The Interpretation of Early Modern Philosophy

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TABLE OF CONTENTS

The view that no substance is relative—a view that is commonly held—would appear to be open to question.

—Aristotle, *Categories*, 7 (8a13-16)

All things can be arranged serially in various groups […] everything, with regard to its possible usefulness to our project, may be termed "absolute" or "relative".

—Descartes, *Regulae*, 6.

The Ideas then of Relations are capable at least of being more perfect and distinct in our Minds, than those of Substances.

—Locke, *An Essay Concerning Human Understanding*, II, 25, 8.

In some domains, such as perceptual and motor systems, one assumes that the cognitive processes at work are essentially invariant across the human species. In other domains, it has been standard to assume that the cognitive system can vary across populations in arbitrary ways. This has been the normal view about social and cultural cognition, at least until recently. Language demonstrates something in between: striking superficial diversity that can be reduced to a small number of discrete factors within a universal matrix. This is a model of cognitive architecture that should be kept in mind when studying other aspects of human culture.

—Mark. C. Baker, *Linguistic differences and language design.*

CHAPTER ONE*

THE INTERPRETATION OF EARLY MODERN PHILOSOPHY

What is early modern philosophy? That is, taking the standard periodization of early modern philosophy as given[1], what gives it intellectual unity? There have been a number of attempts (from Kant to the present) to answer this question, and by doing so to draw a coherent picture of what might be called (in more contemporary language) the early modern "paradigm", if we are to assume that such a thing might exist; to identify what, if anything, might successfully identify the distinctive features of early modern philosophical thought, if in fact modern philosophy can be approached in such a way, that is, as an epoch of thought that is internally coherent and distinctive, aside from any historical, social or institutional unity it may possess.

For the purposes of argument, I will take it as given that such an approach possesses at least an initial plausibility. There have been, historically, and continue to be, many attempts to sketch such a picture[2].

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* Note: all translations from sources not in English are my own, unless indicated by a citation of a published translation.

[1] I.e. Descartes to Kant. There is of course a certain arbitrariness in beginning with Descartes, and it is certainly arguable that elements of modernity are to be found in thinkers preceding Descartes, such as Galileo, Francis Bacon or Ockham. Some find many anticipations (if this is a coherent idea) of modern thinking in certain late medieval scholastic thinkers. I will have something to say about some of these anticipations below. I see Kant as the culmination of modernity, not as the initiator of a new pattern of thinking, which I would argue begins with Fichte. Contrary to some recent work that appears to show that there is little intellectual unity in the standard periodization of modernity, for example Ariew (2010) and Pasnau (2011), I believe there is a distinctive intellectual unity to be found in early modern thought which distinguishes it from earlier and later periods; this unity, is not, however, historically unique (see chap. four).

[2] For a sketch of the standard picture (of early modern thought as centered on epistemology), and its historical origins, see Haakonssen (2004). For a sketch of

To anticipate: I would like to propose that the logical structure of relation, in particular that of a binary or dyadic anti-symmetrical (i.e. one-way) relation[3], can function as an interpretative framework for early modern philosophy. I also would like to propose that it is to characterizations of causality[4] that we must turn to, if we are to fully understand early modern thought and the role of dyadic relations within it. I shall have more to say about causality in section 3.6, and the concluding chapter four, below. I believe that these characterizations are fundamental, and cannot be explained in any other manner, such as by explanations based on the introduction of the idea of laws of nature in early modern thought[5]; of revisions to medieval ontological concepts such as substance[6]; nor to the introduction of philosophies of corpuscularism or mechanism[7]; the abandonment of an Aristotelian picture of a self-governing universe and Aristotelian interpretations of causality[8]; nor to the purported rationalization and / or mathematization of thought allegedly brought about by modern thinking[9], or to changes to concepts of space or time[10]. I

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the history of the interpretation of early modern thought, especially in the English-speaking world, see Vanzo (2016). I discuss other interpretations below, of which the most important appear to me to stem from Heidegger's (and Husserl's) work in the history of philosophy, on the one hand, and those focused on reconfigurations of specific scholastic concepts, influenced by developments in the physical sciences. How these two approaches differ, despite some overlap, will be explained in chapter three. I must emphasize that my interpretation (chapter four) differs markedly from both of these.

[3] A binary (two-place) anti-symmetrical relation is a relation R such that for any *x*, *y*, if *x*R*y* and *y*R*x*, then *x* = *y*. See also the historical note at the end of this section for some remarks on historical adequacy.

[4] Characterizations of causality, as opposed to explicit theories of causal relations—I use the more general and ambiguous expression for reasons that will become apparent below. Briefly, such relations are not necessarily manifested as causal relations, but can regulate perception, temporality, and other domains, but at bottom are motivated by a view of the nature of interaction and dependence.

[5] E.g. Ott (2009); for a survey see Henry (2004).

[6] See section 3.2 *infra.*

[7] See the discussion in the immediately following paragraphs, as well as section 1.1, and sections 3.2, 3.6 *infra.*

[8] E.g. Heil (2016, 135).

[9] Associated with Heidegger, Koyre, Burtt, and others. See section 3.3 *infra*.

[10] No doubt there were such changes (see 3.7 below); but they are neither sufficient (early modern theories of space and time carried over into the very different intellectual climate of the nineteenth-century), nor necessary (Aristotelian philosophy, in particular that of the historical Aristotle, as I hope to explain in

will examine some of these other interpretations of the roots of early modern thought in some detail in chapter three.

Apropos the fourth point above, the alleged early modern rejection of Aristotelian causality, I would like to comment on some contemporary debates in the metaphysics of causality, and on the question of whether such debates might be relevant for the historical issue that is at the centre of this essay[11]. Contemporary metaphysics of causality comes in two main varieties: Humean and Aristotelian (or NeoAristotelian)—the first, an event-based view of causal interaction governed by regularity or laws of nature; the second, centering around causal powers and dispositions. It is fair to claim that Humean causation captures something of early modern accounts of causality, although not all were event based, but is the NeoAristotelian view genuinely Aristotelian (could it be said to accurately represent the positions of the historical Aristotle?), and does the opposition between the two represent a real historical conflict? Can we read the contemporary conflict between the two interpretations back into the past, into the genesis of the early modern system from the medieval?

