism is the ancient Roman poet Lucretius, whose philosophical poem, in many ways, is connected to a performative materialist understanding of Homer.[16] In addition, we also find a great deal of merit to the recent call for greater recognition of and sustained engagement with the affinities (and differences) between a performative "new" materialism such as Barad's "agential realism" and the many and varied agent ontologies discussed in indigenous studies literature, which in some cases can be traced back many millennia.[17] We thus understand performative materialism as a recovery in novel form of older subterranean or largely disparaged or disregarded materialisms and certainly not as an *ex nihilo* appearance.

The aim of this paper is to clarify what distinguishes a performative or pedetic approach to materialism by illuminating its differences with both older materialisms and other new ones. The general aim of Part 1 is to develop the former distinction.

part 1: old materialisms

In the first part of this paper we compare two types of old materialisms: ancient and modern. Each is distinct from the other but also shares a conception of matter as essentially passive, non-performatively constituted, and discretely self-contained. In both cases, moreover, this conception derives from the non-performative, crypto-idealist presumption that humans uniquely occupy an objective vantage radically external to (the rest of) matter that enables us (and only us) to access matter's true nature or essence.

ancient materialism

The roots of materialism are generally traced to pre-Socratic atomism and its later modification by Epicurus. We begin here because ancient atomism provides such a pivotal expression not only of how materialism has long been defined but also, as we discuss in Part 3, of what new materialists both recuperate and seek to overcome about this old or standard account. In this section, we therefore discuss the key features of ancient atomism – its ontological account, its conception of matter's inherent passivity, and its presumption of humans as external, objective observers – in a way that highlights their significance for the shift to new materialisms. In doing so, we also provide a critical consideration of ancient atomism from a performative materialist vantage, which we think yields a helpful set of criteria for assessing new materialist efforts, to which we return and develop further in Part 3 below.

As is well known, Leucippus and Democritus argued that all of reality consists, ultimately, of nothing but eternal, tiny, and indivisible atoms careening perpetually through the void.[18] Hence everything, in their view – from the biggest stars down to the smallest creatures, including humans and even the gods – is reducible to the ongoing collisions and resulting compositions and decompositions of indestructible bits of flying matter too small to observe directly.

The most important feature of ancient atomism that today's new materialists embrace is that it is ontological rather than merely epistemological. According to ancient atomism, that is, humans need not remain trapped within the biases or limitations of their sensory perceptions, cultural conventions, or language but are capable, instead, of accessing real being: atoms and void. And although Democritus opposes the "bastard" knowledge of the senses to the mind's ability to provide

"genuine," reliable truth,[19] he asserts that even mind is in fact constituted solely of material atoms as well.[20] Ancient atomism thus avoids what Quentin Meillassoux calls correlationism – the view that the real is accessible only as a correlation of human thought – as it claims instead to provide access to the real itself.[21]

What new materialists find most problematic about ancient atomism, however, is its conception of matter as intrinsically passive. That passivity, moreover, reveals a profound – and profoundly unsatisfying – irony at the heart of atomist ontology: the atoms "produce" nature through their collisions and resulting combinations based on their infinite number of pre-existing shapes and sizes. And yet the atoms exert zero creative agency over their own productions, since their shapes and sizes are eternal and unchanging and their immediate velocity determined only by their most recent collision. How, then, could entities so utterly lacking in agency ever give rise to living, thinking creatures? Atomism can endeavor to answer this question only via a thoroughgoing determinism that deprives everything, including humans, of any agency at all.

Furthermore, as some new materialists have recognized, despite their tremendous variety, the atoms' inherent passivity entails a fundamentally random and non-creative Universe as well.[22] The atoms, that is, "produce" only through totally random collisions that passively realize *pre-existing* possibilities.[23] And thus, whatever compounds particular atoms may form, *the totality of possible compounds* remains just as eternally fixed and unchanging as the atoms' given characteristics. And although it would certainly be extremely unlikely for such haphazard collisions to result only in this one complexly ordered world we know, Democritus argues that our world is in fact far from unique. Indeed, he asserts that, just as there are an infinite number of atoms, there are also an infinite number of coexisting worlds, or *kosmoi*.[24] And because of the atoms' inherent randomness, the realization of any possible *kosmos*, including ours, is therefore equally likely. In short, due to matter's essential passivity and fixity, the full range of cosmic possibilities is predetermined and immutable, even as an infinite number of worlds emerge and disappear (randomly) within it.

Later on, perhaps as an effort to secure a measure of human agency, Epicurus granted individual atoms a modicum of spontaneous unpredictability with his famous notion of the swerve, thereby also attenuating Democritus' determinism.[25] In this modified account, while atoms generally remain on random, predetermined paths, occasionally a single atom will swerve onto a neighboring path, thereby potentially triggering a cascade of events that, much like the "butterfly-effect" of chaos theory, can result in enormously changed outcomes.[26]

Some new materialists have embraced a generalized version of the Epicurean swerve as a means of understanding matter as inherently creative and "alive."[27] Others, however, have rightly recognized that such a view actually leaves matter and reality just as essentially non-generative and confined to an unchanging totality of possibilities as ever.[28] While agreeing with this latter view, we would like to state our reasons for such agreement in explicitly performative terms.

In essence, it is only because the atoms of Democritus and Epicurus remain *internally* unchanged across their movements and encounters with one another that the sum total of cosmic possibilities remains unchanged as well. Conversely, as we elaborate below, a performative understanding of matter maintains that what matter is, at every scale, is iteratively transformed by each new movement and encounter, however slightly. Performative matter is thus never exhaustively quantifiable, whether in random/deterministic (Democritean) or probabilistic (Epicurean) terms. Instead, matter's iterative performances are always partly incalculable because they ceaselessly constitute novel entities and/as relations, thereby also ceaselessly generating novel possibilities and impossibilities that did not exist already.

Before concluding this section, one remaining *non*-performative dimension of ancient atomism must also be noted, which we think

continues to be the most deeply entrenched and under-examined presumption of all. As the classicist Daniel W. Graham noted recently, Greek atomism (like Western metaphysics generally) begins from the presumption that the universe is "a closed system of natural explanation."[29] This presumption, moreover, positions us humans – due to our allegedly unique capacity for reason and language – as privileged, radically external observers of a self-contained material world that remains unchanged by our observations of it. As we argue in the final section below, only performative new materialists have managed to fully challenge this presumption and, thus, to theorize human meaning and observation in thoroughly material terms.

modern materialism

The second type of old materialism is modern materialism, which emerged around the sixteenth century. Just as atomism allowed for human access to the metaphysical real of *matter* (atoms and void), modern materialism allowed for human access to the metaphysical real of *force* to explain the movement of matter. In both cases, humans (and only humans) were granted ontological access to the real even though what that real was differed in each case. Modern materialists largely accepted the passive materialism of Greek atomism but also invoked an active vital *power* to explain it.

It is a grave mistake in the history of philosophy that the so-called "age of mechanism" has been thought of as an age of corporeal determinism.[30] It is true that there was a rise in materialist physics and naturalist theologies in the medieval and early modern periods, but in the last instance the primary motive cause of matter's mechanistic motion always remained a *force* – a metaphysical power that caused bodies to move. In short, the ancient formula of "form and matter" was increasingly replaced by the early modern one of "force and mechanism." Far from opposing each other, then, vitalism and mechanism go hand-in-hand during this period.[31] In the modern mechanistic vision, nature was increasingly described as composed of discrete "atoms" or "corpuscles" whose bodies fit together like the gears of a clock.[32] However, there was always someone (God) or something (force) winding up the clock and transmitting the movement through the gears.

Matter, for the moderns, therefore did not move itself but instead was moved by something else: *force*. For example, in the sixteenth century, the English philosopher Francis Bacon (1561–1626) not only followed the same formulation of divine impetus (force) proposed originally in the sixth century by Philoponus and later in the fourteenth by Burdian but also described nature as a clockwork machine that operated according to the laws of this force: "The laws of Nature, which now remain and govern inviolably till the end of the world, began to be in force when God first rested from his works and ceased to create."[33]

God creates nature and then imbues it with force (the laws of nature) that, just like clockwork, unfolds itself autonomously according to the transfer of tensional motion imposed by these very simple principles. "*The force implanted by God in these first particles*" makes up all the "variety of things," according to Francis Bacon.[34] God externalizes himself in the form of atomistic particles of matter, which then, through collision, produce all of nature following a force or impetus initially imparted by God. Bacon was thus one of the first to introduce a synthesis of theology, naturalism, and mechanism in a single theory of vital force relations. From this point on mechanism almost always included some kind of metaphysical vitalism.

Although René Descartes espoused a very hardline dualism between matter and spirit, what is less well attended to is the crucial role that vital forces play in his physics.[35] Just as humans can make automatons that are capable of several kinds of motion, so, Descartes says, God made humans and nature in the same manner, albeit capable of vastly greater motions. The movements of nature and the human body therefore follow "just as necessarily as the movement of a clock follows from the *force*, position, and shape of its counter weights and wheels."[36] Just as the motive

force of a tensional weight is communicated through the gear train, so God's force is similarly externalized into and through the coordinated parts of nature.

