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Introduction

Benjamin Hill, Henrik Lagerlund, and Stathis Psillos

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Abbreviations

A Aristotle. 1985. *The Complete Works of Aristotle: The Revised Oxford Translation*. Edited by Jonathan Barnes. 2 vols. Princeton: Princeton University Press.

AT Descartes, René. (1897–1913) 1964–76. *Oeuvres de Descartes*. Edited by Charles Adam and Paul Tannery. 12 vols. Paris: J. Vrin.

B Boyle, Robert. 1991. *Selected Philosophical Papers of Robert Boyle*. Edited by M.A. Stewart. Indianapolis: Hackett Publishing.

CSM Descartes, René. 1984–85. *The Philosophical Writings of Descartes*. Edited and translated by John Cottingham, Robert Stoothoff, and Dugald Murdoch. 2 vols. Cambridge: Cambridge University Press.

CSMK Descartes, René. 1991. *The Philosophical Writings of Descartes: The Correspondence*. Edited and translated by John Cottingham, Robert Stoothoff, Dugald Murdoch and Anthony Kenny. Cambridge: Cambridge University Press.

DM Suárez, Francisco. (1597) 1965. *Disputationes Metaphysicae*. Hildesheim: G. Olms.

EHU Hume, David. 2000. *An Enquiry concerning Human Understanding: A Critical Edition*. Edited by Tom L. Beauchamp. Oxford: Clarendon Press.

Essay Locke, John. 1975. *An Essay concerning Human Understanding*. Edited by Peter H. Nidditch. Oxford: Clarendon Press.

Search Malebranche, Nicolas. 1997. *The Search After Truth with Elucidations of The Search after Truth*. Translated by Thomas M. Lennon and Paul J. Olscamp. Cambridge: Cambridge University Press.

ST Aquinas, Thomas. 1947–48. *Summa theologica*. Translated by the Fathers of the English Dominican Province. 3 vols. New York: Benziger Brothers.

T Hume, David. 2007. *A Treatise of Human Nature: A Critical Edition*. Edited by Davide Fate Norton and Mary J. Norton. 2 vols. Oxford: Clarendon Press.

THM La Forge, Louis de. 1997. *Treatise on the Human Mind*. Translated by Desmond M. Clarke. Dordrecht: Springer.

Introduction

Benjamin Hill (Western), Henrik Lagerlund (Stockholm), and Stathis Psillos (Athens)

The present volume brings together twelve scholars from different philosophical disciplines (metaphysics, philosophy of science and history of philosophy) with the aim to discuss the ontic status of causal powers, blending together historical and conceptual perspectives. Most of the authors in this volume had the privilege of discussing early drafts of our papers among ourselves and with students during a Summer Institute organised by the Rotman Institute of Philosophy—Engaging Science, of the University of Western Ontario and partly funded by a SSHRC grant. The event lasted for two weeks in July 2014 took place in London ON and on the shores of the Lake Huron.

The motivating idea behind the twelve specially written papers is that understanding the resurgence of powers in current metaphysics and philosophy of science, as well as their role in the current scientific image of the world, is best achieved by mapping the trajectory (both conceptually and historically) of the movement *away* from powers and the dominant Aristotelian conception of nature in the seventeenth century and *towards* powers in the end of the twentieth century. This mapping will cast light on the key arguments against powers in the seventeenth century, will unravel their philosophical and scientific presuppositions and will examine their relevance (or lack thereof) for the current debate about powers. At the same time, this mapping will locate the current trend to revitalise powers within its proper historical and conceptual context and attempt a comparison of the current conceptions of powers with the ones offered by Aristotle and the Medieval Aristotelians and criticised by the *novatores*. Along the way, the attempted mapping will offer re-appraisals of dominant views about, or dominant interpretations of, various important philosophers, such as Descartes, Hobbes, Malebranche, Locke and Hume.

When all is said and done, it might appear that the elimination or re-conceptualisation of powers that took place in the seventeenth century has been a long(ish) interval in an otherwise continuous appeal to *sui generis* causal powers to ground and explain activity in nature. And yet, powers are subject to scrutiny and criticism today as they were in the seventeenth century and for more or less the same reasons.

In the rest of this long introduction and before a summary of the individual papers, there is an attempt (not wholly impartial) to sketch the key conceptions of, and arguments for and against, powers from Aristotle up to the present. This narrative is, of essence, selective and incomplete, but it hopefully offers the basic contours of the movement away from powers and back to them, and the backdrop against which the essays are set. The papers offer more nuanced accounts as well as alternative interpretations of parts of this narrative.

1. The History of the Powers Debate

1.1. Aristotelian Powers

Once upon a time, powers ruled the world. In his *Sophist*, Plato had the Eleatic Stranger tie real existence with the power to produce change or to undertake change. Here is the characteristic quotation: “everything which possesses any power of any kind, either to

produce a change in anything or to be affected even in the least degree by the slightest cause, though it be only on one occasion, has real existence" (Plato 1997, 247d–e, 269; translation amended) To be, then, is to be powerful. Later, Aristotle (A 1046a10–11, 2:1652) developed the first systematic theory of power. A power is "a principle of change in something else or in itself *qua* something else." Principles are causes; hence powers are causes. Powers are posited for explanatory reasons—they are meant to explain activity in nature: change and motion. Action requires agency. For *X to act on Y*, X must have the (active) power to bring a change to Y, and Y must have the (passive) power to be changed (in the appropriate way) by X. Powers have modal force: they ground facts about necessity and possibility. Powers necessitate their effects: when a (natural) power acts (at some time and in the required way) and if there is "contact" with the relative passive power, the effect necessarily (that is, inevitably) follows. Here is Aristotle's (324b8, 1:530) example: "and that *that which can be hot* must be made hot, provided the heating agent is there, i.e. comes near."

At the same time, what is possible for X to do is exactly what it has the power to do. Power (qua attribute of substances) belongs to the category of relative (*pros ti*). This is because "their very essence includes in its nature a reference to something else" (1021a27–28, 2:1612). Positing (both active and passive) powers implies that they "point to" (they are directed towards) something outside themselves, viz. something that will suffer change when they act (having the suitable passive power) or something that will cause change in them (having the suitable active power).

Aristotelian powers are real, irreducible, inherent in substances, causal, and relative. Moreover, powers are possessed by their objects even when they are not acting. In fact, that X has the power to Φ and yet X is not Φ-ing captures *what it is* for X to have the power to Φ. Hence, what it is for X to possess the power to Φ is not the same as X actually Φ-ing (acting). X's having the power to Φ grounds and explains X's Φ–ing.

This theoretical account of powers was retained, more or less intact, throughout the Middle Ages and became the major explanatory framework for all kinds of accounts of the phenomena. Powers were taken to be natural tendencies (inclinations) that objects possess in virtue of their (God-given) nature. Hence, objects possess specific natural tendencies and lack others. These natural inclinations act of necessity (so long as the power is unimpaired) and act uniformly. Importantly, powers are directed to their acts (Aquinas also highlights this, see *ST* 1.77.3, 1:385–86.). Hence, powers "point" to something outside themselves. Qua relatives, they have a being toward something else. They have an "esse ad." This towardness of powers reinforces the teleological element in nature that characterised Aristotelianism. Take gravity, viz., the downward movement of (heavy) bodies. To this, Aquinas (1a.36.1, 1:748) assigned a "twofold cause." The final cause of a heavy body's downward movement is the lower place: the body is seeking the lower place. The efficient cause ("principle of movement") is a natural inclination resulting from gravity.

The locus of powers of an object was its substantial form. Forms are active: the active principle of a thing is a form. As Aquinas put it, "Heat is a disposition to the form of fire" (1a.74.4, 1:921). The form was the very nature of simple things or a constituent of the nature of a thing, which was composed of matter and form. Given the diversity of forms, there is no general and unified explanation of natural phenomena: each particular causal explanation is distinct from any other in that it appeals to an individual *sui generis* form.