I believe, contrary to Heil (2006), that we cannot, and that the contemporary NeoAristotelian view is not a correct representation of either Aristotelian, or in fact much of scholastic Aristotelian theories of causality. To be brief, I shall contrast the two in the following table:[12]

Table 1-1: Classical and Contemporary Dispositionalism

Classical and Medieval Aristotelianism	Contemporary NeoAristotelian Theories of Causality
Substance Oriented	Process Oriented
Causal interactions are uni-directional and uni-local (from agent to patient, located in the patient)	Interactions are mutual[13]

chapter four, is much less opposed to early modernism than conventionally thought).

[11] The commentary that follows is largely in response to the "historical interlude" in Heil, *op. cit*.

[12] The right side of the table is largely taken from the accounts in Heil (2016) and Mumford (2014).

[13] "Since the process of production is depicted as an equal partnership, the view [advocated here] jettisons the Aristotelian idea that one partner is passive and the other active." (Mumford 2014, 327.)

Unity of matter and form imply an at least weak form of compositionality	Non-linear and non-compositional
There is only one unequivocally self-moving and self-governing substance	Dispositions are self-governing and self-moving[14]

Contemporary dispositional theories of causality are largely process-oriented[15]; Classical Aristotelianism, despite its emphasis on actualization and entelechy, remains, arguably, a substance-oriented philosophy (as can be seen in the scholastic dictum *operari sequitur esse*, activity follows upon being). Contemporary dispositionalists tend to see causal composition as non-linear and non-compositional[16], while, in classical Aristotelianism, components of composites retain a kind of identity as powers or potentialities within the composition. For example, according to the classical Aristotelian account of compositionality[17], the corrosive power of chlorine should remain in the sodium-chloride composite of salt as a kind of corrosive potentiality within the salt, even if the chlorine itself does not remain (as a separate, unbonded element). Not so according to current dispositionalism—the whole of the salt is greater, and different, from the parts, and the properties of the compound cannot be analytically deduced or predicted from the properties of the isolated parts. Furthermore, the identity criterion of properties of powers differ greatly between the two accounts; Heil (2016, 131) prefers a "multi-tracked" account of powers that individuates powers according to circumstances, so a single power may have many different manifestations; classical Aristotelianism tends to identify powers with particular properties or

[14] "It has become common to think of dispositions as standing in need of stimuli. They are depicted as capable of doing nothing on their own [...] there is, though, something that is problematic about this as an account of the activation of power [...] potentialities do not need stimulating but, rather, they come to be realized if nothing prevents them." (*idem*., 323).

[15] "The notion of process becomes crucial, which is why some dispositionalists have an interest in Whitehead's (1929) process metaphysics." (*idem*., 330).

[16] "There are of course reasons why salt is neither combustible nor poisonous, due to its other properties and their interaction, but that doesn't detract from the point the case makes: powers do not simply add." (*idem*., 335).

[17] *On Generation and Corruption*, I, 10. The example of salt is obviously not from Aristotle. It is taken from Mumford, *op. cit.*

manifestations of substances. I leave it to the reader to judge which is the more accurate theory, but it should be remembered that the Aristotelian understanding of the micro-structure of the world is very different from ours—Aristotle's comparatively simpler account of the physical world, lacking the complex structures revealed by modern science, has less resources for accounting for the hugely varying range of manifestations that a multi-tracked account would admit, without sacrificing coherence and unity of explanation.

Finally, the contemporary theory usually prescinds from the Aristotelian cosmos and theology, which is a vitally important part of the classical Aristotelian picture.

There is a genuine conflict between event-oriented theories of causality and dispositional theories, and I don't mean to doubt that this conflict played a role in the genesis of early modern causal theories. There is also a conflict between the orientations of the left and right sides of the table, but this conflict is not the same conflict as the first. In fact, it should be noted that many contemporary versions of Humean causation adopt the positions on the left side, that is of classical Aristotelian causality, rather than the positions of NeoAristotelian dispositionalism, on the right, and I believe that much of this motivates the contemporary debate[18]. NeoAristotelian dispositionalism is really a dispositionalism filtered through contemporary metaphysical concerns and pre-occupations. Thus, we should not read the contemporary conflict between disposition-oriented theories and Humean or regularity theories, a conflict which is, in addition, one between the orientations of the outlooks of the left and right sides of the table, into the differences that existed between medieval Aristotelianism and early modernism, which is likely better characterized as a debate centered purely around dispositionalism vs. event causality, without the extra conflict of what I will here call "right" vs. "left".

That being said, I do think that the genesis of early modern causal theories involved something rather more than the replacement of medieval dispositional theories by regularity theories[19]; in fact, I believe that the left-right conflict in the table above was more central to this genesis than the dispositional-regularity conflict. The important conflict of the time was

[18] Heil (*op. cit*., 131, n. 7) attributes the standard account of single-tracked powers to over-dependence on the role that counterfactual and subjunctive conditionals (which are usually associated with contemporary Humean accounts of causality) play in accounting for powers.

[19] Contrary to Heil (2016). Heil interprets dispositionalism in the NeoAristotelian manner, and so brings in the extra layer of interpretation mentioned here.

not, however, a conflict between early modern thinking and Aristotelianism (which did indeed motivate the other, dispositional-regularity conflict), but between certain directions in late scholasticism (and Renaissance thought), and early modernism (not limited to theories of causality), a conflict which I have tried to anticipate somewhat here by what I have called the left-right conflict. I shall have to leave a fuller exploration of these thoughts to the final chapter of this essay.

In this introductory chapter, however, I would like to return to the question of schemes of interpretation of early modernism, and anticipate the discussion in chapter three by examining a number of problem areas that typify many of the responses to the interpretive problem of early modernism. The first is an attempt to account for early modern explanations of causality in terms of mechanism. The second examines a certain trend in work in the history of philosophy that finds early modernism best explained by the emergence of rationalizing tendencies in causation and ontology. Certain aspects of the latter approach not directly connected with relations (subjectivity, representationalism) will be explored in sections 3.3 and 3.4.