Like Descartes, Thomas Hobbes also stripped God of direct control over motion and left him nothing but efficient causality, from which nature then takes on its own autonomous laws. Therefore, because motion, for Hobbes, is "a continual relinquishing of one place, and acquiring of another,"[37] the *beginning* of a body's motion must constitute an *infinitely small* change in that body's place. This infinitely small change is what Hobbes called "endeavor" or "force."[38]

Whereas Descartes introduced the metaphysics of *conatus* in order to explain internal tendency and external causality, Hobbes argued instead that *conatus* was nothing other than an "infinitesimal movement." Hobbes thus tried his best to bury force in the infinitesimal interstices *between* motions. Where Descartes explicitly separated the determination of motion (force) from the tendency toward motion, Hobbes tried to unify them. "Endeavor," Hobbes writes, "is to be conceived as motion," but not a quantified motion.[39] "For, the very first beginning of any thing is a part of it and the whole being motion, the part (that is, the first Endeavor) how weak soever, is also Motion."[40] Hobbes thus wanted there to be nothing but matter in motion. However, he did not achieve this insofar as his views still make recourse to an infinitesimal *cause* of motion, which is different from motion itself, and which he calls endeavor, *conatus*, *tendentia*, and *appetitus* – and which God initiates. Thus, once again transcendent vital forces ultimately prevail as the cause of matter's mechanistic motion.

Modern materialism is thus defined by the *passivity of matter* insofar as matter is what is caused or moved by something else: vital and causal forces or natural laws of motion. As with ancient materialism, matter again is not what is creative or performative in itself. Through a religious modification, however, matter now is what is moved by God and the laws of nature he ultimately sets in motion.[41] Furthermore, modern materialism, again following ancient materialism, continued to treat matter as irreducibly composed of discrete simple bodies, particles, or atoms. In this way, despite offering a revamped account of matter, modern materialism simply continued the atomist trend of treating matter as a passive entity that must be animated by something immaterial and outside the flux and movement of matter itself: force.

part 2: an epistemological interlude

In this part, we discuss a theoretical orientation that we think is an important intermediary between old and new materialisms. While its most recent formulations by Jacques Lacan and Judith Butler are often treated as materialist by contemporary theorists,[42] we think such treatment has contributed a great deal of confusion over what may be "new" about new materialist theories or about how to distinguish among them. As we hope to make clear, despite its partial overlap with both old and new materialisms, failed materialism is not a materialism in an ontological sense at all. Instead, it ought to be understood as part of the epistemological, anthropocentric, or, in Meillassoux's terms, correlationist tradition from which new materialists all seek to move away.

failed materialism

As we have seen in the previous two sections, all ancient and modern materialisms deny matter any self-determining agency over either its own characteristics or the invariant, external laws or forces that constrain or determine its movements. Likewise, these materialisms all share the assumption that we humans are exceptional given our ability *to know* those fundamental properties, laws, or forces. While failed materialism agrees with old materialisms that (non-human) matter is incapable of such (self-) knowledge, what distinguishes failed materialism from them is its denial of such knowledge *to humans* as well, at least in any direct or non-correlational form. Accordingly, any

attempt to capture matter and render it meaningful through mathematics, human language, or discourse must result in either partial or complete failure.

In critical ways, the roots of a failed materialist perspective can be traced to Immanuel Kant, according to whom reason can never perfectly comprehend things-in-themselves (*noumena*). Whereas the Cartesian and Newtonian efforts to comprehend matter and its mechanics of motion presupposed a one-to-one correspondence between mathematics and physical reality, Kant restricted such knowledge to the confines of an ostensibly universal structure of human reason. And thus, while Kant considered the mechanistic view of matter developed by Descartes and Newton to be the greatest achievement of modern science, he also thought they erred in believing this knowledge to correspond to a reality beyond what he called the "transcendental subject." In this way, Kant advanced what Meillassoux calls "correlationism," which maintains that "we only ever have access to the correlation between thinking and being, and never to either term considered apart from the other."[43]

Although not quite a form of failed materialism, given that for Kant reality consists ultimately of immaterial *noumena*, Kant's correlationism nevertheless set the stage for the various constructivist and failed materialist theories that followed due to its assertion of a radical discontinuity between ultimate reality, on one hand, and the constructed "reality" we humans can know or access, on the other. And by essentially replacing Kant's immaterial *noumena* with a material real, the subsequent theories remain equally correlationist and, hence, equally epistemological in their orientations toward matter. In many ways, constructivism and failed materialism come to dominate nineteenth- and twentieth-century philosophy. Given space affordances, and because the partial overlap between failed materialism and new materialisms specifically has led to confusion, we restrict the remainder of this section to a discussion of two key figures of failed materialism, namely Jacques Lacan and Judith Butler.

Through his particular phenomenological, psychoanalytic, and structuralist inflections of Kant and others, Jacques Lacan argued that the acquisition of language imparts humans with an essentially fragmented subjectivity, what we could call the human subject *manqué*. Occurring through his "mirror stage,"[44] language acquisition culminates in the tripartite Real–Imaginary–Symbolic registers of human subjectivity that Lacan famously represents as three overlapping Borromean rings.[45] In this account, the Imaginary marks the image (*imago*) of the whole or unified subject that is distinct from our actually always already fragmented subjectivity, as well as a minimal kind of awareness of this distinction. Only through language (the Symbolic), however, do we register this distinction on a more conscious level, which at once constitutes our self-recognition on the basis of a mis-recognition or *méconnaissance*. The Real, meanwhile, acts as the ultimate enabling condition for this *méconnaissance*, given that it is figured – retroactively, from within language – as a pre-Imaginary, pre-Symbolic domain of absolute wholeness and plenitude which now remains lost irrevocably.

Since in Lacan's account the domain of language or the Symbolic is not simply a given but is constituted only through the failure to (re)capture that which forever eludes and exceeds it (the Real), human subjectivity emerges as much more unstable and thus historically mutable and contestable than it was for Kant. Nevertheless, a *non*-historical anthropocentric residual continues to haunt and structure Lacanian subjectivity insofar as meaning remains an exclusively human purview whose – utterly uncontestable – limit is marked by the non-linguistic material Real itself. In other words, as that which precedes the Symbolic and from which we derive our biological bodies, the Real is a domain of plenitude and wholeness only by virtue of its *absolute lack* or *absence* of (always fractured) meaning.[46] Moreover, given Lacan's phallocentric association of the Symbolic with the "Law of the Father" and of the Real with "Woman," women and other historically marginalized groups arguably remain confined to a logic of

deficiency that is just as essentialist, ahistorical, and incontestable as in Kant.

In what is perhaps the most sophisticated version of failed materialism, Judith Butler develops a performative alternative to Lacan.[47] Indeed, a number of scholars have even insisted there is nothing in new materialism that is not already in Butler.[48] Butler's aim, more specifically, is to show how the failure of discourse to capture matter is never absolute but is instead an ongoing process of "iterative citationality" that is never fully or finally settled.[49] With each new (partial) failure to capture matter, then, discourse constitutes human identity in novel ways. Thus, matter does not enable discourse formation merely through its *absolute* or *irrevocable* absence, as in Lacan, but instead plays a *mutable* and *dynamic* role through its always partial and particular exclusions. According to Butler, these "constitutive exclusions"[50] manifest – within a given discourse – as particular abject or non-normative human identities. And it is therefore precisely those non-normative identities that harbor the greatest potential for rearticulating discourses anew, that is, by continually opening and foreclosing novel possibilities for identity contestation.

We can illustrate both the important contributions and limitations of Butler's performative account of the materialization of meaning by returning briefly to the Borromean rings. In Lacan's version of this image, the boundaries between the three domains are utterly static, unmoving, and uncontestable. The discrete separation of matter from meaning is complete and final. In Butler's version, by contrast, the rings of Discourse and Matter would be perpetually moving, engaging in a continual performative process of negotiating just *where* the boundary line between them gets drawn.[51]

Despite this important difference, however, Butler's theory of matter is still fundamentally defined and driven by a *failure* – that is, by the perpetual, ongoing failure of human discourse to ever fully or completely capture matter. While the specific *location* of the boundary line between matter and discourse is always shifting, Butler nevertheless continues to presume that that very same boundary line must continually get drawn *somewhere*. In other words, Butler continues to presume that there really is a pre-existing and unchanging ontological division between human discourse and matter, as domains. As Vicki Kirby puts it, matter as such "is rendered unspeakable and unthinkable in Butler's account, for the *only* thing that can be known about it is that it exceeds representation."[52] And thus, in Butler's rendering, matter is "constitutive" or "active" only by virtue of its recalcitrance, that is, only insofar as it *passively resists* being captured by what is essentially *not* matter (i.e., human discourse).

part 3: new materialisms

What, then, is "new" about new materialism? The general consensus seems to be that new materialism embraces a non-anthropocentric realism grounded in a shift from epistemology to ontology and the recognition of matter's intrinsic activity.[53] We believe that the nature of the relationship between these terms has been widely misunderstood, however. Contrary to common assumption, neither an ontological focus nor a recognition of matter's activity necessarily implies the other. Nor do they suffice, either alone or together, to provide an escape hatch from anthropocentrism – as we hope Parts 1 and 2 help to clarify. Although a shift to ontology eschews correlationism and is certainly "new" compared to failed materialism or poststructuralism generally, such a shift could simply mark a recuperation of a materialism such as ancient atomism. This is no less true, moreover, if atomism's passive conception of matter is merely replaced with an active one that still positions (fully material) humans as exceptional, external objective observers of a material real.[54] In what follows in Part 3, we argue that both vital and negative new materialism indeed preserve human exceptionalism in this respect.[55] Only the ontoepistemology of performative new materialism, we argue, problematizes human exceptionalism at every level. As we address at the end of the performative section, this does not render such an approach radically "new" in a way that would

perpetuate a non-performative account of novelty. In fact, what we find most novel and compelling about performative "new" materialism (in relation to the dominant Euro-Western tradition) is that it enables a recuperation of many ancient, subterranean, and non-Western ontologies.

vital new materialism

By far the most prevalent type of new materialism is almost certainly that of vital new materialism, so much so that it tends to overshadow and absorb important differences between itself and the other two kinds – as we shall see.