The Middle Ages brought with it an important and ineliminable agent: God. He fixes the natural order by giving all creatures their natures, that is, their causal powers. This creates a network of relations of necessitation among distinct existences and hence a network of natural necessities. These could be violated by God (e.g., God could make fire not burn the three boys in the fiery furnace) but if nature is left to run its own course, natural necessity rules. As John Buridan (quoted in King 2001, 16) put it: "There is another necessity which is called 'natural', which is not necessity *simpliciter*, but which would be necessity with all supernatural cases put to one side." For Aquinas, natural necessity has an inleliminable teleological element. It is an impression from God—God directs things to their ends. God fixes the nature of things and they tend towards their ends. Natural necessity is evidence for Divine Providence.

There are two ways in which something may happen outside the natural order. The first is when there is action against the natural powers or tendencies of things—as when an agent throws a heavy thing upwards against its natural inclination to move downwards. This action is against nature. The second is when there is action against the natural inclinations of a thing but is caused by the agent on whom these natural inclinations depend—as when in an ebb of tide there is movement of the water against its natural inclination to go downwards. Aquinas (*ST* 1.105.6, 1:519–20), who uses this example, notes that this kind of action, dependent as it is on the influence of a heavenly body, is not against nature. God then acts on nature in the second way. Hence, if God does something outside the natural order (hence against the natural inclinations of things), this is not against nature.

1.2. The Revolt Against Powers

This, in broad outline, is the power ontology against which the *novatores* of the seventeenth century revolted—a revolt that had partly started already in the fourteenth century. With the mechanical account of nature and its two catholic principles—matter and motion—in place, the critique of the medieval-Aristotelian account of powers acquires centre stage. The *novatores* put forward a different conception of explanation of natural phenomena in terms of the microscopic (and hence unobservable) parts of matter and their interactions (collisions) subject to universal laws. Matter is divested of its sui generis causal powers. Descartes, in a now famous passage of his posthumously published *Le monde*, states boldly:

> Someone else may if he wishes imagine the "form" of fire, the "quality" of heat, and the "action" of burning to be very different things in the wood. For my own part, I am afraid of going astray if I suppose there to be in the wood anything more than what I see must necessarily be there, so I am satisfied to confine myself to conceiving the motion of its parts. For you may posit "fire" and "heat" in the wood, and make it burn as much as you please: but if you do not suppose in addition that some of its parts move about and detach themselves from their neighbours, I cannot imagine it undergoing any alteration or change. (AT 11:7; CSM 1:83)

Fire burns wood not because it has some *sui generis* burning power based on its substantial form, but because its minute parts move rapidly and constantly and collide with the minute parts of wood. Motion is the principle of change and not substantial

forms, which are taken to be 'occult qualities.' Indeed, Descartes wrote to Regius in January 1642: "If they say that some action proceeds from a substantial form, it is as if they said that it proceeds from something they do not understand; which explains nothing" (AT 3:506; CSMK 208–9).

But the most puzzling feature of powers was their towardness. Descartes put forward the well-known "little souls" argument. Only minds can have content which is about something else. Hence to attribute powers to things in virtue of which they behave is like attributing little minds to them. In a letter to Mersenne dated April 26, 1643, he noted: "I do not suppose there are in nature any real qualities, which are attached to substances, like so many little souls to their bodies, and which are separable from them by divine power" (AT 3:648; CSMK 216). Gravity is a case in point. His medieval predecessors, Descartes thought, took gravity to be a real quality "of which all we know is that it has the power to move the body that possesses it towards the centre of the earth" (AT 3:667; CSMK 219), thereby wrongly attributing to it soul-like attributes.

If powers can no longer play the role of necessitating principles, what plays this role? The laws of nature. Descartes, in the *Principles of Philosophy*, introduces the idea that matter and its motion are governed by universal and few in number laws of nature, which follow directly from God's immutability and constitute the "the secondary and particular causes of the diverse movements which we notice in individual bodies" (AT 8a:62; CSM 1:240–41). The idea that laws can be causes of motion is so alien to the current mind that it does not seem to make sense. And yet it does (proving that Descartes's conception of laws of nature is so different from ours). The (rough) idea is this: if bits of matter are inert and powerless something must causally determine their behavior when they move on their own and when they collide with others. Descartes's radical claim is that God does this (qua the primary and universal cause of all motions) *via* laws. Laws then are God's tools (instruments) for the redistribution of quantities of motion to bits and pieces of matter, while, due to God's immutability, the total amount of quantity of motion in the universe, set by God during the Creation, is conserved.

In the Cartesian occasionalism, God—via simple and comprehensive laws, which He chooses—is the sole cause of all motion. Father Malebranche argued that Aristotle's idea of nature, that is the idea that things have *natures* in virtue of which they behave—of necessity—the way they do is a "pure chimera." We have no conception of power of secondary things; no object can move itself; let alone another thing. Occasionalism emerges as the view that bodies lack motor force and God acts on nature via general laws. Not all *novatores* wanted to eliminate powers. But most took it that power has a place in the new mechanical theory *only if* it is suitably connected with the primary qualities of matter and their motion. In his famous lock and key case, Robert Boyle takes it that both the key and the lock, qua pieces of metal with certain sizes and shapes, acquire a new capacity, when, by means of motion they are "applied to one another after a certain manner" (B 23): the key unlocks the lock. But this capacity is *new* not in the sense that any new real or physical entity was added to the key or the lock. It's new in the sense that it does not supervene on either the key or the lock, but it supervenes on both and their relations. Boyle is adamant that though his scholastic predecessors would look at this capacity as "a peculiar faculty and power in the key that it was fitted to open and shut the lock," (23) nothing of the kind is the case. Nothing real (a new real quality) was added to each object taken separately. Nothing "distinct from the figure it had before those keys were made" (23). But of course, "nothing new" does not imply

nothing. Due to being part of a relational structure, the body—qua matter—acquires a modification (and not a *res*) which enables it "to produce various effects," which it would not have been able to have had it not been part of this relational structure. Given these new effects, we "make bodies to be endowed with qualities" "upon whose account" the effects follow. But these qualities are not "any real or distinct entities, or differing from the matter itself furnished with such a determinate bigness, shape, or other mechanical modifications" (24).

John Locke took it that objects have powers (active and passive). He (*Essay* II.xxi.1, 233) says: "Fire has a power to melt Gold, i.e. to destroy the consistency of its insensible parts, and consequently its hardness, and make it fluid; and Gold has a power to be melted." But these powers are not like scholastic faculties. Why is meat digested in stomachs? To say, like the scholastic philosophers did, that the stomach has a digestive Faculty is trivial and non-explanatory. It amounts to saying, "Digestion is performed by something that is able to digest" (II.xxi.20, 244). They are powers suitable for mechanical philosophy: they depend on the micro-constitution of objects. Like Boyle, Locke takes it that "Power includes in it some kind of relation" (II.xxi.3, 234). This is analysed in Draft B of the *Essay*, where Locke talks about the purgative power of rhubarb. This is grounded in the micro-structure of rhubarb. It is relative nonetheless because whether or not this micro-structure has a purging power depends on whether there are forms of life the right kind of digestive system. For Locke (1990, 262) "the purgeing power in Rhubarb is relative for rhubarb would still be the same were there noe animal in the world capable of being purged." The ascription of power then depends on the relational structure in which rhubarb is embedded.

Significantly, Leibniz took it that extension is not enough for matter and that some notion of inherent power should be added. Based on a general metaphysical principle that "there is neither more nor less power in an effect than there is in its cause," (Leibniz 1989, 125) he argued that a "formal principle" must be added to "material mass" as an irreducibly dynamical notion, which accounts for the power there is in matter. This notion of "power" in bodies, Leibniz explains, is twofold. It is passive force when it is thought of as "matter or mass" and active force when it is thought of as constituting "entelechy or form." Matter is dynamical precisely because it is characterized by impenetrability and resistance to motion (inertia). But there is active power too. Leibniz takes this to be distinct from the scholastic *potentia*. He takes the scholastic notion of power to be passive in the sense that it amounts to "receptivity to action." Whereas Leibniz's power is active *already* in the sense that it involves an actual *conatus* or tendency toward action such that "unless something else impedes it, action results" (252). The notion of active power plays a role both in metaphysics *and* in physics, with the former role being the primary and the latter being the derivative. The primary sense of active power is metaphysical, since it is what makes a substance what it is—its form. This form is dynamical but at the same time mental; it is "either a soul or something analogous to a soul" (Leibniz 1956, 504). But if the primary sense of active power is what makes a substance what it is, its relevance to physics is nowhere to be seen unless it is somehow gets connected with natural forces. Hence Leibniz talks about a derivative power, known as "impetus, conatus, or a striving [*tendentia*] . . . toward some determinate motion" (Leibniz 1989, 253).