An historical note: It must first be mentioned that the early modern conception of relation differs markedly from the conception familiar to most contemporary philosophers (and which will be used in the present exploration). The standard picture of a dyadic or binary relation, familiar from modern mathematics and physics, is that of a two-place relation xRy. Yet this analysis is not what most philosophers, from antiquity to the 18th century would have understood as an appropriate formal analysis of relation. Instead, compatible with the traditional substance-accident understanding of entities, the traditional category of relation identified what might be called directed accidents (or relatives), that is, monadic properties of substances that somehow contained an internal orientation to the other pair or pole of the relational (purely mental) structure. In place of the relationship of fatherhood, for example, that a contemporary thinker might posit existing between a father and a son, the traditional analysis would instead claim that this relationship was constituted by a single monadic accident, inherent in the father, that enabled this relation to occur. As a relative property, then, fatherhood, consisted of a real, relative accident inherent in one subject; but the two-place relationship that corresponded to it was merely a being of reason, existing in the mind only.

Despite the challenges and revisions to many medieval concepts in the early modern period, such as to the concepts of substance and causality (to

be noted below), it appears that early modern thinkers by and large followed the traditional account of relation[20], an account that was not to be fully revised until the development of mathematical logic in the nineteenth century. My attempt to use the contemporary concept of dyadic relations as a heuristic guide to understating early modern thought may therefore perhaps be charged with anachronism. Indeed, it seems rather foolhardy to claim that such relations are key to early modern thought, when it is kept in mind that not only did early modern philosophers adopt a reductionist point of view concerning the reality of relations, but they even lacked the vocabulary or logical language to express what we would now call polyadic relations, or at least lacked the willingness to create a logic out of such expressions, seeing them as parasitic upon traditional subject-predicate logic.

In my defense, (I shall have more to say on methodological concerns in the concluding section, so here I will be brief) I would like to point out that willful anachronism does not always lead to misunderstanding; indeed, it is generally necessary to interpret that past with the tools available to us in the present. The so-called hermeneutic circle could hardly be a problematic issue, were this not the case. As will be pointed out below (section 3.4), the longstanding discussion of early modern representationalism has proceeded, despite the lack of a strictly equivalent term for representationalism (a position many early modern thinkers have alleged to have held) in the early modern philosophical vocabulary. In fact, many of the most familiar problem areas of philosophy take their names from terms that are much more recent additions to the philosophical vocabulary than commonly supposed: no-one hesitates to speak of Aristotelian metaphysics, ontology, epistemology, or aesthetics, for example, despite the fact that these terms (or their equivalent in any European language) didn't emerge until the 1st, 17th, 19th, and 18th, centuries, respectively. One also might remark that, if half-forgotten concepts of the past can occasionally shed light on the problems of the present, as has sometimes been claimed, it may not be unreasonable to claim that the reverse state of affairs may also claim a certain amount of plausibility.

Further, despite the pull of the traditional account, one of the goals of this monograph is to show that there are in fact a number of developments in early modern thought which point to the beginnings of a different picture; these developments are covered, among other issues, in chapter three. According to some, these latent tendencies toward a more modern

[20] Weinberg (1965, 112 ff). But see Brower (2016) for a counter-perspective.

conception may have been hindered by the persistence of the language of substance and accident[21]. More perspicaciously, one might suppose that the lack of an adequate vehicle on which to base external relations might have played a part. With the growth of the concept of laws of nature, of the independent reality of space and time, of the gradual identification of the causal and temporal orders[22], and of the development of the language of mathematical physics, came grounds, in the end, for the modern view. Note, however, that any one of these can supply grounds for the reality of external relations: the modern account developed by Russell, and the Humean account of causal relations (with the caveat that the reality of the latter are restricted by Hume's phenomenological account of time) originate with the last and second last of these. It would seem inappropriate, therefore, to look to any one of these developments for the modern conception, and part of what I want to argue for here is that what one might call the governance of the idea of dyadic relations in early modern thought is independent of any of one or any set of these developments, independent as well from causal regularity theories, although a full expression of the modern view no doubt requires some such vehicle for its expression.

Mugnai (2016), in his study of the origin of the modern conception of polyadic relations, writes that, "If a necessary condition for developing even the most elementary logic of relations is that of being acquainted with some fundamental properties belonging to relations, like symmetry, reflexivity, transitivity, etc., then it is quite natural to conclude that the scholastic logicians did not possess a logic of relations". Although they may not have been recognized as such, I think we can discern the beginnings of concerns with such properties in the early modern period, along, perhaps, with a sense that such properties did not match traditional understanding, that there was indeed something new about these positions: For example, the doctrine of *causa sui*, or the self-causation of God, (section 3.6 below), claimed by Descartes, and after him, Spinoza, despite the traditional claims that self-causation is not a coherent concept, as causation must be an irreflexive property[23]. The symmetrical principle of

[21] This is the view of Weinberg, *op. cit*.
[22] For this latter, see Fox (2006), chap. 3.
[23] For example, Arnauld, in the fourth set of objections to the *Meditations*: "I think it is a manifest contradiction that anything should derive its existence positively and as it were causally from itself [...] there is a mutual relation between cause and effect. But a relation must involve two terms." (Descartes 1984, 146, 147: AT VII, 208, 210.)

action (Newton's third law), differs from the traditional Aristotelian understanding of action as a unidirectional influence from agent to patient. The well-known conservation principles of physical quantities (such as motion, momentum, and energy), which began to be formulated at the beginning of the early modern period, such as Descartes' principle of the conservation of motion, have also been associated with principles of symmetry[24] or invariance. In classical physics, for instance, invariance with respect to place (that the laws of physics do not change with spatial displacement) is equivalent to the theorem of the conservation of momentum (by Noether's theorems).