Historically, vitalist new materialism emerged from Gilles Deleuze's 1960s reading of Baruch Spinoza's (and to a lesser degree Leibniz's) theory of *conatus*.[56] Deleuze first turned to Spinoza and Leibniz because, in contrast to other modern materialists, Spinoza and Leibniz thought that all of nature was defined *primarily* by an immanent vital power or force. For Bacon, Descartes, Hobbes, and Newton, for example, vital force was something distinct from mind or matter and thus remained extrinsic to them, often in the form of God or deistic natural laws. In Spinoza and Leibniz, however, force was immanent to matter, because matter is nothing other than an expression of *force itself*.

According to Spinoza, God expresses his power through the *conatus* of singular determinate things, which simultaneously express God's power of being and acting. Together the two express the same *conatus*:

> Singular things are modes by which God's attributes [thought, extension, and others unknown to us] are expressed in a certain and determinate way, that is, things that express, in a certain and determinate way, God's power [*Dei potentiam*], by which God is and acts […] Therefore, as far as it can, and it lies in itself, it strives [*conatur*] to persevere in its being.[57]

Instead of deploying a concept of *conatus* without giving it a formal place in his philosophy as Descartes did, or trying to bury causal powers in the infinitesimal interstices of matter in motion as Hobbes did, Spinoza raised *conatus* to the highest ontological level: God and/or nature, *deus sive natura*. Spinoza's is thus an ontology of immanent power or *conatus*. He thereby makes explicit what was already essential and primary in Descartes – the inner force, striving, and power of all material things – and raises it to the infinite.

In *Specimen Dynamicum* (1695), Leibniz even goes so far as to reduce motion, space, and time to unreal mental constructions derived from the force of substance:

> Space, time, and motion have something akin to a mental construction [*de enterationis*] and are not true and real per se but only insofar as they involve the divine attributes of immensity, eternity, and activity or the force of created substances.[58]

The only thing that is real for Leibniz, then, are *relations of force*. Motion is only real insofar as it is "a force striving toward change. Whatever there is in corporeal nature besides the object of geometry, or extension, must be reduced to this force."[59] Therefore, Leibniz concludes, force is what is real and absolute, and motion (and matter) simply belongs to a subclass of relative phenomena.

Vital new materialists have today taken up this tradition in an attempt to move beyond the ancient and modern mechanistic materialist treatments of matter as the passive object of external forces (natural or divine) and the anthropocentrism of the failed materialists. For example, Jane Bennett, the post-Deleuzian source who is likely the most cited proponent of this approach, explicitly calls attention to this difference:

> What I am calling impersonal affect or material vibrancy is not a spiritual supplement or "life force" added to the matter said to house it. Mine is not a vitalism in the traditional sense; I equate affect with materiality, rather than posit a separate force that can enter and animate a physical body. My aim, again, is to theorize a vitality intrinsic to materiality as such, and to

> detach materiality from the figures of passive, mechanistic, or divinely infused substance. This vibrant matter is not the raw material for the creative activity of humans or God.[60]

Following Spinoza and Leibniz (and Deleuze), matter, for Bennett, is nothing other than the relations of *forces as such*. As Diana Coole and Samantha Frost argue, there is "an excess, force, vitality, relationality, or difference that renders matter active, self-creative, productive, unpredictable."[61] Variations of this view appear in numerous vital new materialist philosophers in discussions of things such as "pre-accelerations," "vibrant matters," "virtual forces," and "affects."[62] A major difference between old materialism and vital new materialism is therefore the ontologization of an *immanent activity* of vital forces *minus* the mechanistic passivity of atomic matter. Vital matter is therefore neither deterministic, deistic, naturalistic, nor epistemological. Vital matter is not something constructed by human consciousness, language, or social structures – nor is it something that enables their construction through their failure to fully capture it – but is really and actually creative in itself.

Problematically, however, vital new materialism is not so much about *materialism* as it is about the *forces* of an ontological *vitalism*. Elizabeth Grosz seems to be one of the few vital materialists who has recognized the intimate link between materialism and idealism in the new vitalist tradition. "With the rise of so-called new materialism," Grosz writes, "it is perhaps necessary to simultaneously call into being a new idealism," because "Deleuze's rereading of Spinoza is responsible for a 'new idealism'" as well.[63] Therefore choosing to call vitalism "materialist" or "idealist" ultimately amounts to a rhetorical strategy grounded in something else, as Leibniz already made explicitly clear: an *ontology of forces*, not matter.[64]

If all matter is active to the point that it has been stripped of passivity, then how can matter act without an object on which to act? This affirmative vitalism thus risks "flattening" the multiplicity of material practices into a vague flat ontology of force *in general*. As N. Katherine Hayles argues, vitalist new materialism tends to be extremely "imprecise about the nature of 'force' and fails to distinguish between different kinds of forces, although these kinds of distinction have been extensively investigated in various scientific fields."[65]

Flat vitalist ontologies are additionally problematic because they have chosen to ontologize only the historically dominant side of the life/death binary (life, activity, agency). If death, passivity, and receptivity literally have *no being* and *no place* in the "flat ontology" of life, this has dangerous conceptual and political consequences, which have been noted by numerous critics.[66] Conceptually, vitalist new materialism simply cannot account for the entangled relationship between life and death, activity and passivity. Politically, it cannot avoid the historically rooted privileging of life over non-life and the implications this privileging has had on the exploitation and expropriation of human and non-human bodies associated with non-life.[67]

Finally, the ontology of force leads to a non-performative view of matter because, for Bennett, things possess "a certain vital force"[68] *before* entering into performative connection. "In other words," as Thomas Lemke rightly observes, "there is a vital force before and beyond assemblages that pertains to the assembled individual entities regardless of the relations they enter into."[69] But if force precedes material relations then it cannot simply *be* the performative intra-actions of relations themselves. Accordingly, vital new materialism remains a deeply metaphysical, ahistorical, and apolitical position.

negative new materialism

The second type of new materialism is perhaps the oddest one. What we are calling "negative new materialism" here is the theory that matter is *non-relationally external to thought*. We call this "negative" because it denies the relation between thought and matter. This approach thus results from the rather surprising/interesting combination of the rationalism of old materialism and the discontinuity of failed materialism. The two main traditions of

negative materialism we will look at here are "speculative realism" and "object-oriented ontology." Although the two fundamentally disagree, they both share a commitment to the non-relationality of thought.

In Quentin Meillassoux's speculative realism,

> [M]aterialism holds in two key statements: 1. Being is separate and independent of thought (understood in the broad sense of subjectivity), 2. Thought can think Being. Thesis number 1 is opposed to any anthropomorphism which seeks to extend subjective attributes to Being: materialism is not a form of animism, spiritualism, vitalism, etcetera. It asserts that non-thinking actually precedes, or at least may in right precede thought, and exists outside of it, following the example of Epicurean atoms, devoid of any subjectivity, and independent of our relationship to the world. Thesis number 2 affirms that materialism is rationalism.[70]

For Meillassoux, matter is independent of thought, and yet it is precisely thought and rationality alone that can think matter in its radically non-relational being. Meillassoux recognizes Greek atomism as ontological but rejects their claim that atoms and void are *necessarily* the ultimate elements of reality.[71] Matter, for Meillassoux, is *necessarily* and radically *contingent* and, thus, capable of producing absolutely anything at all at any given moment, even God.[72]

Although Meillassoux is careful not to conflate the scientific and mathematical thought of matter with *human* thought, he also says that no other being yet known is capable of thought – which emerged *ex nihilo* in humans. Non-thinking matter existed before humans and then suddenly thought emerged non-relationally from non-thinking matter. Meillassoux's materialism is therefore based on a kind of unexplainable miraculous ontological dualism between matter and thought with no explanation of how one could possibly emerge from the other.[73] What he calls the "Hyperchaos" of being is a direct consequence of this deeply non-relational philosophy.[74] If being is non-relational then it can become anything, including God. But if being is so radically contingent that it can become even God, why is this called "matter"?[75]