Opposing occasionalism, Leibniz argued that powers are "in bodies" and they cause (or causally contribute) to the motions of bodies. Though for Leibniz the motion of

matter is law governed, where the laws are instituted by God on the basis of maximising simplicity and perfection (comprehensiveness), bodies have innate forces by virtue of which they act according to laws.

Perhaps surprisingly, in his unpublished text *De gravitatione*, Isaac Newton took a rather hard line on powers. Criticizing Descartes's account of matter as extension, Newton (2004, 21) argued that though it is not customary to "define substance as an entity that can act upon things, yet everyone tacitly understands this of substances." He then went on to define a body as something with three kinds of power: impenetrability, mobility, and capacity to affect our senses. To be sure, these are conditions imposed by God on determined quantities of extension. But they are powers nonetheless. Newton doesn't say much about their ontic status. But he does say two important things. First, they are not like the scholastic substantial form, and second, they are subject to laws. In fact, the key power of bodies to move amounts to the transference of impenetrability from one part of space to another "according to certain laws" (28). Besides, "we do not move our bodies by a proper and independent power but by laws imposed on us by God" (30).

This idea of law-constituted powers Newton did not develop further in *Principia* except in a crucial respect when it comes to gravity. In his famous "General Scholium" from *Principia*, Newton declared that he feigns no hypotheses for the cause of gravity. He added rather boldly that hypotheses have no role to play in experimental philosophy. And he stressed: "In this experimental philosophy, propositions are deduced from the phenomena and are made general by induction. The impenetrability, mobility, and impetus of bodies, and the laws of motion and the law of gravity have been found by this method. And it is enough that gravity really exists and acts according to the laws that we have set forth and is sufficient to explain all the motions of the heavenly bodies and of our sea" (1999, 589). What's important for our purposes is Newton's claim that gravity exists and acts according to *laws*. The inverse square law constitutes gravity, at least when it comes to its causal-explanatory role. That there may be an unknown causal basis for this power is irrelevant. In an unsent letter written circa May 1712 to the editor of the *Memoirs of Literature*, Newton stressed that it is not necessary for the introduction of a power—such as gravity—to specify anything other than the law it obeys; no extra requirements should be imposed, and in particular no requirement for a mechanical grounding. He said:

> And therefore if any man should say that bodies attract one another by a power whose cause is unknown to us, or by a power seated in the frame of nature by the will of God, or by a power seated in a substance in which bodies move and float without resistance and which has therefore no *vis inertiae* but acts by other laws than those that are mechanical: I know not why he should be said to introduce miracles and occult qualities and fictions into the world. (2004, 116)

In 1713 in the preface to the second edition of *Principia*, Roger Cotes noted emphatically that gravity is a "primary affection of bodies" and that like other primary affections, such as extension, mobility, and impenetrability, is one of the primary qualities of all bodies universally (Newton 1999, 391). Indeed, Newton employed the famous third rule of philosophy, which is a rule of induction, in order to argue that "all bodies gravitate

toward one another." And yet he added that he is not affirming that "gravity is essential to bodies" (796).

In a 1693 letter to Richard Bentley, Newton (2004, 102) had stressed that it is "inconceivable that inanimate brute matter should, without the mediation of something else which is not material, operate upon and affect other matter without mutual contact, as it must be, if gravitation in the sense of Epicurus, be essential and inherent in it." It is an absurdity, he later added in print, that "gravity should be innate, inherent, and essential to matter, so that one body may act upon another at a distance through a vacuum, without the mediation of anything else, by and through which their action and force may be conveyed from one to another" (1999, 796). The only inherent force is "the force of inertia." Newton took it that if gravity were essential to bodies, then there would be action at a distance. If action a distance is to be avoided, gravity should not be taken to be essential to bodies, qua material substances.

But this does not imply that gravity is not a universal quality of bodies. Gravity depends on the mass of bodies, which is an essential and universal quality of bodies. And Newton has shown how exactly gravity depends on mass in the law of universal attraction. In the "General Scholium" Newton sums up his findings about gravity thus:

> Thus far I have explained the phenomena of the heavens and of our sea by the force of gravity, but I have not yet assigned a cause to gravity. Indeed, this force arises from some cause that penetrates as far as the centers of the sun and planets without any diminution of its power to act, and that acts not in proportion to the quantity of the surfaces of the particles on which it acts (as mechanical causes are wont to do) but in proportion to the quantity of solid matter, and whose action is extended everywhere to immense distances, always decreasing as the squares of the distances.(943)

If the action is extended everywhere to immense distances and it obeys a law, gravity is hardly a non-universal force. In fact, gravity exists insofar as it acts according to laws. This is the law-constitutive approach to powers introduced by Newton.

1.3. Hume's Critique of Powers

By the time Hume's *Treatise* appeared, *sui generis* causal powers were far from abandoned. This made Hume offer a systematic critique of the ontic and epistemic status of powers. Echoing Melebranche, Hume put forward a disagreement argument: There is a diversity of philosophical views about how powers play their role and "none of them has any solidity or evidence." The whole panoply of substantial forms, accidents and faculties is perfectly unintelligible and inexplicable (*T* 158). Then, in line with his overall empiricist approach which implies that legitimately held ideas require prior impressions, he advanced a verificationist argument: There is no impression of efficacy or power: "we never have an impression that contains any power or efficacy" (*T* 160). Hume argued that "'tis impossible we can have any idea of power or efficacy, unless some instances can be produc'd, wherein this power *is perceiv'd* to exert itself." Hence, there cannot be unmanifested powers, i.e., powers which exist, even though there are no impressions of their manifestations. In fact, the very ascription of a power to a thing

requires that this power has been exercised. Hence, "The distinction, which we often make betwixt *power* and the *exercise* of it, is equally without foundation" (*T* 171).

To all this he added what might be called the "unnecessary duplication argument": Power or efficacy is not to be confused with an unknown quality of the objects—it is taken to be signify something that grounds the action and causation of bodies. But the constant conjunction of ordinary qualities of the bodies is enough to account for action and causation as well as for the idea of efficiency (*T* 171).

Finally, Hume advanced the key argument that powers cannot be necessity-makers. Powers were supposed to ground the necessary connection between cause and effect. But what kind of necessity is this? Hume takes it that if there were such a necessity, it would be such that the effect would be entailed by the cause—and the entailment would amount to a demonstration of the effect on the basis of the cause—hence the impossibility of the cause without the effect. But it is conceivable that the cause is unaccompanied by the effect and conversely. Hence, there is no metaphysical necessity in causation.

Could it be some weaker kind of necessity—natural necessity—which characterizes the power-based connection among distinct existences? In line with the standard distinction between the absolute and the ordained power of God, there are philosophers who attribute efficacy to secondary causes (natural bodies) and hence a "derivative, but a real power and energy to matter" (*T* 161). It could then be argued that though it is metaphysically possible that though A has the power to produce B, A exists without B, it is naturally necessary. Hume's far reaching point was precisely that this appeal to natural necessity can be questioned.

For Hume this kind of issue takes the following form: Can there be knowledge of Principle of Uniformity of Nature (PUN) based on experience, and in particular on probable reasoning? His famous answer is that this kind of move would be question-begging. Probable reasoning begins with experience and memory (*T* 89–90) and should provide a connection between something given in experience and something not given in experience. Hence, probable reasoning is causal inference: the only "just inference from one object to another." But then here is the problem: probable inference of the sort required, being causal inference, is founded on the "presumption of a resemblance betwixt those objects, of which we have had experience, and those, of which we have had none." Hence, this presumption (PUN) cannot come from probable reasoning. The very same principle cannot be the ground for an inference *and* the product of this inference. Or as Hume put it: "The same principle cannot be both the cause and effect of another; and this is, perhaps, the only proposition concerning that relation, which is either intuitively or demonstratively certain" (*T* 90).