It might seem to be putting the cart before the horse to look towards something like structure (e.g. uninterpreted dyadic relations) as an explanatory factor, instead of towards specific embodiments of structure, in particular, to the concrete changes in doctrines of natural science that are so characteristic of the era. But the plurality of various explanatory approaches to modernism (which will be explored in more detail, and partially criticized, in chapter three), and in particular the way many appear to converge on the distant focal point of these dyadic relations, but not to any one particular version of these relations, argue for a different approach. The Suarezian systematization of ontology and prioritization of efficient causality, the Leibnizian equation of causality and rationality, the Humean causality of relations of temporal succession, or the mechanization and mathematization[25] of causality as evinced by Galileo, Descartes, and Newton, have all at one time or another been separately claimed to be the ultimate expression of early modern thinking concerning causality, and so of early modernism itself. It is arguable that many of these interpretative threads have emerged out of distinct schools of interpretation of the history of early modern thought[26]. As in so many instances of group-oriented doctrinal disagreement, there has been little inter group communication, or even awareness, of the other side.

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[24] The observations I make here about the growing prevalence of symmetrical interactions might seem to undermine my proposal concerning anti-symmetrical relations; such symmetry, however, has a different source: Not the directedness of the underlying causal interactions (which are anti-symmetrical as they are in Aristotle), but the ontological reductionism entailed by their dyadic structure. Causes can become effects, and vice-versa (a culminating example is a being which can be its own cause or *causa sui*), not typical in Aristotelian hylomorphism.

[25] I merely mention this viewpoint here; the question of the mathematization of early modern natural philosophy is discussed and criticized below in section 3.3.

[26] For a sketch of these interpretations of early modern thought, see Vanzo (2016).

I hope to offer at least a sketch of my own answer to this problem in the conclusion. In another place (Taborsky 2010, chap. 3), I attempted an in-depth exploration of what was called therein the causal paradigm, (one of three models of causality) in terms of approaches to causal dependency, identity, time, and growth. A full exploration of this model would go beyond the bounds of this essay (and of early modernism). I trust that the explanations in the conclusion will suffice to make my approach plausible at least.

Finally, my concern centers not so much on the category of relation as such, but with the dyadic (and anti-symmetrical) properties of the particular kind of relation proposed here, as opposed to monadic[27] and triadic relations, on the one hand, or to other kinds of dyadic relations, such as symmetrical dyadic relations. This opposition governs other areas of philosophical controversy, as we have seen. The conflict, as I have mentioned regarding classical and NeoAristotelian causal theories, can even appear within dispositionalism itself: e.g. the question of whether dispositional powers are best seen as having a characteristic manifestation (single-tracked, and so able to fit into an anti-symmetric dyadic scheme of power→manifestation), or many different kinds of manifestation (multi-tracked, and thus not so schematizable); or whether the manifestations of such powers are to be understood causally as effects, or instead as the products or outcomes of mutual symmetrical interactions[28]. Heil (2016), choosing the second of each of these options in his interpretation of powers, rejects the idea that causality is an external relation, for such relations can only be based, in his opinion, on a mistaken understanding of powers as both single-tracked and not mutually interactive. Heil thus rejects the idea of causality as an asymmetrical external relation, or, to put it in another way, according to Heil, truthmakers for causal interactions are based on non-relational features of the universe. Note, however, that for Heil this is a conclusion that derives from the nature of powers, not from that of causality or relations; powers (and their manifestations) are to explain causal relations, not vice-versa. More specifically, it is the multiple realizability and mutual reciprocity of powers, the "dispositional matrix" of the totality of powers that motivates Heil's analysis of causal relations. Such a matrix cannot be mapped on to a bijection of causes to effects that occurs when causal relations are dyadic and anti-symmetrical. For Heil, this fact seems to preclude any sort of relational analysis of

[27] Somewhat counterintuitively, properties or qualities are sometimes thought of as monadic relations (e.g. Mendelson 1987, 5).
[28] For both of these, see Heil (2016).

causality, yet it appears to me that it is not so much relations that Heil objects to, but the dyadic, anti-symmetrical nature that he appears to believe must characterize any sort of relation based on causality (indeed it is telling that Heil explicitly distinguishes his language of powers and manifestations from the language of causes and effects—for Heil, an ontology of powers is supposed to explain causation, not instantize it. That is, a manifestation can only be considered to be an effect by analogy). In other words, Heil adopts a NeoAristotelian, and not classical, dispositionalism.

I would like to claim that the early modern thinkers are motivated by a similar (or rather, opposing!) commitment to the dyadic and anti-symmetrical nature of key features of reality, rather than to relations as such. The convenient, and conventional contemporary interpretation of such features as relations has motivated my discussion. Given this, it is likely best to work with a contemporary understanding of relations, rather than adapting or resurrecting an unfamiliar idiom.

1.1 Early modern philosophy and mechanism

It is often claimed that early modern thought is to one extent or another an outcome of what has been called, in Boyle's phrase, the "mechanical philosophy"; in other words, the early modern age is an age of mechanical causation[29], early modern thinkers having reduced the Aristotelian and

[29] "Mechanism" is a notoriously ambiguous term. Pasnau's version (Pasnau 2012, 8; 91), taken from Boyle, that causal behavior of bodies is to be explained by local motion and contact (roughly, the "billiard ball" model) is too restrictive, as it would exclude Newtonian celestial mechanics, and likely much of 19th century continuum mechanics (which is not based on the interactions of discrete particles). The least one can say is that mechanism, as a model, is related to the functioning of machines, but exactly what this implies depends on both the facts of, and our interpretation of, what machine behaviour comprises. For example, it is often taken for granted that mechanical interaction is of necessity linear and deterministic, but this is not the case. Classical continuum mechanics, as developed by Cauchy, for example, largely concerns the non-linear phenomena of stress and strain. The historian of classical mechanics and continuum mechanics physicist Clifford Truesdell has even seen fit to claim that "Mechanics as whole is non-linear." (Truesdell 1968, 353). The relationship between mechanism, determinism, linearity, and dyadic causal relations is not easy to determine, but these features should be kept conceptually separate. Part of my point here is that if linearity is to be found as an implication of a particular mechanical theory, it is not due to "mechanism" itself, but to other factors, such as conceptual simplification, or the philosophical commitments of that particular model.