The second strand of negative new materialism is "object-oriented ontology" (OOO) – a term Graham Harman coined that defines a theoretical commitment to thinking the real beyond the human experience of matter. "What is real in the cosmos," he asserts, "are forms wrapped inside forms, not durable specks of material that reduce everything else to derivative status. If this is 'materialism,' *then it is the first materialism in history to deny the existence of matter.*"[76] For Harman, the essence of beings is to withdraw from all the objects that compose it and think it. As such, being is never something anthropocentric, experienced, or relational but is something absolutely and non-relationally "withdrawn" from everything else, as though it were completely "vacuum sealed." As it happens, this essentialist view of identity as something radically self-contained is in fact perfectly captured by the three discrete, individually circumscribed circles, zeros, or "O's" that have become the theory's standard iconic shorthand. This view also leads Harman to affirm what he calls "a new sort of 'formalism.'"[77]

Timothy Morton similarly argues against "some kind of substrate, or some kind of unformed matter"[78] in favor of essential forms that infinitely exceed the human domain of meaning-making. For example, Morton describes "hyperobjects" such as global warming as "real entities whose primordial reality is withdrawn from humans."[79] For him, as for Harman and Tristan Garcia, "objects" ultimately refer to an infinitely hidden essence that never even partially reveals itself in any relation.

The crucial problem with this from a performative materialist perspective, however, is that since the withdrawn essence is not itself relationally constituted, then that essence never changes. Furthermore, we see no reason to count any philosophy that rejects the existence of matter as a "materialism" at all. Just as vitalism defines matter as a mysterious subjective force that transcends the performative and relational movement of matter, OOO defines matter

as an ideal withdrawn essence that also transcends the performative and relational movement of matter.

In the end, we think negative new materialism is not actually a materialism at all because of its staunchly non-relational rationalism that cuts thought off from matter. Although its sincere aim is to overcome anthropocentrism and put forward a new realism, both versions of negative new materialism allow thought only for humans and end up treating this thought as *immaterial*. Critics are therefore right to note that the radical and withdrawn realism of OOO is much closer to a kind of rational subjectivism than it is to a theory of objects.[80] Indeed, Meillassoux himself has aptly critiqued Harman for being "subjectalist," and hence also anti-materialist.[81] At the same time, however, Meillassoux applies the materialist label to himself in part because he endorses old materialisms' assertion of a strict externality between being and thought, an externality that a performative materialism refuses.[82]

Finally, negative new materialism also tends to privilege a Western canon populated by white male philosophers, bringing to light the political limitations of its agenda, as well.

performative new materialism

The third type of new materialism is what we are calling "performative" new materialism. To date, the performative approach has, unfortunately, been largely overshadowed by and conflated with the other two. In this section, we seek to clearly differentiate the performative theory from the others – specifically regarding its account of ontology, agency, and the status of human observation – in order to elucidate why we find it the most promising one. We do so primarily through a discussion of the work of Karen Barad[83] and Vicki Kirby,[84] which we see as formative and exemplary of a performative approach.

In distinct ways, as we have seen, all new materialisms embrace a shift from epistemology to ontology. Nevertheless, all non-performative theories continue to take ontology and epistemology to exist independently of one another. In a performative approach, in contrast, ontology and epistemology are inherently co-implicated and mutually constituting. That mutual constitution, moreover, neither requires nor is in any sense restricted to humans.

Barad provides a particularly compelling basis for such a view through her "intra-active" account of the "measurement problem" in quantum physics. This problem arose with the famous double-slit experiments in which, depending on the experimental arrangement, light (or atoms etc.) appears either as a wave or particle, despite their mutually exclusive properties. While debate continues to rage even today over how best to interpret these conflicting findings, its basic contours were largely defined by the early interpretations of Erwin Schrödinger, Werner Heisenberg, and Niels Bohr. Barad's intervention into this debate begins from her novel reading of Bohr as having advanced an "ontic" interpretation against the "epistemic" interpretations of the former two. What Barad seizes on as Bohr's ontic breakthrough insight, which had not previously been appreciated, is that entities simply do not determinately exist apart from the particular, physical measuring apparatuses that constitute them one way to the exclusion of others.[85] Inherently, then, light, like all matter, is *indeterminate*. And thus, what light *is*, as a (relatively) determinate entity, does not entirely precede – and is not fully separable from – the physical, material apparatus used to observe it.

Through a careful elaboration and radical extension of this insight, Barad proposes an "ontoepistemological"[86] account of reality in which observations never simply "disclose pre-existing values"[87] or properties but, in fact, also always play a role in *constituting* them. Moreover, whereas Bohr's humanism limited his consideration of the constitutive role of observation to the confines of scientific laboratories in which pre-existing humans wield determinate tools and technologies, Barad pursues the implications much further.[88] Crucially, Barad argues that since there is in fact no strict or fixed boundary line dividing even a scientific laboratory from the rest of the world,

humans can therefore *never* observe the universe as though from outside of it.[89] Thus, she argues, "[t]o the extent that humans participate in scientific or other practices of knowing, they do so as *part of* the larger material configuration of the world and its ongoing open-ended articulation."[90] As such, humans (like everything else) always partly constitute and are partly constituted by that which they observe.

This ontoepistemological account, which she calls "agential realism," leads to a thoroughly "performative"[91] and relational materialism in which matter just is what it does or how it moves.[92] No property of any discernible thing, that is – whether its physical features, agency, or even its speech or thought – entirely precedes or remains unchanged by its actions or encounters with other things.

Such an account, therefore, radically refuses a flat ontology wherein a vital force pervades all things or remains unchanged across a thing's actions. Agency and vitality, rather, simply do not exist apart from particular intra-active performances. A given plant, for example, performs – and thus constitutes – agency differently from a particular rock or human. And so, whereas Bennett's vital materialism can be rightly critiqued for erasing any distinction between organic and inorganic things,[93] or for a "naïve realism" that imputes a "more-than-relational" agency to all things,[94] Barad's materialism cannot. Moreover, although Barad's word choice does tend to emphasize vitality or liveliness more than death or inanimacy, she states directly that by the former she does not mean "a new form of vitalism, but rather […] a new sense of aliveness,"[95] one that "makes possible the very distinction between the animate and the inanimate."[96] In sharp contrast with Bennett, then, Barad's notion of matter's vitality does not derive from alleged essential differences between life and death, *but is what performatively engenders those differences*. For this reason, in fact, Barad can recognize the death and mortality even of quantum particles.[97]

Without any radical exteriority between things, moreover, performative materialism refuses any ultimate or unchanging totality of what is possible. Instead, a generative "ontological indeterminacy"[98] prevails at the heart of such an account such that with each new performance the very "possibilities […] and impossibilities" of what matter can do "are reconfigured,"[99] albeit always through *internal* divisions only, that is, local limits determined by specific and always somewhat indeterminate "constitutive exclusions." Unlike Butler's exclusions, however, Barad's do not result from the failure of human discourse to fully capture something radically outside itself but, rather, from an internal cut or fold that provisionally resolves matter's inherent indeterminacy in a particular way.[100] And unlike OOO, what is excluded or withdrawn is therefore not an unchanging essence but is also always performatively and relationally constituted and, thus, novel.

In advancing an equally compelling and thoroughgoing performative materialism, Kirby highlights the larger theoretical consequences of such an approach in especially vivid and provocative terms. Kirby is struck, in particular, by the implication that if we humans are performances of matter as much as anything else, then anything allegedly exceptional about us must be but a particular inflection of a fully generalizable behavior of nature. Thus, if humans speak, perhaps it is because nature already speaks, in countless proliferating languages, and therefore spoke us into existence. And if we humans read and write, then surely we ought to entertain the possibility, however "scandalous," that "nature is literate," that "nature scribbles or flesh reads."[101] Encapsulating this line of inquiry in the title of a 2008 book chapter, she asks: "What if Culture Was Really Nature All Along?"[102]

In further pursuing such questions in a subsequent book, Kirby explores this "originary humanicity" through numerous ingenious forays into domains both human and otherwise, examining, for example, how lightning is a nonlocal phenomenon that is aware of and even sparks a conversation with the ground before striking,[103] and proposing that geological scientists are but one particular instance of nature's

actually ubiquitous (yet always specific) practice of studying, analyzing, quantifying, and predicting itself.[104] In doing so, we must stress that Kirby has no interest in flattening reality by projecting any sort of uniform linguistic, cognitive, or affective equivalent of vitality onto everything. Instead, she begins from the premise that if there is no radical or absolute boundary line between things, including between humans and non-humans, then humans have no more monopoly over what counts as intelligence, language, or even scientific inquiry than anything else does. Kirby's rendering, thus, enables an appreciation of the endlessly proliferating *specificity* and *variegation* of such notions as they are ceaselessly (re)constituted across countless human and non-human performances.