Could it be that powers are posited to ground causal inference? This might well be a legitimate metaphysical inflation of the world by means of powers. Here is the relevant argument, as summed up by Hume: "The past production implies a power: The power implies a new production: And the new production is what we infer from the power and the past production" (*T* 90). Hence, the argument for powers might be the following:

1. A has been constantly conjoined with B.
2. A has the power to produce B.
3. A necessarily produces B.

4. Hence All As are B.

It's no surprise that Hume argues that this argument begs the question, since it relies on a power-based PUN. The move from 2 to 3 and then to 4 requires that "the same power continues united with the same object, and that like objects are endow'd with like powers" (*T* 91).

Suppose that powers were allowed in the sense that the production of an object B by object A implies a power in A. It is still the case that the past exercisings of A's power to produce B are not enough to prove that A necessarily has the power to cause B i.e., A causes B *simpliciter*. The reason is that past experience "can only prove, that that very object, which produc'd any other, was at that very instant endow'd with such a power; but can never prove, that the same power must continue in the same object or collection of sensible qualities; much less, that a like power is always conjoin'd with like sensible qualities." So, unless a variant of PUN is assumed, the conclusion that A causes B does not follow. But this PUN-like principle raises the further question of its own provenance, and the standard Humean objection is repeated: "why from this experience we form any conclusion beyond those past instances, of which we have had experience"? This would lead to regress "which clearly proves, that the fore going reasoning had no just foundation" (*T* 91). Hume's point, then, is that powers cannot be necessity-makers either on metaphysical or epistemic grounds.

1.4. From Powers to Laws

Hume's critique of powers did not persuade Reid to stop positing powers. He spoke freely of active powers and took it that

(a) the very concept of power is simple and undefinable;
(b) power is *not* something we either perceive via the senses or we are aware of in our consciousness (we are conscious only of the *operation* of power and not of the power itself);
(c) power is something whose existence we infer by means of reason based on its operation/manifestation;
(d) power is distinct from its exertion in that there may be unexerted powers;
(e) the idea we have of power is relative, viz., as the conception of something that produces or brings about certain effects;
(f) power always requires a subject to which it belongs: it is always the power *of* something; the power that something *has*; and
(g) causation is the production of change by the exercise of power.

Exercising a power requires agency and there is no agency in nature, strictly speaking, there is no causation in nature. Indeed, Reid (2011, I.6, 41–47) insisted that properly understood, active powers require subjects that have intelligence and will to exercise them. Inanimate matter then can be no such subject. Only God—who is an "off-stage agent"—can be the cause possibly by means of secondary causes.

But Reid wrote after Newton and thought that the universe was law-governed. Yet, subsumption under laws of nature does not constitute causation; nor does it amount to causal explanation. For him, "the laws of nature are the rules according to which the effects are produced; but there must be a cause which operates according to these rules. The rules of navigation never steered a ship. The rules of architecture never

built a house" (I.6, 47) Hence, a cause is something that has the power to bring about an effect *in accordance with the law*; but knowing the laws does not amount to knowing the causes. From all this, he drew the rather pessimistic conclusion that in spite of the fact that scientists have discovered a number of laws of nature, "they have never discovered the efficient cause of any one phenomenon" (I.6, 47). Which, for Reid, is just as well since those scientists who understand what science is about and what the laws of nature are do not claim that science discovers (or aims to discover) causes. For Reid causation is tied to agency and laws of nature are not agents. As he (IV.3, 288) put it, laws of nature "are not endowed with active power, and therefore cannot be causes in the proper sense. They are only the rules according to which the unknown cause acts."

John Stuart Mill's critique of *sui generis* powers (or qualities, or virtues) consolidated the move from powers to laws of nature. Besides, Mill was among the first to secularise the conception of natural laws. Mill's key argument against powers is that they are the products of a double vision. Echoing Hume, but not referring to him directly, Mill argued that there is nothing more to the power of an object to produce Φ than actually producing Φ. So, when, for instance, snow is endowed with whiteness, being the power to produce in us a certain sensation of white, what is really asserted is that "the presence of snow produces in us that sensation." Positing the power ("something in virtue of which the object produces the sensation") is redundant. As Mill noted, this hypostatization of powers (or qualities) "Moliere so happily ridiculed when he made one of his pedantic physicians account for the fact that opium produces sleep by the maxim, Because it has a soporific virtue" (Mill 1911, 58). According to Mill, stating the "soporific virtue" "merely asserted over again, the fact that it produces sleep." More generally, when it is asserted that object A has the power P to produce Φ, it is asserted that A produces Φ.

With this "reductive" understanding of powers in mind, Mill had no problem with talking about powers, as required by common opinion and common language, noting at the same time that this does not imply any recognition of powers "as real existences," since this recognition is not "warranted by a sound philosophy" (65).

As is well known, Mill tied causation to regularity; in particular, to the presence of an invariable and unconditional sequence of events. To say, then, that C causes E is not to say that C has a power to produce E. Rather it is to say that C and E are in a relation of co-existence and succession and that events like C are invariably and unconditionally followed by events like E. As he put it: "the cause of a phenomenon" is "the antecedent, or the concurrence of antecedents, on which it is invariably and unconditionally consequent" (245).

The condition of unconditionality is meant to exclude cases in which C and E are effects of a common cause (like the succession of night and day). Causes then are not powers but (antecedent) conditions upon which the effect (consequent) follows. Similarly, the distinction between the agent and patient vanishes. "Patients are always agents" and "all the positive conditions of a phenomenon are alike agents" (243). Mill attributes the search for power in nature in the "disposition of mankind in general, not to be satisfied with knowing that one fact is invariably antecedent and another consequent, but to look out for something which may seem to explain their being so" (261). It is precisely this disposition that should be resisted. Power-ascription reduces to causation, which is uniformity.

Causation, for Mill, is tied to laws. Indeed, causation is subject to an overarching

law, viz., that every fact in nature invariably succeeds some other fact which has preceded it (236). These invariable successions, ("the uniformities which exist among natural phenomena"), are the Laws of Nature, "when reduced to their simplest expression" (231). There is a seamless transition from causation to laws and conversely, via the idea of natural uniformity. Significantly, Mill frees the concept of laws of nature from any theological connotations and underpinnings. In a beautiful passage of the *System of Logic* (230) he states that "the expression, law of nature has generally been employed with a sort of tacit reference to the original sense of the word law, namely, the expression of the will of a superior." Then, Mill adds, when "it appeared that any of the uniformities which were observed in nature, would result spontaneously from certain other uniformities, no separate act of creative will being supposed necessary for the production of the derivative uniformities, these have not usually been spoken of as laws of nature." But instead of giving up the expression "laws of nature" as applicable to ungrounded uniformities, Mill makes his famous proposal: "According to another mode of expression, the question, What are the laws of nature? may be stated thus:—What are the fewest and simplest assumptions, which being granted, the whole existing order of nature would result? Another mode of stating it would be thus: What are the fewest general propositions from which all the uniformities which exist in the universe might be deductively inferred?" Hence according to Mill, the laws of nature are those regularities which are captured by axioms and theorems in a simple and comprehensive deductive systematisation of our knowledge of the world. This view, adopted by Frank Ramsey (1978) and David Lewis (1973) in the twentieth century, has become the main empiricist account of laws of nature.

1.5. Bringing Powers "Down to Earth"

The legacy of this movement of thought to the twentieth century was that powers became problematic and, ultimately, redundant. In the hands of most philosophers at least until the 1970s, powers (aka dispositions or dispositional properties or capacities) were eliminable and dispensable.