scholastic four causes (material, efficient, formal, final) to one type of cause, efficient causation, by dispensing with the baroque scholastic ontology of powers and essences. Just what this characterization means, and how to interpret the causal doctrines of the early modern thinkers has been a source of controversy—as Margaret Wilson has noted, although causality appears to be central to many of the doctrines of the early modern period, few early modern thinkers appeared to have given precise and detailed accounts of their understanding of the functioning or nature of causality (Wilson 1999, 141). To complicate this picture further, it would seem that none of canonical figures of early modern philosophy (Descartes, Spinoza, Malebranche, Leibniz, Locke, Berkeley, Hume) would appear to have unequivocally espoused a purely mechanistic account of causation. O'Neill (1993), for example, notes that of the three primary forms of causal influence contemporary to the philosophizing of the early modern period, as recounted and to an extent canonized by Leibniz, *viz*., occasionalism, pre-established harmony, and the doctrine of physical influence (*influxus physicus*), only the first two, not usually understood as mechanical, occupied most of the attention of early modern thinkers. Only the last and least discussed of the three could be reasonably directly interpretable in terms of mechanical causation; yet it turns out, to further complicate the picture, that the doctrine of *influxus physicus* (as understood by Leibniz as a designation for certain causal theories other than his own) is actually a rather complicated portmanteau of late scholastic ideas (such as the idea of the intension and remission of forms), alchemic inner propensities and powers, and ideas which would more naturally be thought of as involving materialistic interpretations of causality (i.e. those that do not postulate active powers to matter).

As O'Neill's argument well illustrates, it is not exactly clear who we are to understand as proponents of the so-called physical influx model, given that, as coined by Leibniz, it is essentially what anthropologists would call an "etic" term (i.e. not a self-designation). It might be thought reasonable to suppose, however, that early modern atomists or neo-Epicureans such as Gassendi could be thought of as likely supporters of such a doctrine.

Yet it is important to note that in Gassendi, for instance, there are deviations from a purely mechanical account of nature. Gassendi, for example, while maintaining purely material accounts of a wide range of natural phenomena, much as Descartes, is nonetheless interpreted by some as having maintained a doctrine of continuous atomic motion, seeing

atoms (and apparently *a fortiori* matter) as somehow inherently mobile[30], thus complicating the relationship between matter and motion, usually taken as two independent aspects of mechanism, indeed imputing an active power to matter (or at least to atoms), unlike the Cartesian understanding of matter as pure extension. And despite Gassendi's thoroughgoing atomic reductionism, many of Gassendi's purported mechanical explanations of natural phenomena, despite their reliance on explanations in terms of interactions between atoms, ultimately rested on non-mechanical principles, regularly bringing in explanations that relied on action-at-a-distance, or on tendencies or innate properties that resembled the "hypostatical principles of the chemists" (to quote Boyle). Gassendi's explanations of the phenomena of gravitational attraction, for example, or the tendency of the sense organs to react in certain ways to certain sights or tastes, reintroduced (or unwittingly relied on) the kinds of explanation on the atomic or micro-level that mechanical explanations had obviated on the macro-level[31]. As Osler (2001) notes in this regard, "Gassendi moved the problem of sympathy and antipathy from the level of macroscopic objects to the realm of microscopic particles affecting the senses, but he did not succeed in giving them purely mechanical explanations**."** (435). Another example of this tendency: Ariew and Waugh (2014) report that a number of other early modern atomists (Nicholas Hill and Sebastien Basso) could realistically only be considered to be quasi-mechanists, because of their admittance of apparent concurrentist or occasionalist notions such as the necessity of allowing for the need for divine action in order to account for the motion of atoms, and notions such as an ether or world soul. In fact, according to Ariew & Waugh, "The philosophical horizon before 1640 does not provide much evidence for pure deflationary mechanists."

However**,** given the complexity and variety of the phenomena in the natural world, and the simplicity of the available mechanical structures and models of matter (especially as compared to what we now know about the structure of the physical world), it is to be expected that a simple mechanical model of the entire range of material interaction would face severe explanatory pressures, leading to explanatory gaps that were inadvertently filled-in by familiar and traditional non-mechanical explanations. To this extent, it is hardly surprising that many of the models of the atomists would end up resembling the hypostatical models of the alchemists, or that Leibniz and others would eventually propose revisions to the Cartesian hydrostatic model of dynamics that were to eventually

[30] See e.g. Lolordo (2007, 150-1), and the references therein.
[31] This summary is largely taken from Osler (2001).

undermine the purely matter-in-motion picture of Descartes and his followers.

Perhaps due to these frustrations, later in the seventeenth century, the occasionalism of Malebranche and others such as LaForge shifted the locus of causal explanation entirely away from matter and material bodies to the divinity. By the end of the early modern period, the phenomenalism and idealism of Hume and Kant become the predominant interpretations of causality. What had become of mechanical causation, if indeed it ever was?

Ott (2009) attempts to resolve this problematic absence of evidence by offering a unified account of the development of the idea of laws of nature as an explanatory factor of causality[32]. In Ott's interpretation, both occasionalism and the quasi-mechanistic explanations of the early modern corpuscularians can be fully brought into a strictly mechanistic picture by distinguishing between two versions of mechanism: "Ontological" mechanism and "course-of-nature" mechanism. Ontological mechanism (which Ott links to what he refers to as a "top-down" version of laws of nature), as the name suggests, implies something about the structure of physical reality—that physical entities are constituted from a short list of what might be called mechanical properties, such as extension and motion—but leaves open the question of what determines the cause of their behavior or motion (there may be other powers outside of finite entities that account for their activity, such as laws of nature or God). Course-of-nature mechanism, on the other hand, deals not with the physical make-up of things, but with their behavior. According to the course-of-nature mechanist, bodies behave the way they do solely on account of their own physical, bodily properties, and for no other reason, such as divine action, constituents or parts of objects which are not intrinsic properties, such as forms, or laws of nature (though bodies may behave in accordance with natural laws, their behavior is so not on account of these laws, but to their own natures). Ott connects this latter view with what he terms bottom-up laws of nature: laws that are explanatorily dependent on the essences (in particular, material essences) of things. Ott thus leaves us with two semi-mechanisms (my terminology): One, a mechanism restricted to the make-up, but not to the behavior or properties linked with bodies, and another, which restricts causes of physical