In pursuing the mathematical implications of this argument more recently, Kirby provides an extremely incisive performative materialist response to Meillassoux's ultimately non-performative views about mathematics.[105] Interestingly, as Kirby notes, both she and Meillassoux recognize inorganic matter as "inherently mathematical."[106] Where they fundamentally diverge, however, is over who or what does and does not *perform* mathematics. In effectively adopting the prevailing scientific view on this question, Meillassoux deems inorganic matter mathematical only insofar as it passively enacts a fixed, predetermined nature. Mathematical *thought*, meanwhile – the ability to actively *do* mathematics in order to access and represent that nature[107] – is for Meillassoux a uniquely human capacity that arose simply miraculously, *ex nihilo*.[108]

While similarly struck by "the unreasonable effectiveness of mathematics" in understanding and predicting the natural world, Kirby draws nearly the opposite conclusion.[109] For Kirby, just as language is not exclusive to humans, neither is mathematical thought; everything practices mathematics, albeit always in particular ways that also serve to ceaselessly (re)define what mathematics is. However strange or absurd such a view may seem to those conditioned by human exceptionalism, it nonetheless follows quite directly from what we think is the rather modest and reasonable premise that, if humans are fully material beings who do mathematics, then matter does mathematics.[110] And indeed, how else could nature have produced human mathematicians if it were not already mathematical? How else could it have generated the very principles that mathematicians claim to discover? And why else, finally, do those principles, despite their undeniable success, never quite manage *to fully* quantify or predict matter – unless matter is also inherently performative and improvisational?

In short, Kirby advances a performative materialism in which matter continually studies and reinvents itself without any strict or unchanging external limit. As she pithily encapsulates her approach, while also indicating her indebtedness to (a materialist reading of) Derrida, Kirby's argument that "there is no outside of text" means ultimately that "there is no outside of Nature."[111]

Finally, we would like to note briefly the rather striking resemblance between the performative materialisms formulated by Kirby and Barad and the ontologies we find in both the Homeric epics and in Lucretius' Homer-inspired philosophical poem *De Rerum Nature*. Indeed, in a recent book, Nail makes the case for reading Lucretius as a full-fledged performative new materialist who, rather astonishingly, aptly anticipated many of the most important new materialist-friendly views currently emerging in the natural sciences, including in quantum physics.[112] Equally astonishing is Nail's discovery that, contrary to how the poem has always been translated into English, Lucretius appears to have studiously avoided any variant, version, or translation of the word "atom." Indeed, based on our preceding discussion, we can understand why Lucretius *could not* be an atomist and also espouse a fully performative and relational view of matter. In a work in progress, Chris Gamble argues for a performative new materialist reading of the Homeric epics as well.[113] A key aim of the latter work, moreover, is to pursue the implications of performative new materialism as a means of illuminating important connections with Western history's own oral, indigenous past, thereby also facilitating and encouraging greater engagement with indigenous ontologies in the present as well.[114]

part 4: the future of new materialism

In the fourth and concluding part of this article, we would like to propose three general theses or criteria, extracted from historical and contemporary thinkers of performative materialism, that we think are central for the future development of a performative new materialist philosophy: pedesis, ongoing process, and relation. It is not enough merely to say that everything is matter. This amounts to saying everything that is is.[115] For us, there is "*nothing but* matter,"[116] but unlike old materialisms this is not a reductionistic claim because matter is not a substance that everything can be reduced to. Matter, for us, is a fundamentally indeterminate performance or process-in-motion. We can put these in the form of three entangled theses on performative materialism:

(1) The activity of matter itself must be *pedetic*, or characterized by *indeterminacy*, otherwise new materialism will fall back into attributing the activity of matter *to something else* such as forms, deterministic or probabilistic natural laws, forces, or God.
(2) Matter must be an *ongoing iterative process*, or else new materialism will fall back into substance-based ontology or risk reducing matter to something else like rationalism or formalism.
(3) Matter must be fully *relational* and immanently self-caused. Matter is not the merely passive effect of God, nature, or humans. Nor is matter a merely active agent, however. Material relations are always asymmetrical (both active and receptive at once) – not "flat."

Together, we believe that these three theses outline the core insights of performative materialism. To conclude, let us briefly develop each in turn.

pedesis

The first criterion for a performative new materialist philosophy is that matter is pedetic. Pedesis (from the PIE root **ped*-, meaning "foot") is the motion of semi-autonomous self-transport: the motion of the foot to walk, to run, to leap, to dance somewhat unpredictably. In contrast to deterministic, probabilistic, or random theories of motion, pedesis is directly and iteratively related to its immediate past but is not determined by it.

Pedesis, therefore, is an irregular and partly unpredictable motion, but it is neither *random* nor *probabilistic*.[117] As pedetic movement, matter not only generates metastable formations but, crucially, these formations also generate novel possibilities for subsequent formations. By contrast, while randomness and probability are at least partly unpredictable, they are not generative. Randomness, as we have discussed, is defined against a predetermined and fixed range of discrete, equally likely possibilities. Through their interactions, an infinite number of randomly moving entities (such as Democritus' atoms) can realize infinite outcomes or even worlds within that finite range of possibilities. Across iterations, certain combinations of those random outcomes may occur more or less frequently and so reflect a higher or lower probability than others, just as repeatedly rolling two six-sided dice will produce more sevens than twos. However, because the intrinsic characteristics of randomly moving entities like dice or Democritean atoms do not change across interactions, the complete range of possibilities that can be realized never changes, either. That range, in short, remains an absolute, immutable limit because random matter is not performative matter. In fact, the very idea of a purely random motion presupposes that it was not affected by or related to anything else previously, which, itself, presupposes that it was the first thing and before it was nothing, which is a version of the internally contradictory hypothesis of *ex nihilo* creation: something from nothing.

Unlike random or probabilistic motion, pedetic motion is thoroughly relational and thus also performative and generative. Whereas the former two are unpredictable insofar as each entity remains essentially unchanged by its interactions, the

unpredictability of pedetic motion is due precisely to such relational change. It is the intra-action or mutual influence of matter with itself that gives it its unpredictable character. Through its ongoing processes, the pedetic motions of matter combine and stabilize into relatively fixed patterns, synchronies, and relations, giving the appearance of stability and solidity, only to become turbulent again and enter into new conjoined relations. This is how indeterminacy is increasingly determined.[118] In other words, pedesis is neither random, determinate, nor probabilistic, but *generatively indeterminate*.[119] Matter is thus active and receptive only if its movement is pedetic or relationally improvisational. Otherwise its being and motion could be explained by something *else*.

ongoing iterative process

The second criterion is that matter is performative *if and only if* matter is understood to be an iterative, ongoing, indeterminate process.[120] If matter is nothing other than what it does or how it moves, and if its movements – from the very smallest to the largest spatiotemporal scales – are never finally or fully complete, then the only essential characteristic of matter is its unending pedetic reinvention.

Certainly, then, the fundamental character of performative, pedetic matter cannot be pinned down and captured by the unchanging, eternal natural laws of older materialisms. But neither can such matter be animated by an unchanging – and therefore *non*-performative – vital force. However creative such a force may be, that creativity will always be limited in advance by what essentially defines it: life, agency, vitality. The pedetic movements of performative matter, in contrast, ceaselessly (re)articulate their own limits and boundaries, without ever permanently fixing or standardizing the meaning of what falls on either side. Nevertheless, while no boundary or limit is absolute, this does not lead to a world of radical contingency or caprice such as Meillassoux's Hyperchaos. Floating space-rocks cannot sprout wings or legs with which to roam around the biosphere of a particular, relatively bounded planet; however, given enough pedetic iterations, those rocks can help create such a biosphere and indeed eventually become those winged and legged creatures.

Such transformative becoming is possible, however, only on condition that, while every "individual" iteration is somewhat novel and unique, none is ever completely determined or separable from any other. Even the always-partly-unique-and-unpredictable performances of the tiniest "single" electron, thus, serve to reconfigure the "entire" open-whole of the cosmos anew. In short, performative matter always remains radically entangled and therefore also always partly indeterminate and improvisational.

Furthermore, as an inherently indeterminate process-without-finality, there can be no underlying substance that unifies all of material reality as a continuous whole. Nor can matter create or bring into being something that was ever absolutely absent. Performative matter, thus, is neither a continuous nor discontinuous substance *nor a discontinuous process*.[121]

If matter were a radically continuous substance, it would be a homogeneous totality. Matter would be One – a finite or infinite unity – without the possibility of change or motion outside of itself since there would be no outside to it. In this case, all movement, as Zeno and Parmenides once argued, would be an illusion. However, if matter were One total being that contained all of being, the being that contained all of being would have to be different from the being that was contained by it. Material being would thus be separate from itself, i.e., non-total. We thus reach the paradox of the One that Gödel and others discovered long ago:[122] that the One cannot be included in that which it contains. Substantial continuum without motion thus results in a paradoxical conception of totality that cannot include itself in its own totality.