Rudolf Carnap, in his "Testability and Meaning" (1936; 1937), set the agenda for what was to follow by suggesting that dispositional predicates such as "visible," "edible," "fragile," and "soluble" can and should be analysed by means of conditional statements. An attempt to *explicitly define* predicates such as "is soluble in water" by reference to stimulus conditions and response conditions failed patently. An explicit definition has the form:

$$\forall x\,(Qx \leftrightarrow (Sx \rightarrow Rx)) \qquad (D).$$

(D) says that the predicate Q applies to x if and only if, when x satisfies the *stimulus-condition* S, x displays the (observable) *response* R. For instance, an explicit definition of the dispositional predicate "soluble in water" would be like this: An object A is soluble in water if and only if if A is put into water, then A dissolves. But if the conditional ($Sx \rightarrow Rx$) is understood as material implication, then ($Sx \rightarrow Rx$) is true even if the stimulus-conditions S do *not* occur. So, explicit definitions turn out to be empty. To avoid this, explicit definitions must be understood as a subjunctive statement, i.e., as stating that the object A has the property Q iff if A *were* to be subjected to stimulus-conditions S, then A *would* manifest the characteristic response R. All this brought in

tow the problem of the truth-conditions of subjunctive and counterfactual conditionals. To avoid it Carnap suggested that dispositional predicates should be introduced by Reduction Sentences. Unlike explicit definitions, reduction sentences do not fully define (and hence eliminate) the *definiendum*.

A dispositional predicate Q is introduced by means of the following *reduction pair*:

$$\forall x\,(S_1x \,\Box\!\!\rightarrow (O_1x \rightarrow Qx)) \quad (G1)$$
$$\forall x\,(S_2x \rightarrow (O_2x \rightarrow \neg Qx)) \quad (G2) \qquad (RP)$$

where S_1, S_2 describe stimulus conditions and O_1, O_2 describe characteristic responses. In the case that $S_1=S_2$ (=S) and $O_1=\neg O_2$ (=O), the reduction pair (RP) becomes a *bilateral reduction sentence*

$$\forall x\,(Sx \rightarrow (Qx \leftrightarrow Ox)) \qquad (RS).$$

So, suppose that we want to introduce the predicate Q, "soluble", by means of a reductive sentence. This will be: if the stimulus-conditions S obtain (i.e., if we put object A into water), then A is soluble iff the characteristic response R obtains (i.e., if A dissolves in water). This is fine as far as it goes, but it does not go very far. The reduction sentence (RS) does not fully define the predicate Q. The meaning of Q is *not* completely specified by virtue of stimulus-response conditions. At best, the reduction sentence gives, as Carnap (1936, 443) put it, "a conditional definition" of Q. Even if the content of a dispositional predicate can be further narrowed down by the introduction of more reduction sentences, it will be never fully specified by them. Hence dispositional predicates have excess content over their conditions of application.

This excess content might well be a dispositional property (a *power*). But to many, admitting *sui generis* dispositional properties was an anathema. For one, it seems they have had a weird ontic status: they existed even if they did not act, which reminded the Aristotelian potential vs actual distinction. Hence, dispositional properties were taken to be non-actual, non-occurent properties, which exist potentially. They were contrasted with kosher categorical properties (like shape, size, and figure) which were taken to be occurent, actual properties of their bearers. For another, dispositional properties were associated with stimulus and response conditionals (to be fragile is to such that if it is suitably struck it breaks), which to many it meant that dispositions have a *conditional* existence.

This kind of hostility to powers was captured very powerfully by Nelson Goodman (1983, 40) who said that ascribing dispositions to a thing is like making it "full of threats and promises." The dispositions of a thing "strike us . . . as rather ethereal." Hence, Goodman concluded, "we are moved to inquire whether we can bring them down to earth; whether, that is, we can explain disposition-terms without any reference to occult powers." The spectre of occults qualities, of power and substantial forms loomed large again. It had to be put to rest.

For Goodman the key problem with dispositional predicates is that they are modal: they apply to things in virtue of possible situations (e.g., a fine china is fragile even if it never breaks). Hence, he thought that a genuine solution to the problem of dispositional predicates is to specify their ascription conditions "in terms of manifest

predicates" (42). As Carnap's work has shown this is easier said than done. It turns out that any attempt to link dispositions with conditionals (the so-called conditional analysis of dispositions) relies on what would have happened under certain circumstances and not on what actually happens.

Be that as it may, what came to be known as Simple Conditional Analysis states the following: Something X is disposed at time t to give response R to stimulus S iff, if X were to undergo stimulus S at time t, X would give response R. Irrespective of how we understand subjunctive conditionals, this account fails because dispositions might well fail to entail any conditionals. For instance, it might be that the conditions under which a disposition is triggered are such that they cause the loss of the disposition. This is the case of the so-called finkish dispositions (see Martin 1994). For instance, think of a device (an "electro-fink") attached to a wire such that wire is live if and only is it is in conduct with the conductor. In effect, the electro-fink makes sure that no current flows through the wire when it does not touch the conductor. Now, the conditional "If the wire were touched by a conductor then the wire would be live" is true even though the wire is dead. But it may also be the case that the associated conditional is false because the disposition is "masked": the disposition is not lost and yet its manifestation is prevented. Throwing a glass wrapped up in packing material is a case in point; the glass is still fragile and yet it is not the case that if it were dropped it would break. (Antidotes make a similar case.)

Though examples such as the above are meant to dissociate ascription of dispositional properties with conditionals, and hence to show that dispositions are not reducible to conditionals, the immediate response is that the simple conditional analysis is too simple to be credible. It is typically replaced by a "reformed conditional analysis," suggested by David Lewis (1997, 157): "Something x is disposed at time t to give response r to stimulus s iff, for some intrinsic property B that x has at t, for some time t´ after t, if x were to undergo stimulus s at time t and retain property B until t´, s and x's having of B would jointly be an x-complete cause of x's giving response r." Let's not dwell much on this reformed analysis. Instead, let us bring out its main feature and the concomitant philosophical issue. It ties dispositions to the existence of stable intrinsic categorical properties, which objects possess as long as they possess the relevant disposition. The key idea here is that dispositions need grounding in "categorical" properties. For instance, salt is soluble is water in virtue of its molecular structure, which is meant to be a non-dispositional property. Quine (1974, 11) went as far as to argue that the dispositional idiom is a temporary heuristic device which will have "no place" "ideal language for a finished theory of reality." Until them, ascription of a disposition is reference to a hypothetical unknown mechanism, which brings about the phenomena of interest. When these mechanisms become known, the dispositional idiom becomes redundant.

John Mackie (1977, 366), echoing Hume and Mill, argued that the idea that there are intrinsic powers—the referents of the dispositional predicates—is the product "of metaphysical double vision." The power is just the causal process doubled as something latent in the objects that engage in this process: water, apart from its molecular structure, has the power to dissovlve salt and so on. Powers and dispositions, on this view, are "shadows" cast by the interactions of the categorical properties of things.

1.6. Powers: The Come-Back

In the last few decades of the twentieth century powers have made an impressive comeback. One of the first to take power talk at face value was Rom Harré. According to him (1970, 85), the ascription of a power to a particular has the following form: X has the power to $\Phi =_{def}$ if X is subject to stimuli or conditions of an appropriate kind, then X will do Φ, *in virtue of its intrinsic nature*. Hence, power-ascriptions are analysed in terms of

a) a specific conditional (which says what object X will or can do under certain circumstances and in the presence of a certain stimulus); and
b) an unspecific categorical claim about the nature of X.

As Harré and Madden put it: "To ascribe a power to a thing or material is to say something specific about what it *will* or *can do*, but to say something unspecific about what it *is*. That is, to ascribe a power to a thing asserts only that it can do what it does in virtue of its nature, whatever that is" (1975, 87). The claim about the nature of X is unspecific, because the exact specification of the nature or constitution of X in virtue of which it has the power to Φ is left open. Discovering this is a matter of empirical investigation. This, however, implies that ascription of powers is, at best, explanatorily incomplete and, at worst, trivial, unless something specific is (or can be) said about the *nature* of the thing that has the power. Otherwise, power-ascription merely states what needs to be explained, viz., that causes produce their effects. As Harré (1970, 276) admitted: "In the ascription of powers the categorical component is like a promissory note, we only believe that it is not logically impossible for it to be cashed." This is where generative mechanisms come in. Specifying the generative mechanism is cashing the promissory note. As he put it: "Giving a mechanism . . . is . . . partly to describe the nature and constitution of the things involved which makes clear to us what mechanisms have been brought into operation" (1970, 124).