[32] It should be noted that Ott restricts himself to an examination of causal powers as they play a role in the concept of laws of nature. Thus Ott has little to say about other notions of causality in the early modern period, for example those to be found in Leibniz and Spinoza.

behavior to bodies alone, but may admit of a potentially broader ontology in the make-up of physical things (e.g. this position does not necessarily exclude various capacities such as powers or potentialities being attributed to bodies, as long as they can be conceived of as intrinsic properties of matter alone). Both kinds of mechanism, can, according to Ott, serve as an explanatory basis for laws of nature, of either the top-down or bottom-up variety, respectively. Additionally, these two versions of mechanism ground two versions of, not simply causality, but causal necessity, which Ott sees as a further important characteristic of early modern interpretations of causality[33]: the cognitive and geometrical models of causality. Briefly, according to Ott (and others), if causality must be understood as necessitarian, (i.e. effects necessarily follow from their causes) and if it can be argued that ontological mechanism offers no *material* basis for effects to necessarily follow from their causes (because for example there can be no necessary connection between one part of extension and another), then this necessity must have non-material grounds, which must be in the only other kind of substance accepted by early modern philosophers, that is, mind (whether finite or divine). This model of causal necessity Ott calls the "cognitive" model. In addition, Ott finds room for another model of causation, which he calls the "geometric model"; this position comprises a fusion of the two forms of mechanism, uniting both ontological and course of nature mechanism, yet—as a variety of mechanical causality—avoids the baroque scholastic ontology of powers. This thorough-going version of mechanism, that combines both the ontological parsimony of the ontological view with the naturalism of the course-of-nature view, functions only by grounding dispositions (which would appear to exceed the capacities of the simple properties permitted by ontological mechanism) in a sort of relational situatedness; that is, by permitting a certain degree of reality to be granted to inter-material relations, or more accurately, to the truth-makers of such relations, (the two relata) which allow material bodies to have a kind of causal fit with

[33] Lin (2014) stresses this aspect of the early modern aspect of causality as well. Even Hume can be included in this characterisation, if we recall that, according to Lin (2014, 165–166), "[Hume] assumed that, [if causality were in fact a necessary connection] it would be absolutely or logically necessary". It must be noted, however, that there is a strong element of contingency in the Cartesian account, at least, of the laws of nature themselves (see *infra*. sections 3.3 & 3.6), which ground causal laws. Thus, while it might be correct for a Cartesian to conclude that *aquae regis* (A) dissolves gold (D) necessarily, this statement itself is not necessarily so. In symbols: $\Box (A \rightarrow D)$, but $\Diamond \sim \Box (A \rightarrow D)$.

each other. This fit is then interpreted as a disposition. Locke gives the example of a lock and key: a particular key will fit a particular lock, and no other (*Essay*: IV, 3, 25). This fit, according to Ott's interpretation, resides in neither the key nor the lock, but in the relation between the two, which itself is nothing but the key and the lock taken together. The Geometric model, then, is Ott's term for a rather unique version of causal necessitation that is based on a comprehensive form of mechanism that manages to fuse both ontological mechanism and course-of-nature mechanism, thereby avoiding both occasionalism, on the one hand, and the kind of realistic dispositionalism that characterized scholastic ontology[34].

Both varieties of mechanism preclude something like a scholastic ontology of powers. Ontological mechanism, because of its restrictive, materialistic ontology (powers of bodies are excluded forthright); course-of-nature mechanism due to its elimination of metaphysical parts[35] of entities (powers and relations may exist, but must be material or due to material constitution, and not due to form or other kinds of explanation). According to Ott, by these two varieties of mechanism most of the causal doctrines of the early modern period can be understood to be mechanical in one way or another—the occasional causation of Malebranche and other Cartesians, for example, is mechanical in the ontological sense in that these thinkers adopt the Cartesian perspective on the physical world (i.e. bodies consist of extension alone, excluding powers, secondary qualities, and so on). Course-of-nature mechanism characterizes the philosophy of others[36] who likely (out of an attempt, perhaps, to avoid occasionalism as a

[34] Whether Ott's geometric model is an accurate interpretation of Locke is something I shall leave aside. I take it that Ott's interpretation imputes to Locke a form of what Pasnau (2011, 519) calls "bare dispositionalism", an interpretation which Pasnau rejects, on the grounds that relative or non-categorical properties were never recognized by early modern thinkers, though they may be part of contemporary vocabulary. Be that as it may, my point (to be explicated below), is that a comprehensive interpretation of mechanism, such as Ott's, which can account for the philosophies of both Descartes and Locke (Pasnau rather sees Locke as a nominalist, closer to Berkeley and Hume than to 17th century thinkers), is in fact too comprehensive, in that it fails to isolate what is particularly distinctive about early modern mechanism, as compared to both earlier and later varieties of mechanism.

[35] See section 3.2 below for an explanation and discussion of metaphysical parts.

[36] Ott is not entirely clear as to which philosophers of the early modern period accept course-of-nature mechanism while rejecting its ontological version, but among the philosophers that Ott mentions, likely Gassendi and Cudworth could be included in this group.

consequence) impute a larger range of properties to bodies, but who still attribute the behavior of bodies to bodily nature alone. Some thinkers (Ott mentions, in addition to Locke, Pierre-Sylvain Régis) attempt to merge the two positions, as we have seen; others, such as Berkeley and Hume, adopt a non-mechanistic form of causality that is nevertheless compatible with the law of nature perspective.