On the other hand, if matter's movements were ever *radically discontinuous* substances or processes, they would need to radically begin and end and so, paradoxically, there would be no movement at all. Strictly speaking, a radically "discontinuous movement" is

therefore not a movement at all. For example, for an entity moving from point A to point B through a succession of radically discontinuous leaps, the spatiotemporal distance between each leap would be divided by an infinity of intermediate points, themselves divided by an infinity of intermediate points, and so on ad infinitum. Moreover, if it remained the very same entity across each new leap, then that entity would clearly not be performatively constituted. Instead, we could merely say that a radically discrete and abstract entity underwent a series of changes in its location along its route from A to B. Each change in location, then, would not constitute different aspects of the same movement but radically different points without any movement between them at all. Radically discontinuous movement is therefore not movement at all but merely discontinuous, formal, or logical *change*.[123]

relation

The third criterion is that matter must be fully *relational* and immanently self-caused, otherwise it remains the merely passive object of another non-material agency such as God, nature, or anthropic structures. This has direct consequences for the philosophical practice of new materialism. Both vital new materialism and negative new materialism posit something outside relationality (whether a vital force, withdrawn essences, or *ex nihilo* creation). Accordingly they treat materialism as a strictly ontological type of inquiry about the nature of matter *as such*. However, if there is nothing but performative and kinetic matter, then the very inquiry of ontology must itself always amount to a particular material practice of matter observing, excluding, and thus constituting itself anew.

Furthermore, relations are always asymmetrical (temporally, spatially, politically, and so on) – *not flat*. In contrast to vitalism, which flattens out all relations into generalized subjective forces, and to OOO which eliminates all relations completely by privileging the withdrawn essences of particular objects, the performative approach attends to the asymmetry – and therefore also to the specificity – of particular material relations.[124]

Ontology is not merely an anthropic constructivism or failed materialism in which "the real" of matter always recedes. Rather, matter and ontological practices are really co-constructed and entangled in the interminable movements of their performances.

The primary inquiry of new materialism therefore must be ontological but not foundational; that is, it must be *historically relational*.[125] In other words, it does not aim to identify the absolute or immutable structure of being for ever and all time (being qua being). Rather, it seeks to identify, given a particular historical emergence of which we ourselves are an integral, fully-material part, the real conditions of that emergence.

We wish to be absolutely clear, however: this is a notion of history in which humans, when they are involved, are reading and writing as particular performances of matter reading and (re)writing itself. For us, performative new materialism is therefore a strictly historical and *regional ontology* of *ontological practice* itself, limited by the present but not reducible to it – without any ontological claim on the possible being of the future. Performative materialism is not metaphysics. Following Marx's retrograde reading of history, we can say that it is precisely the appearance of increased material entanglement in the Anthropocene that makes possible for us this new historical ontology of a moving and entangled matter.[126]

disclosure statement

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notes

1 "Vitalist," "negative," and "performative" new materialism. For three widely cited sources defining "new materialism(s)," see Stacy Alaimo and Susan Hekman, eds., *Material Feminisms* (Minneapolis: Indiana UP, 2008); Diana Coole and

Samantha Frost, eds., *New Materialisms: Ontology, Agency, and Politics* (Durham, NC: Duke UP, 2010); Rick Dolphijn and Iris van der Tuin, eds., *New Materialism: Interviews and Cartographies* (Ann Arbor, MI: Open Humanities, 2012). The introductions to the former two collections define new materialisms as attending to interactions between ontology and epistemology, or matter and meaning, which neglects the ontoepistemological intra-actions or entanglements of performative new materialism (despite the former collection including performative new materialist chapters by Karen Barad and Vicki Kirby). The second source's introduction also endorses a vitalist approach. The third book includes interviews with proponents of all three new materialisms and, in its second half, puts them into productive conversation with one another in order to develop a "transversal" new materialism which in many ways embraces a performative approach. None of these sources theorizes what we consider the key *differences* between performative, vitalist, and negative new materialisms, however, which is our paper's primary theoretical aim.

2 Except that negative new materialists tend to eschew terms such as "alive," "lively," or "vital." See, for example, Timothy Morton, *The Ecological Thought* (Cambridge, MA: Harvard UP, 2010), who says calling the Internet a "'Web' is a little too vitalist […] for my taste" and prefers the less vitalist-sounding "Mesh" instead (28).

3 For the initial formulation, see Sara Ahmed, "Imaginary Prohibitions: Some Preliminary Remarks on the Founding Gestures of the 'New Materialism,'" *European Journal of Women's Studies* 15.1 (2008): 23–39; pursued further by Nikki Sullivan, "The Somatechnics of Bodily Inscription: Tattooing," *Studies in Gender and Sexuality* 10.3 (2009): 129–41. More recently, see Caroline Braunmühl, "Beyond Hierarchical Oppositions: A Feminist Critique of Karen Barad's Agential Realism," *Feminist Theory* 19.2 (2017): 223–40; Dennis Bruining, "Interrogating the Founding Gestures of the New Materialism," *Cultural Studies Review* 22.2 (2016): 21–40. For responses, see Davis, "A Response and Feminism's Anti-Biologism: A Response to Sara Ahmed," *European Journal of Women's Studies* 16.1 (2009): 67–80; Iris van der Tuin, "Deflationary Logic," *European Journal of Women's Studies* 15.4 (2008): 411. As Davis notes, the feminist science work that Ahmed cites treats the relationship between human meaning and biology as what Barad calls a "mixture," not an "entanglement" (71, 75 n. 5). The former presumes a pre-existing, discrete, unchanging boundary and so implicates a "both/and" or "interactional" logic, whereas in the latter case boundaries are mutually or "intra-actively" constituted. We argue that *only* performative new materialism enables an intra-actively entangled account. For an important recent critique of feminism's "antibiologism," see Elizabeth A. Wilson, *Gut Feminism* (Durham, NC: Duke UP, 2015).

4 Simon Choat, "Science, Agency and Ontology: A Historical-Materialist Response to New Materialism," *Political Studies* 66.4 (2011): 1027–42; Joss Hands, "From Cultural to New Materialism and Back: The Enduring Legacy of Raymond Williams," *Culture, Theory and Critique* 56.2 (2015): 133–48.

5 Angela Willey, "Biopossibility: A Queer Feminist Materialist Science Studies Manifesto, with Special Reference to the Question of Monogamous Behavior," *Signs: Journal of Women in Culture and Society* 41.3 (2016): 553–77.

6 See Sarah Ellenzweig and John H. Zammito, eds., *The New Politics of Materialism* (London and New York: Routledge, 2017). This collection describes itself as "the first to ask what is 'new' about the new materialism and place it in interdisciplinary perspective." Most chapters answer this question in a critical way.

7 See note 1 above.

8 See Carol A. Taylor, "Close Encounters of a Critical Kind," *Cultural Studies – Critical Methodologies* 16.2 (2016): 201–12, most directly in relation to the object-oriented ontology theorist Ian Bogost (210). This criticism is reiterated in Thomas Lemke, "Materialism without Matter: The Recurrence of Subjectivism in Object-Oriented Ontology," *Distinktion: Journal of Social Theory* 18.2 (2017): 133–52.

9 Thomas Lemke, "An Alternative Model of Politics? Prospects and Problems of Jane Bennett's Vital Materialism," *Theory, Culture and Society* 35.6 (2018): 31–54. "To put it in an old-fashioned vocabulary: Bennett endorses an 'idealist' account of materialism" (46). "To put it bluntly: there is a lack of materiality in this vital materialism" (47). For a consonant critique of vital new materialism, see Quentin Meillassoux, "Iteration, Reiteration,

Repetition: A Speculative Analysis of the Meaningless Sign," trans. Robin Mackay, Freie Universität, Berlin, 20 Apr. 2012, 4.

10 While not proposing a (fully) performative solution to this recurrent problem, for a related critique of how materialisms have continually been plagued and undermined by various idealities, see Jean-Michel Salanskis, "Some Figures of Matter," trans. Ray Brassier, *Pli: The Warwick Journal of Philosophy* 12 (2001): 5–13.

11 Barad, *Meeting the Universe* 151; emphasis added.

12 Thomas Nail, *Being and Motion* (Oxford: Oxford UP, 2018).

13 See note 4 above.

14 For example, Barad's influential assertion in *Meeting the Universe* that "There is an important sense in which the only thing that doesn't seem to matter anymore is matter" (132).

15 Nail, *Being and Motion*; Christopher N. Gamble and Joshua S. Hanan. "Figures of Entanglement: Special Issue Introduction," *Review of Communication* 16.4 (2016): 265–80.

16 See Thomas Nail, *Lucretius I: An Ontology of Motion* (Edinburgh: Edinburgh UP, 2018); *Lucretius II: An Ethics of Motion* (Edinburgh: Edinburgh UP, forthcoming 2020); on Homer, see Christopher N. Gamble (MS in progress).

17 Jerry Lee Rosiek, Jimmy Snyder, and Scott L. Pratt, "The New Materialisms and Indigenous Theories of Non-human Agency: Making the Case for Respectful Anti-Colonial Engagement," *Qualitative Inquiry* (forthcoming 2019).

18 The atomists' void, however, is distinct from a contemporary conception of empty space. David Sedley, "Two Conceptions of a Vacuum," *Phronesis* 27.2 (1982): 175–93.