So, the key idea is this. Causes produce their effects because they have the power to do so, where this power is grounded in the mechanism that connects the cause and the effect and the mechanism is grounded in the nature of the thing that does the causing. A similar view was advanced in the 1980s by Nancy Cartwright (1983; 1989) who took it that capacities are irreducible, primary and causally active constituents of the world.

In the last few decades, there has been the rise of neo-Aristotelianism. Two are the main entry points of powers: the nature of properties and the nature and necessity of laws.

1.7. The Nature of Properties

Powers have re-appeared as modally laden properties. Dispositionalists take properties to be (active and passive) powers, while categoricalists take properties to be purely qualitative and inert, trying to account for the presence of activity in nature on the basis of laws of nature. Dispositionalists argue that the identity of properties qua powers is given by their causal role. This view was defended by Sydney Shoemaker (1980). He suggested that all properties are best understood as powers since the only way to identify them is via their causal role (the things they can do). Accordingly, two seemingly distinct properties that have exactly the same powers (ie., causal role) are, in fact, one the same property. And similarly, one cannot ascribe different powers to a

property without changing this property. For the pandispositionalist, as Mumford and Anjum (2011, 45–46) put it, "all things have properties and all properties are powers."

A key argument for pandispositionalism is that it avoids quidditism. A quiddity is an individuating factor that makes a property what it is independently of its causal role. Friends of powers ague that if properties have quiddities, these will end up being unknowable. To avoid this unwanted consequence, pandispositionalists take it that properties do not have quiddities, that is, properties have no intrinsic nature over and above their causal profile. This view has become known as Causal Structuralism. The main idea is that causally isomorphic structures are identical. Suppose that there are two possible worlds W_1 and W_2 such that they differ only in the following: in W_1 two properties A and B act in tandem to generate a certain causal profile Q whereas in W_2 a *single* property C has the causal profile Q. Suppose, further, that in W_1 A or B, taken individually, do not have any further causal role. Causal structuralism entails that, all else being equal, W_1 is identical with W_2. Quidditism entails that they are different possible worlds. The argument would be that even though we may never be able to figure out whether we live in W_1 or W_2, to make sense of this metaphysical possibility we need to go beyond causal roles. But Causal Structuralism would deny that this scenario is even metaphysically possible.

A key argument against pandispositionalism is the so-called the "always packing, never travelling" argument (Molnar 2003, 173; Armstrong 1997, 80). The idea is this: If properties are nothing but powers, then when a power is manifested, its *effect* (the acquiring of a property by a particular) will also be a *power*. Hence, nothing really happens apart from the shifting around of powers from particular to particular. As Armstrong (1997, 80) put it: "Given purely dispositionalist accounts of properties, particulars would seem to be always re-packing their bags as they change properties, yet never taking a journey from potency to act."

The friends of dispositions take it for granted that powers can be causes. Not everyone agrees. To many, dispositions are causally inert. The causing is done by the categorical property that "realises" or "grounds" the disposition. Take the property of being fragile. It's not fragility that causes the vase to break (when hit hard with a hammer, let's say). Rather it is the molecular structure of the vase that is the cause of the breaking. Fragility, it is said, is a second-order property that is realised by a categorical property., viz., the molecular structure. In this setting, Prior, Pargeter, and Jackson (1982) produced a general argument for the claim that dispositions are causally impotent. It is this. Dispositions are distinct from their causal bases (since they are properties of them). But they must have a causal basis (a realiser). This causal basis (some properties) are themselves a sufficient set of properties for the causal explanation of the manifestation of the disposition (whenever it is manifested). Hence, the disposition *qua* distinct property is causally impotent.

A typical reply is that the grounding is done by other dispositions. But then, is it dispositions all the way down, as it were? The so-called ultimate argument for powers offers a qualified positive answer. One might acknowledge that most garden-variety dispositions are grounded in the properties of the components or parts of the entities that bear them (where these properties might be dispositional or categorical). And yet, states the ultimate argument, the fundamental properties (the properties of the fundamental particles) *are* pure or bare powers. Physics, it is claimed, posits irreducible powers: mass, charge and spin. The fundamental particles are *simple*: they have no

internal structure. Hence, they have no parts (components) which can be deemed the bearers of further properties (be they powers or non-powers) which, in turn, ground the properties of the particles. This is an empirical argument and it is very popular among the friends of powers.

How compelling is this argument? It turns out that the empirical situation is might well be much more complicated than the friends of powers typically presume. The fundamental properties of the elementary particles are determined by global and local symmetries that exist in nature. More specifically, they emerge as invariances under sets of (global or local) transformations, which form a group. So, the properties of elementary particles are far from being, ungrounded, though they are grounded in symmetries. The role of symmetries in the metaphysics of nature has yet to be fully understood. But no matter what one thinks on this issue, symmetries do identify fundamental properties in a way that does *not* involve what they can do.

1.8. The Nature of Laws of Nature

A second entry point for powers is the status and necessity of laws of nature. During most of the twentieth century, philosophers of science and metaphysicians took it that a broadly empiricist-Humean conception of laws of nature is the right one: Laws are universal regularities. Hence laws are contingent. A key problem with this view was the following: how can laws be distinguished from accidentally true generalisations? The answer was, typically, that something should be added to a regularity to count as a law; something robust enough to distinguish it from accidents but thin enough not to sneak in any kind of necessity. The prevailing view was that of Mill (1911), as revamped by Ramsey (1978) and Lewis (1973): the regularities that constitute the laws of nature are those that are expressed by the axioms and theorems of an ideal deductive system of our knowledge of the world, and in particular, of a deductive system that strikes the *best* balance between simplicity and strength. Simplicity is required because it disallows extraneous elements from the system of laws. Strength is required because the deductive system should be as informative as possible about the laws that hold in the world. Whatever regularity is not part of this *best system* it is merely accidental: it fails to be a genuine law of nature. This approach came to be known as MRL-view (Mill-Ramsey-Lewis view).

But many philosophers felt that this view does not offer a robust and objective answer to the question: what is a law of nature? A particularly sticky problem was the modal force of laws: laws don't merely state what things do, but also what must (or cannot) do. A first reaction to the MRL was by David Armstrong (1983), Fred Dretske (1977), and Michael Tooley (1977) (the ADT-approach), which took it that the laws are not the regularities themselves though the entail the regularities. On this approach, lawhood is a certain contingent necessitating relation among properties (universals). Accordingly, it is a law that all Fs are Gs if and only if there is a relation of nomic necessitation N(F, G) between the universals F-ness and G-ness such that all Fs are Gs. Given that N is a *contingent* relation of necessitation, it's a worldly add-on; it might fail to obtain in other possible worlds.

Despite its attractions, this view faced two important problems. One is that it is unclear, to say the least, why N(F, G) entails all Fs are Gs. The motivation for the ADT-approach was that there must be something that makes a law (viz. a regularity) *law*—otherwise laws float on nothing. It turns out that if this something is this mysterious N

(the *contingent* relation of necessitation), it fails to account for the existence of regularity. By the same token, (problem number 2) N, being contingent, turns out to be itself a free-floater. There is no explanation of why N obtains. It is just a brute fact that certain universals (and not others) are related by N.

As a reaction to this second problem, it was suggested that far from being an external (contingent) relation of necessitation N, there is an internal relation of necessitation, that is, a relation that bilaterally supervenes on the intrinsic properties of the relata. Given that the relata (the related properties) are what they are, they must be so related—that is, there has to be a necessitating relation between them. On this view, the necessitating relation between distinct properties F and G is such that it is (metaphysically) impossible that F is instantiated without G being instantiated. But for properties to be able to stand in non-trivial relations to each other, they must be *powers*. Only then can properties be such that, though distinct existents, they can nonetheless bear non-trivial relations to each other (in particular, relations of entailment and "repugnance," as they would put it in the Middle Ages). On this view, it does not even make sense to say that properties are united by laws. Rather, properties—*qua* powers—*ground* the laws. Laws of nature end up being metaphysically necessary.

But here there is a split between Realist lawlessness, advocated by Mumford (2004), and Realist lawfulness, advocated by Bird (2007) and Ellis(2001). On the first view, precisely because properties are modally loaded, i.e. they are powers, and, as such, they bear certain relations to each other, viz., relations of necessary connection, exclusion and production, there are no laws. Whatever job laws were supposed to do, it is done by powers. Hence, laws are not real (see Mumford 2004, 193). Other dispositionalists, however, (Bird (2007) and Ellis (2001)) argue that laws are real but not fundamental: they supervene on powers.