However, is mechanism, in either of these senses, sufficient to account for the kind of causality we encounter in early modern philosophy, not to speak of the genesis of the idea of laws of nature? A number of thoughts about Ott's two versions of materialism immediately suggest themselves[37]. First, there are many examples of philosophical systems that subscribe to a version of ontological mechanism in their account of the physical world, but are nevertheless part of philosophical systems very different from the early modern systems that Ott intends to explicate. Anaxagoras' corpuscularian account of the natural world, for example, is arguably a version of ontological mechanism, in that it combines a limited set of material or bodily capacities with a non-material, non-formal causal agency (*nous* or mind) for the purposes of explanation of physical reality. Yet Anaxagoras' philosophy appears to be far removed from the occasionalist philosophies of the seventeenth century that would be its putative philosophical companions under this interpretation. Another, more contemporary example of such an approach is modern chaos theory, or rather certain interpretations of the relationship between this theory of certain specific physical systems and traditional scientific values such as law-like behavior and predictability. Chaos theory, as a part of modern statistical dynamics, studies the behavior of certain physical systems entirely governed by well-known laws of physics, yet which yield complex, unpredictable behavior at sufficiently large scales. Since the entities studied by chaos theory are governed by laws entirely within the domain of modern mechanical physical theories, it is certainly acceptable as a form of mechanism (in contemporary terms). Yet chaos theory has been interpreted by some as an example of a radically new form of science that precludes law governed behavior and predictability as they are conventionally understood within science. An example is the well-known property of chaotic systems, sensitivity to initial conditions, responsible for the so-called butterfly effect. In a chaotic system, a suitable small

[37] I note, of course, as Ott's question is "What makes an early modern philosopher a mechanist?" (Ott 2009, 35) and not "What makes mechanism an explanation of, or a model for, early modernism?", none of what follows should be taken as a criticism of Ott.

difference in initial conditions, smaller than any acceptable level of observational measurement error, can lead to widely divergent paths of development of the entity as a whole, and hence to unpredictability. In this sense, chaotic systems are inherently epistemically indeterministic, that is, in terms of our knowledge of their future states, as there may be no acceptable level of observational error that can be compatible with predictability. Needless to say, without predictability, laws of nature are moot.

It might be objected that these two examples are really better understood as examples of the other kind of mechanism, course-of-nature mechanism. But recall that in this second sort of mechanism, the causal behavior of bodies follows solely from the properties of those bodies. This is clearly not the case for the Anaxagorean model; one might think that it would be easier to make this case for the chaos model, but if we take knowledge and predictability into account, as all scientific theories must, then this would not be the case. It is true that, since the underlying laws governing the movement of the individual particles or elements that go to make up chaotic systems are strictly mechanical and deterministic, particular states of such systems depend only on immediately previous states. However, our knowledge of such states can never be precise enough, leading to our inability to predict large-scale, aggregate behavior. In this sense, previous states cannot determine subsequent states; thus, chaotic systems can be mechanical only in their constitution, not in our knowledge of their behavior.

Given these two examples, it would seem that ontological mechanism cannot be a sufficient condition for the development of either early modern causality or a law of nature perspective, for neither the ontological mechanisms of Anaxagoras nor of chaos theory yield anything like early modern accounts of causation or of laws of nature. And while it might be reasonable to suppose that the cognitive model might work for Anaxagorean causality (presumably as it would be based on mind or *nous*), it clearly cannot be a model for causality in chaos theory. Exactly what constitutes or grounds causality in chaos theory may be something of a puzzle (as much as it is in other areas of dynamics that deal with large-scale, non-classical behavior, such as thermodynamics or indeed the entire field of statistical mechanics), but as part of modern physical theory it can in no way be claimed to have a cognitive basis[38].

[38] One might object here that chaos theory (along with the entirety of modern statistical mechanics) does not work with a necessitarian understanding of causality, which is as we have seen one of the key characteristics of early modern

Similar examples and observations can be made for Ott's second version of mechanism, naturalistic or course-of-nature mechanism. For example, Hellenistic materialism, the materialistic philosophies of the Hellenistic period of classical antiquity (the two or so centuries following Aristotle), especially that of Stoicism, can be reasonably held to be examples of course-of-nature mechanism[39]. According to Stoic doctrine, both material and immaterial entities exist, but only bodies can be causally active. Stoic physics is thoroughly materialistic in that causal explanation must be limited to bodily interaction—although there are immaterial entities in the Stoic cosmos (such as the void, or the objective correlate of meanings known as *lekta*) they have no capacity for causal activity. Yet the Stoic account of causality differs in important respects from anything to be found in early modern thought[40]. In particular, the Stoic *aition sunektikon* or "containing" cause is unusual from an early modern perspective in that it is both co-temporal with its effects (coming into existence along with them, and ceasing when they cease), and held to be the cause of the identity or unity of an object. Neither of these aspects (co-temporality, unity) are familiar aspects or functions of material causes as they were understood in the sixteenth and seventeenth centuries. The containing function of the containing cause, in particular, has led some to compare it to Aristotelian form.[41] Furthermore, although there are some who would see a role for formal causality in the work of some early modern thinkers (in particular, in Spinoza and Leibniz), it would appear that the function of formal causality in even these thinkers differs

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causal models, and so would be precluded from being an adequate example of a version of ontological mechanism. But I would argue that this simply indicates other considerations must be added to the model of ontological mechanism to yield something adequate for early modern philosophy.

[39] Materialism is equivalent to mechanism, for the Stoics, as Stoic causes are comparable to Aristotelian efficient causes: "By 'mechanism' I refer to the support for a principle of causal closure, namely, efficient causes are necessary and efficient for their effects [...] materialism and mechanism are apparently taken by both the Stoics and Plotinus to be mutually entailing doctrines." (Gerson 2016, 45).

[40] In fact, *all* accounts of causality in classical antiquity differ from early modern accounts in that they are generally formulated in a triadic language of agent, patient (or locus of the cause), and effect, not binary language of cause and effect familiar now and in the early modern era (see section 3.6 below for a fuller account of this difference.)

[41] Cf. Frede (1980, 145). The containing cause is only *analogous* to form. As only bodies have causal efficacy in Stoicism, and for Stoics all causes are active causes, it is likely closer to an efficient (or moving) cause in Aristotelian terms.

significantly from its putative role in Stoic causality. For example, according to Hübner (2015), formal causality in Descartes and Spinoza is best understood as a relationship which mediates between an entity's essence and its properties. A formal cause for Descartes is that capacity in an entity which somehow binds an entity's properties to its essence, "binding" being understood in a logical or inferential manner. Hübner calls this interpretation of formal causality the mathematical and inferential reading of formal causality[42], in that it adopted mathematical and inferential models from geometry and from Aristotle's *Posterior Analytics*, at the same time freeing it from the ontological commitment of assuming the existence of scholastic forms.