19 DK 68B6-11.

20 DK 68A28.

21 Quentin Meillassoux, *After Finitude: An Essay on the Necessity of Contingency*, trans. R. Brassier (London: Continuum, 2009) 36–37. Meillassoux addresses Epicureanism ("the paradigm of all materialism"), yet the point applies equally to Democritus.

22 Ibid. 99–101.

23 On the atoms' random movement, see DK 67A14, 68A37.

24 DK 67A24, 68A40.

25 See David Sedley, "Epicurus' Refutation of Determinism" in *SUZHTHSIS: Studi Sull' Epicureismo Greco E Romano Offerti a Marcello Gigante* (Naples: Biblioteca della Parola del Passato, 1983) 11–51.

26 For an accessible introduction to chaos theory, which opens with a discussion of the "butterfly effect," see James Gleick, *Chaos: The Making of a New Science* (New York: Viking, 1987). Nevertheless, it is worth noting that, despite this similarity of small divergences resulting in large changed outcomes, only the Epicurean swerve is truly *spontaneous* (i.e., immanently caused and thus irreducible to any external laws or forces), whereas the butterfly effect of chaos theory is unpredictable due simply to our lack of knowledge about initial conditions and natural laws that, in principle, are knowable (or would be to an omniscient being).

27 On seeing the swerve as a "lively impetus intrinsic to materiality per se […] the vital materialist sides with the Epicureans," see Jane Bennett, *Vibrant Matter: A Political Ecology of Things* (Durham, NC: Duke UP, 2010) 68. However, Bennett critiques Epicureanism's "imagery of *individual* atoms falling or swerving in the void" (xi; emphasis added), emphasizing instead the composite agency of Deleuzian assemblages (see ch. 2). For a critique of this vitalist interpretation of Lucretius, see Nail, *Lucretius I*.

28 See note 22 above.

29 Daniel W. Graham, *Explaining the Cosmos: The Ionian Tradition of Scientific Philosophy* (Princeton: Princeton UP, 2006) 15.

30 New materialists have made a similar error. See Charles T. Wolfe, "Varieties of Vital Materialism" in Ellenzweig and Zammito, *New Politics of Materialism* 44–65; Coole and Frost, *New Materialisms*.

31 For an example of an essay that opposes vitalism and mechanism, see Georges Canguilhem, "Aspects of Vitalism" in Georges Canguilhem, *Knowledge of Life* (New York: Fordham UP, 2008) 59–74.

32 Edward Dolnick, *The Clockwork Universe* (New York: HarperCollins, 2011).

33 Francis Bacon, *A Confession of Faith* [1602] in *The Works of Francis Bacon*, ed. James Spedding (London: Green, 1857–74) 14: 49–50.

34 Idem, "On Principles and Origins According to the Fables of Cupid and Coelum" in *The Works of Francis Bacon*, ed. James Spedding (London: Green 1857–74) 10: 648.

35 Rodolfo Garau, "Late-Scholastic and Cartesian Conatus," *Intellectual History Review* 24.4 (2014): 479–94 (484).

36 René Descartes, *Discourse on Method*, Adam and Tannery edition of the *Oeuvres de Descartes* (Paris: Librarie philosophique J. Vrin, 1976) VI: 50; emphasis added.

37 Thomas Hobbes, *De Corpore* in English Works 1: 109.

38 Ibid. 206.

39 Ibid.

40 Ibid. 207.

41 See Wolfe, "Varieties of Vital Materialism."

42 For materialist treatments of Butler, see Bruining, "Interrogating" and Ahmed, "Imaginary Prohibitions." For such a treatment of Lacan, see Christian O. Lundberg, "On Missed Encounters: Lacan and the Materiality of Rhetoric" in *Rhetoric, Materiality, and Politics*, eds. Barbara Biesecker and John Louis Lucaites (New York: Peter Lang, 2009) 161–83.

43 Meillassoux, *After Finitude* 5.

44 Jacques Lacan, "The Mirror Stage as Formative of the Function of the *I* as Revealed in Psychoanalytic Experience" in *Reading French Psychoanalysis* (London and New York: Routledge, 2014) 119–26.

45 Idem, "Rings of String" in *On Feminine Sexuality*, trans. Bruce Fink (New York: Norton, 1978) 123–36.

46 As Lacan puts it, "The lack of the lack makes the real" (Jacques Lacan, *The Seminar of Jacques Lacan: The Four Fundamental Concepts of Psychoanalysis (Book XI)*, ed. Jacques-Alain Miller; trans. Alan Sheridan (New York: Norton, 1998) ix).

47 Judith Butler, *Bodies that Matter: On the Discursive Limits of Sex* (London and New York: Routledge, 2011).

48 See, for example, Ahmed, "Imaginary Prohibitions" 33; Bruining, "Interrogating," esp. 39.

49 Butler, *Bodies that Matter* 11–14.

50 Ibid. 141.

51 See Vicki Kirby, *Telling Flesh* (New York: Routledge, 1997) 101–28, for a brilliant and incisive critical reading of Butler from a performative new materialist perspective to which our own account is deeply indebted.

52 Vicki Kirby, *Judith Butler: Live Theory* (London: Continuum, 2006) 70; emphasis added.

53 This is indeed the case according to the introductory chapters of the three highly cited edited collections on new materialism referenced in note 1, notwithstanding the differences among them that we also note there.

54 Adopting what Angela Willey calls a "science friendly disposition," such new materialist work endorses recent scientific findings allegedly establishing matter's true nature as dynamic and active rather than passive; see "Engendering New Materializations: Feminism, Nature, and the Challenge to Disciplinary Proper Objects" in Ellenzweig and Zammito, *New Politics of Materialism* 131–53. As Willey rightly notes, such a disposition "operates as a neo-positivist agenda that ultimately reconsolidates the authority to say what we are and might become in scientific disciplinary ways of knowing" (149).

55 Coole and Frost explicitly accept a framework "commensurate" with (a non-performative understanding of) the human-centered sciences (*New Materialisms* 5). Meillassoux grants thinking humans alone objective access to reality – see Dolphijn and van der Tuin, *New Materialism* 81. Finally, it is worth mentioning that Bruno Latour, by our definition, is a new materialist because he is a non-anthropocentric realist. He has a relational ontology like vitalist materialists but does not use the term "vital." However, his view differs from performative materialism because he holds that humans alone have a symbolic capacity to represent the material world, which is therefore distinct from that world. For a wonderfully nuanced appraisal and critique of how Latour's view

ultimately ends up requiring "a human scribe to represent itself," see Vicki Kirby, *Quantum Anthropologies* (Durham, NC: Duke UP, 2011) 79–88.

56 This is true even if some do not agree that Deleuze himself was a materialist. As Coole and Frost (*New Materialisms*) note, "Gilles Deleuze, whose work has been influential in much of the new ontology did not count himself a materialist despite his radical empiricism and some evocative descriptions of materialization" (9).

57 Spinoza, *Ethics*, Book II, Postulate 6.

58 Leibniz, *Specium Dynamicum* 445.

59 Ibid. 436.

60 Bennett, *Vibrant Matter* xiii.

61 Coole and Frost, *New Materialisms* 9.

62 Bennett, *Vibrant Matter* xiii; Erin Manning, *Relationscapes: Movement, Art, Philosophy* (Cambridge, MA: MIT P, 2012).

63 Elizabeth Grosz, *The Incorporeal: Ontology, Ethics, and the Limits of Materialism* (New York: Columbia UP, 2017) 13.

64 See Thomas Nail, *Being and Motion* (Oxford: Oxford UP, 2018) 309–19.

65 N. Katherine Hayles, *Unthought: The Power of the Cognitive Nonconscious* (Chicago: U of Chicago P, 2017) 80.

66 For an example of this critique, see Choat, "Science, Agency and Ontology."

67 Mel Y. Chen, *Animacies: Biopolitics, Racial Mattering, and Queer Affect* (Durham, NC: Duke UP, 2012); Alexander G. Weheliye, *Habeas Viscus: Racializing Assemblages, Biopolitics, and Black Feminist Theories of the Human* (Durham, NC: Duke UP, 2014).

68 Bennett, *Vibrant Matter* 24.

69 Lemke, "Alternative Model of Politics?" 41.

70 Dolphijn and van der Tuin, *New Materialism* 79.

71 For Meillassoux, the only absolute necessity is reality's radical contingency, which, he argues, is revealed solely by "the luminous clarity of intellection," not by the senses (*After Finitude* 91 (cf. 90–92)). The rationalism of the atomists goes astray, then, because it begins instead with empirical observations rooted in the senses' "bastard" reasoning. For Meillassoux's direct critique of atomism, see 36, 51, 99–101.

72 See Meillassoux, "The Immanence of the World Beyond" in *The Grandeur of Reason: Religion, Tradition and Universalism*, eds. Peter M. Candler and Conor Cunningham (London: SCM, 2009) 444–78.

73 On how "the principle of pure contingency" allows for explaining the "miracle" of "*ex nihilo*" emergence such as organic, sentient life from inorganic dead matter, and human thought from organic matter, see Meillassoux, "Iteration, Reiteration, Repetition" 14.