1.9. Dispositional Essentialism

The two entry points for powers (identity of properties and status and necessity of laws) are wrought together in Dispositional Essentialism. This view, defended by Alexander Bird (2007) and Brian Ellis (2001) among others, puts together two metaphysical theses:

(A) Properties have essences—that is, certain characteristics that a property has in virtue of which it is the property it is.
(B) Properties are powers—they are individuated by their causal profile, i.e., by their relations they stand to other properties and the effects they produce under certain circumstances.

A and B imply that the essences of properties are powers.

Not all dispostionalists are essentialists. Some (e.g., Mumford 2004)) take it that all elements of the causal profile of a property are on a par. Not all dispositionalists are pandispositionalists. Some, e.g. Ellis (2001) take it that there are structural-categorical properties. What all neo-Aristotelians share in common is the claim that powers are irreducible, primary and causally active constituents of the world: power are taken to be *intrinsic and actual properties whose nature is to be directed towards their characteristic manifestation*. According to Molnar (2003), intentionality is not *solely* the mark of the mental. Physical powers too, he argued, are intentional properties: they

are *directed* towards their (possibly non-existent) manifestation. This is a key feature of powers that distinguishes them from non-powers. It goes back to Aristotle and Aquinas. What the early modern philosophers thought was a mysterious feature of powers, and a reason to reject them, has become a standard feature of powers, and a reason to accept them.

2. Summary of Contributions

These, in outline, are some of the major phases and arguments of the movement away from powers and towards them. Let us now present the main points made and issues raised by the individual chapters.

Chapter 1, "The Inherence and Directedness of Powers," by Stathis Psillos (Athens)

Key Words: Aristotle, Thomas Aquinas, Francisco Suárez, Powers, *Dunamis*, Relative

Stathis Psillos explores a fundamental ontological puzzle pertaining to powers, in our opinion perhaps the most fundamental one, namely the internal coherence of their dual nature. On the one hand, powers are intrinsic properties of their objects. They are really and truly predicated of their subjects because they are, strictly speaking, constituents of their subjects. Thus their beings are tied to their objects in a way that makes the rest of the world irrelevant for them, and this way is typically characterized through a counter-factual: even if everything else in the world were different, or if nothing else existed in the world, object X would posses any and all powers Φ that it now possesses in the actual world. But, on the other hand, powers are also directed toward their manifestations. This notion of directed is somewhat vague and difficult to nail down, but at the very least it prima facie implies that powers in some important way depend on something external to it and its object. The implication and its externality are crystal-clear in most cases: an active/passive power requires the existence of its co-relative as a necessary condition for that power's ever being manifested. And insofar as the existence of a power depends on the possibility of its being manifested, the existence of any power Φ now seems to require the existence of its co-relatives and, consequently, the bearers of those co-relatives. Psillos begins his exploration from this prima facie conceptual tension, "How can a power be both intrinsic to its bearer and 'have its being' toward something outside of it?" (pp).

Psillos traces this the origins of this puzzle back to the conceptual structure of Aristotle's original account of powers, even though Aristotle himself seemed insensitve to it. Aristoteian "powers," Psillos points out, "have two modes of being: in potency and in act" (pp). This opens up the possibility of distinguishing between a power's possession by an object and its manifestation in a causal event. The ontological duality that generates Psillos' puzzle is then laid on top of this potency-act distinction; it arises through the directedness of powers, a directed they have regardless of whether they obtain in potency or in act: "but either way, being in potency and being in act, powers are toward something" (pp). Aristotle himself did not see this notion of directedness as noteworthy, Psillos emphases, but in the Aristotelian revival of the high middle ages, "it becomes central in understanding powers" (pp). Psillos then turns from Aristotle to explore Aquinas' developments of this feature of directedness.

Aquinas followed Aristotle in holding that powers were qualities and relatives simultaneously. And as in Aristotle, in Aquinas this ontological or categorical duality was what "grounded their two main features: inherence and directedness" (pp). But Aquinas, unlike Aristotle, worried about how to handle cases in which relatives are lost or acquired even though the subject did not change in any qualitive way, i.e. the subject remained the same intrinsically. Aquinas appealed to the analogy of a root—the relative was first in the subject as a root—which Psillos unpacks as follows: "When the power is actualized it enters into actual and real relations with the correlative powers. But because the power exists potentially too, the actualization (and hence the real relation) was in a sense in the substance 'in some way as in a root.' When a power shifts from potentially to actuality there is a real relation 'inasmuch as one thing receives something from another or confers it upon the other'" (pp). Psillos then hooks this characterization of the root analogy to Francisco Suárez's distinction between *inesse* and *esse-ad* to ground the Thomistic account in a bifurcated account of Being (pp). But the difference between *inesse* and *esse-ad*, argues Psillos, is only conceptual and not real, so this provides a coherent and feasible resolution to the puzzle of directedness that looks a lot like the "so-called 'identity theory' of properties" defended by John Heil and C.B. Martin (pp). Psillos concludes:

> Powers, then, are real, but not really distinct from their qualitative grounds. Their directednes is the potential by which, *qua* relatives, powers endow their bearers to enter into relations with other substances. If there were a lonely object in the world, the potential for relations would be there (since the obect would have some inherent qualitative properties) but no relatedness; and hence no change. But since there are various entities (substances) in the world, powers are actualized and this accounts for the natural order in the world, viz., for substances being related to each other. (pp)

Whether contemporary friends of powers would want to embrace this inflated (bloated?), bifurcated account of being, and whether they should, are questions that Psillos leaves for the reader to explore.

Chapter 2, "Powers, Possibilities, and Time: Notes for a Program," by Calvin G. Normore (UCLA)
Key Words: John Duns Scotus, William of Ockham, Megaric Consequences, Possibility, Accessibility Relation, Auriol's Principle, Powers

Of equally fundamental importance to the current debate over causal powers are its Megaric consequences, the connection between powers and modality. One of the central motivations for adopting a powers ontology is said to be the support causal powers provide for grounding and explaining alternative possibilities. Calvin Normore provides a robust defense of this idea by defending the deeper thesis that time makes a difference for modalities because the existence of powers at a time impose formal constraints on the structural conditions governing the accessibility relation between the actual and the possible. Some alternative states of affairs are not genuine possibilities in the actual world, he argues, because of the powers that obtain in the actual world. Normore, moreover, roots his defense of this thesis in the medieval debate between Scotus and

Ockham over whether what is possible is possibly actual (Scotus maintained “no it need not be” whereas Ockham maintained “yes it had to be”).

Normore structures his argument around Scotus and Ockham’s disagreement regarding Auriol’s Principle, *If A is F and A can be not-F, then A can change from F to not-F*. This reduces the question to whether or not the power to F can exist despite never being actualized. Scotus, and anyone who rejects Auriol’s Principle, hold that the power can so exist; Ockham, and anyone who accepts Auriol’s Principle, hold that no power could so exist. To defend Scotus’ position, Normore needs to pull up a couple of distinctions from the medieval context. First, he suggests that Scotus needs a distinction (developed by Ockham) between a proposition being assigned the true relative to a world *secundum vocem* and a proposition that is true because it is grounded in that world *secundum rem* (pp). The basic idea is that there is a difference between a proposition’s whose truth is relative to the actual world and one that is made true by the actual world, and this allows us to see that if a proposition is grounded in a world *secundum rem*, it is necessarily true in that world even though it is not generally true that if a proposition is true in a world, it is necessarily true in that world.