The Stoic containing cause, however, appears to play a somewhat different role in relation to the entities among which it functions. According to Galen, for instance, the Stoic containing cause is that which acts to bind material bodies together, much like glue binds wooden artifacts or bones and tendons bind the bodies of animals.[43] The Stoics, Galen continues, equated these kinds of causes with certain kinds of physical elements, the dynamic elements fire and air, which according to them functioned by holding the material elements such as earth and water together by thoroughly pervading bodies made up of the latter.

This function of containing or sustaining[44] then is quite different from the logico-mathematical function of formal causality as it appeared in Descartes and elsewhere in early modern philosophy. Containing causes appear to be primarily a source of the unity or even of the existence of an object[45]; early modern formal causality rather functions as a source of continuity[46] or possibly of the production or linking of properties and essence. A linguistic illustration might help: In the sentence "Socrates is

[42] Hübner ultimately calls her model a formal-causal account, as she stresses that formal causality in Descartes and Spinoza has ontological implications that a purely logical reading lacks, but these consequences can be left aside here.

[43] See e.g. Galen, *De causis continentibus* (*On sustaining causes*) 1.1–2.4, in (Long, A.A. & Sedley, D.N. 1987, vol. 1, 334–335.)

[44] Both words have been used to translate the Greek *sunektikon*, the first via the Latin *continentibus*, Galen's manuscript on containing causes having survived only in Latin and Arabic translations.

[45] "Primarily […] the sustaining cause is the cause of existence, since an object's persistence as a single entity depends entirely on the qualifying activity of breath." [breath (*pneuma*) is a containing cause]: (Long, A.A. & Sedley, D. N. 1987, vol. 1, 341).

[46] As stressed by Bobro (2016), in his account of Leibniz' understanding of formal causality (in perception).

short and pale", the containing cause might be likened to the conjunction "and" in the sentence, in that it takes up and binds the properties of Socrates (short, pale) into one untied entity, thereby giving him identity, and as a consequence, a kind of at least logical form of existence. The logico-mathematical version of formal causality, however, might be likened to the action of linking or predication in the copula "is", which binds previously existing or identified properties with their subject or centre. It also ensures (logical) existence, not via unity as the containing cause does, but by manifestation or exemplification, by the predicative properties of the verb "to be".

The kind of causality, therefore, exemplified by the Stoic *aition sunektikon* or containing (sustaining) cause would appear to have no parallel within the early modern language of causality, even if we grant that formal causality might have been part of that language. I conclude, then, that course-of-nature mechanism is not by itself sufficient to furnish a model for an early modern account of causality, for the Stoics were also course-of-nature mechanists, yet they worked with a kind of causality that has no counterpart in early modernism.

What of the peculiar fusion of ontological and course-of-nature mechanism that Ott claims to be found in Locke and others, the "geometrical model"? Here we would seem to be on solider ground, in that the geometric model does appear to isolate a form of mechanism uniquely early modern; in Ott's presentation the geometrical model is something of a culmination of early modern thinking concerning causation, for this model resolves the tensions that had existed between the two forms of mechanism, which had forced earlier thinkers into one or another form of quasi-mechanism, forced (according to this narrative) into either conceding too much to a non-naturalistic picture of the world, and accepting divine concurrentism (and occasionalism), or too much to an unsystematic list of unverifiable material powers such as postulated by the "alchemists". Ott (232) notes that Locke's version of causation had become almost "common sense" by the time of Hume, and it is possible to see Humean and even Kantian versions of causality as phenomenalizations of Locke[47]. To understand Hume (and presumably Kant), it is not enough to turn to Berkeley and Malebranche, but to the fully mechanical model of Locke and other casual realists, claims Ott.

However adequate this model may be as a portrait of early modern

[47] In Ott's interpretation, Hume turns Locke's "conceptual foundationalism" into "psychological foundationalism", by turning the natural relational fit between ideas into one of association.

mechanism (and of the idea of laws of nature that succeeded it), my question here is slightly different: is such a model, the geometrical model, which ties cause to effect in the manner that a key is tied to a lock, via a relational fit, really inherent in a fully worked out mechanism, a mechanism that is at once both ontologically simple and naturalistic? To answer this, I note the following: Contemporary chaos theory is both naturalistic and ontologically simple (chaotic behaviour is emergent behaviour, and so presumes nothing external to classical rigid body mechanics), yet is not "geometric" in Ott's sense, as Ott's geometric properties (relations grounded in more than one relata) are not emergent properties, as properties are in chaos theory. Thus, in chaos theory, we have an example of a mechanism that is both ontologically simple and naturalistic, yet that does not fit the model of causation that Ott assigns to its early modern realization. Whatever it is that the geometric model isolates, there must be something additional to it, additional to causal naturalism and ontological simplicity, for the example of chaos theory (and, indeed, all of statistical mechanics) shows that it is not a necessary consequence of these two features.

I conclude, therefore, that even a broad "family concept" interpretation of mechanism such as Ott's (and the internal tensions in that family concept that Ott discerns) is not adequate to isolate what is particular to early modern mechanics, and much less, early modern philosophy, for these characterizations can apply to much mechanics that have gone before and have succeeded the early modern varieties, versions that are clearly significantly different from their early modern counterparts.

1.2 Analytical Heideggerianism: Rationality and systematization

There is another, continental, tradition of interpretation of early modern metaphysics which I will call Analytical Heideggerianism, for reasons to be explained below. Discussion of mechanism and laws of nature as an interpretative key to early modernism forms no part of the work of this tradition.

A number of these (largely) French historians of philosophy, such as J-F. Courtine and V. Carraud, have developed systematic and comprehensive interpretations of the development of early modern thought. Courtine and Carraud examine the development of systematic ontology, and the identity of causality and the principle of sufficient reason in early modern thought, respectively, in place of the examination of developments in modern science or mechanism.