74 Ibid. 11.

75 Meillassoux describes his own project as "neo-materialist" because it seeks to overcome subjectivism and access material reality directly, via mathematical thought (see ibid. 6–7). Nevertheless, for Meillassoux, the *ex nihilo* emergence of thought (and life) demonstrates that matter can manifest in a radically non-relational – and thus, in our view, idealist – manner.

76 Graham Harman, *Tool-Being: Heidegger and the Metaphysics of Objects* (New York: Open Court, 2011) 293; emphasis in original.

77 Ibid.

78 Timothy Morton, "Here Comes Everything: The Promise of Object-Oriented Ontology," *Qui Parle* 19.2 (2011): 163–90 (177).

79 Idem, *Hyperobjects: Philosophy and Ecology after the End of the World* (Minneapolis: U of Minnesota P, 2013) 15.

80 Lemke, "Materialism without Matter"; Taylor, "Close Encounters."

81 Meillassoux, "Iteration, Reiteration, Repetition" 7.

82 "We are materialists in so far as we obey the two principles that belong to any materialism: being is not thought, and thought can think being" (ibid. 12).

83 Barad, *Meeting the Universe*.

84 Kirby, *Telling Flesh*; idem, *Quantum Anthropologies*.

85 In contrast, Barad considers Heisenberg's view "epistemic," for example, because for him

(at least initially) measurement invariably "disturbs" a measured object (e.g., an electron's position or momentum), thus limiting our ability *to know* it, yet without also changing what it *is*; see Barad, *Meeting the Universe* 115–31. For Barad, then, unlike Meillassoux, observation of reality (by humans or non-humans) always partly *constitutes* reality. For an extremely lucid alternative rendering of quantum physics' philosophical implications to Barad's that begins instead from an ontological appreciation of Heisenberg, see Michael Epperson, *Quantum Mechanics and the Philosophy of Alfred North Whitehead* (New York: Fordham UP, 2004). Despite much agreement between their accounts, however, Epperson embraces quantum mechanics' unrivaled precision in making probabilistic predictions that work only under the assumption of a closed universe that mathematics can accurately represent. Barad's universe, in contrast, is never absolutely closed – the mere act of *thinking* a mathematical "representation," an act no less material than any other, is therefore enough to physically change the universe being represented. Accordingly, Epperson and Barad advance incompatible views about temporality. Epperson argues for "absolute" temporal asymmetry in which past actualizations remain forever settled but the future remains open (94–97). In her discussion of the "quantum eraser" experiments, meanwhile, Barad argues that since even the past was never a fully determinate present, "'past' and 'future' are iteratively reworked and enfolded through the iterative practices of spacetimemattering" (315; cf. 310–17).

86 Barad, *Meeting the Universe* 43–44.

87 Ibid. 265.

88 Insofar as Bohr is limited by such humanism, Barad characterizes his account as "epistemological."

89 For a wonderfully poignant example, see Barad's discussion of the Stern–Gerlach experiment, which first empirically demonstrated space quantization. As Barad discusses, the success of the experiment just so happened to hinge not only on the particular performances of matter and the apparatuses of observation used to measure matter but also on the intra-action of Walter Gerlach's own unwitting performance of gender and class, which manifested itself in the high sulfuric content of the smoke emitted by the cheap cigars he was smoking. Barad, *Meeting the Universe* 161–68.

90 Ibid. 342; emphasis added.

91 Ibid. 134–37.

92 See notes 11 and 12 above.

93 Arienne F. Conty, "The Politics of Nature: New Materialist Responses to the Anthropocene," *Theory, Culture and Society* 35.7–8 (2018): 82.

94 Steve Hinchliffe, "Vibrant Matter: A Political Ecology of Things," *Dialogues in Human Geography* 1.3 (2011): 35.

95 Barad, *Meeting the Universe* 177.

96 Ibid. 437 n. 81.

97 Transmaterialities: "Trans*/Matter/Realities and Queer Political Imaginings," *GLQ* 21.2–3 (2015): 394.

98 Barad, *Meeting the Universe*, e.g., 344–45.

99 Ibid. 149.

100 On Barad's critical appraisal of Butler's notion of "constitutive exclusion," see ibid. 64; on Barad's own use of this term, see 135–36.

101 Kirby, *Telling Flesh* 127.

102 In Alaimo and Hekman, *Material Feminisms* 214–36. More recently, see Vicki Kirby, ed., *What if Culture Was Nature All Along?* (Edinburgh: Edinburgh UP, 2017).

103 Kirby, *Quantum Anthropologies* 10–13.

104 Ibid. 39–40.

105 "Matter out of Place: 'New Materialism' in Review" in Kirby, *What if Culture Was Nature All Along?* 1–25. It is worth noting that Kirby's essential disagreement with Meillassoux is directly at odds with Dolphijn and van der Tuin's reading of them. Dolphijn and van der Tuin, wrongly, in our opinion, find essential congruity between Meillassoux and Kirby via Massumi's notion of "ontological priority." See Dolphijn and van der Tuin, *New Materialism* 174.

106 "Matter out of Place" 12; emphasis added.

107 For example, Meillassoux, *After Finitude* 108; idem, "Iteration, Reiteration, Repetition" 18.

108 Meillassoux, "The Immanence of the World Beyond" 461.

109 See Kirby's earlier chapter titled "Enumerating Language: 'The Unreasonable Effectiveness of

Mathematics'" in *Quantum Anthropologies*, which provides a broader yet equally compelling discussion of mathematics.

110 See, for example, Kirby's discussion of the "code-cracking capacities" of bacteria in "Matter out of Place" 5–6. See also Thomas Nail, *Theory of the Earth*, under review. Nail also examines how inorganic matter is mathematical, for example, in phyllotaxis and the lattice bonding patterns of minerals.

111 *Quantum Anthropologies* x.

112 Nail, *Lucretius I*.

113 Christopher N. Gamble (MS in progress).

114 For a recent and compelling essay encouraging such engagement, specifically on the basis of important affinities between Barad's agential realism and the "agent ontologies" of many indigenous cultures, see Rosiek, Snyder, and Pratt, "New Materialisms and Indigenous Theories."

115 As Salanskis puts it, "the assertion 'what there is is matter' means no more than 'what there is is'" ("Some Figures of Matter" 5).

116 Ibid.; emphasis in original.

117 The argument we are glossing here is that randomness, determinism, and probability are all essentially part of a single mathematical and statistical framework that has dominated Western metaphysics and that invariably figures matter as inherently passive and non-generative. In a paper in progress, Christopher N. Gamble fleshes out more fully both how performative new materialism implicates a wholesale critique of such a framework and what such a critique entails.

118 This is a major question that cannot be fully answered here. For a more detailed theory of how indeterminate flows of matter become metastable processes, see Nail, *Being* and *Motion* 55–123. For Barad's congruent discussion of how indeterminacy gets (relatively) resolved, see *Meeting the Universe* chapters 3, 4, 7, esp. 342–50.

119 Lucretius, *De Rerum Natura* 2.114–28; *Meeting the Universe* 114.

120 A complete theory of indeterminate and iterative motion cannot be fully developed here. For a more detailed theory, see Nail, *Being and Motion* 55–123. For Barad's account of iterative, "posthumanist performativity," see *Meeting the Universe* chapter 4; see also 310–17.

121 We fully endorse how we understand Barad to use the term "quantum dis/continuous," where the slash disrupting the latter word performatively invokes the notion that matter is "neither fully discontinuous with continuity [n]or even fully continuous with discontinuity, and in any case, surely not one with itself" ("Quantum Entanglements and Hauntological Relations of Inheritance," *Derrida Today* 3.2 (2010): 240–68). Nevertheless, we do not adopt this term ourselves due to the concern of at least one of us that the slash may be misread as invoking a both/and kind of logic like that espoused by a Whiteheadian "continuous" process of fully *discontinuous* actualizations, each of which is marked by "the evaporation of all indetermination," rather than the neither/nor logic of performative indeterminacy (Whitehead qtd in Epperson, *Quantum Mechanics* 135).

122 See Kurt Gödel, *On Formally Undecidable Propositions of Principia Mathematica and Related Systems* (New York: Basic, 1962).

123 Geach used this phrase to describe Russell and McTaggart's theories of formal change. P.T. Geach, *God and the Soul* (New York: Schocken, 1969) 71–72. See also Alfred North Whitehead's theory of change in Alfred North Whitehead, *Concept of Nature* (Cambridge: Cambridge UP, 1978) 73, 59. According to Whitehead, change is only "the difference between actual occasions comprised in some determined event" and thus it is "impossible to attribute 'change' to any actual entity." Change and motion thus relate to a succession of actual entities, and are constituted only by the differences among them. Every entity is simply "what it is" and becomes with its whole set of relations to other entities inherent therein, and thus *cannot change or move*.

124 This point requires more space and several examples. See Thomas Nail, *The Figure of the Migrant* (Stanford: Stanford UP, 2015).

125 Choat, "Science, Agency and Ontology."

126 The authors of this paper are pursuing new materialism work in several directions following these three criteria. See Nail, *Being and Motion*;

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