This idea of grounding in a world *secundum rem* is then propped up, according to Normore, by the doctrine of causal powers (pp). To see this, we need to reframe Auriol’s Principle to read *If A is F and A can be not-F, then A has the power to change from F to not-F* and also recognize that Spencer’s counter-examples to the “Poss-ability Principle” give us cases where A is F and can be not-F even though it lacks any power to change from F to not-F. Normore illustrates this with an example take from rational agency—"to be free, an agent needs to be able to act differently from the way it does in fact act, but there is no relevant time at which it is able to act differently from the way it does act.” When this occurs, argues Normore, there obtain *instantes* of nature (indices within things that reflect the priorities in nature, as opposed to the priorities in time, between them) that relativize the alethic evaluations of propositions regarding the agent’s action. There is now a prior *instans* of nature according to which the agent is able to act differently than it does and now a posterior *instans* of nature according to which it is not able to act differently. But because these *instantes* revolve around priorities of nature rather than priorities of time, they can co-exist at any given time and nonetheless function as different indices against which the truth of propositions relativizes.

> If we look closely as Scotus’ devices of *instantes* of nature at a given time . . . . we find that at time t, relative to a prior *instans* there is the will with its power to act or not act. At time t, relative to a posterior *instans* it acts, and so if we posit it to be not acting at that posterior *instans* of nature, we can derive the contradiction that it acts and does not. Soctus takes it as sufficient for it be possible that the will not at at t that there be some *instans* of nature at t such that if we posit it not acting relative to that *instans*, we get no contradition. (pp)

In the context of causal powers, rather than the free choices of rational agents, the causal powers themselves are the *instantes* of nature propping up the falsity of the consequent of Auriol’s Principle. Thus, the contradictory modal statements are thereby banished as irrelevant to making the assessment of what is really possible at a given time in a given world because the powers within objects provide a robust metaphysical

principle restricting possibilities to truths relativized to those powers. In this way, Normore gets a link between modality and time akin to this provided by the Principle of Sufficient Reason or the Principle of the Necessity of Origins but with roots that contemporary philosophers of science should find more plausible. But whether or not the friends of powers are able or willing to take on Scotus' doctrine of *instantes* of nature to support they modal semantics remains an open question.

Chapter 3, "Aristotelian Powers, Mechanism, and Final Causes in the Late Middle Ages," by Henrik Lagerlund (Stockholm)
Key Words: Aristotle, William of Ockham, John Buridan, Francisco Suárez, Final Causes, Mechanism, Integral Parts, Wholes, Dispositions, Powers
Henrik Lagerlund explores the topic of final causality in the high and later Middle Ages. He argues that the seventeenth-century mechanists weren't the only one critiquing and rejecting final causality. There were earlier figures who developed a form of mechanical materialism that eschewed final causes, most notably William of Ockham and John Buridan (pp).

Lagerlund begins with the way that Ockham and Buridan in the Fourtheenth Century understood the mereology of the body. Bodily substances were composed of essential parts and integral parts. Essential parts were its metaphysical constituents, its matter and substantial form. Integral parts were its various extended bits. This distinction generated a metaphysical divide between material objects with extended substantial forms and simple, immaterial substances like God, angels, and the human soul. And this divide raises a number of philosophical puzzles for the entities on either side of it. Of special concern to Lagerlund is the numeric identity and unity of material substances across time. Lagerlund shows how Buridan in particular struggled to make sense of the identity and unity of material substances through time. In the end, Buridan could only say that material substances are successively identical through time; they are not totally or partially identical (pp).

Final causality, according to Lagerlund, had no place within this medieval mechanical materialism because Ockham and Buridan strove to reduce their ontological commitments. This allowed them to restrict powers and final causality to the mind alone, much as Descartes would a couple of centuries later (pp). Ockham, and later Buridan, were essentially worried about two things, according to Lagerlund. First, the coherence of the temporal priority of the final cause, qua cause, over the effect and the identification of the final cause with the not-yet-existing effect: "Buridan argues that 'every cause is naturally prior to the caused thing . . . but the end is not naturally prior.' The problem is thus how something that is posterior to its effect can be a cause" (pp). Second, the priority of God over nature: "the cause of God's action of creation is the world being created. But this implies that things inferior to God are causes of His actions, which is clearly absurd. Buridan takes this to be a knock-down argument of final causality" (pp).

But even though Ockham and Buridan had no room for final causality, Buridan still felt the need to hold onto powers in the weak sense of dispositions. According to Buridan, dispositions were special kinds of qualities that underlay an object's natural capacities (pp). Nevertheless, maintains Lagerlund, this does not smuggle causal powers in any metaphyscially objectionable sense back into Buridan's medieval mechanism because it is possible to read Buridan as meaning by "dispositio" nothing more than the

mere arrangment of its material, integral parts (pp). So, even though dispositions make an appearance among the medieval mechanists, it does not make them Aristotelian or compromise in any way their anti-Aristotelian and mechanistic positions.

Chapter 4, "Agency, Force, and Inertia in Descartes and Hobbes," by Deborah Brown (Queensland)
Key Words: René Descartes, Thomas Hobbes, Tendencies, Laws of Motion, Powers

Deborah Brown is looking at how Hobbes and Descartes used the language of "tendency" in their natural philosophies. She contrasts the problems that arise for Hobbes as he tries to reduce tendencies away with a Descartes, for whom "tendency talk is not a mere *façon de parler*" but rather is "real and causally explanatory" (pp), and who strives to incorporate inherent tendencies into his broader mechanistic ontological framework. The resulting interpretation of Descartes sees him as much closer in his conception of natural laws to Nancy Cartwright rather than to David Lewis. One of the real benefits of this interpretation, claims Brown, is that it "might just help to demystify Descartes's references to active forces" (pp).

Brown begins with Louis de La Forge and his slide from Descartes's law of inertia to his occacionalist claim that motive force is not a constituent of the moved body on the basis that motion is only a mode according to Cartesianism. This overlooks Descartes's commitment to active forces (*conatus*) in nature, a mistake encouraged by Descartes's comments regarding his third law of motion and the belief that Cartesian bodies are inert, Brown concedes, but a mistake nonetheless. The root of the mistake is the ease with which readers slip from the idea that bodies are *inertial* to the ideas that bodies are *inert* (pp).

With that mistake diagnosed and interpreters' presumption about Descartes's lack of commitment to active forces softened up, Brown then turns to the argument for the interpretation that *conatus* are tendencies and the laws regarding their unfolding are tendency laws. After establishing Descartes's commitment to tendencies in his three laws of motion, she argues that we have no real basis for not interpreting them as real, inherent properties of bodies because there is nothing in Descartes that in fact suggests otherwise, and because tendencies play a causal role within Descartes physics even when they are "unfulfilled" (pp). Brown makes a strong textual case for her claim that tendencies play a causal role in Descartes physics by carefully analyzing the claims Descartes made regarding tendencies toward motion and showing that typical reductivist readings of them cannot do justice to the conclusions Descartes draws from them (pp). Furthermore, Brown argues, this commitment to the reality of tendencies is compatible with Descartes's well-known rejection of final cause playing any role in natural philosophy.

Having thus establishing that Descartes was a realist about tendencies who nevertheless remained committed to a non-teleological, mechanistic account of nature, Brown contrasts this Cartesian picture with Hobbes's reductive mechanics that eliminated forces and tendencies by equating them with actual motions, including even the "force of a body at rest" (pp). On Brown's analysis of Hobbes, "Hobbesian tendencies are real, causal powers that are neither dispositions nor potentialities" which "belond to the category of motion" (pp). The drawback, however, is that Hobbes cannot maintain a categorical difference between bodies at rest and bodies in motion, between agents and

patients in other words, which entails that Hobbes cannot properly analyze cases in which equipotent forces offset one another, "stalemate cases" in Brown terminology. The Hobbesian reductive analysis cannot work here because it requires the patient, who is being equally acted upon by opposing agents in the stalement case, to be *per impossible* simultaneously moving in both directions. Brown then turns to consider how Descartes's adoption of real tendencies can be applied to the Cartesian mind and why it avoids the pitfalls await Hobbes's reductivist account.

Chapter 5, "The Ontological Status of Causal Powers: Substances, Modes, and Humeanism" by Benjamin Hill (Western)
Key Words: David Hume, John Locke, Nicolas Malebranche, Louis de La Forge, Powers, Occasionalism

Benjamin Hill is seeking to initiate deeper contemporary discussion of the ontological challenges that drove early modern philosophers (namely, several early Cartesians, Berkeley, and Hume) to accept the negative thesis of occasionalism, that no physical object can truly be an efficient cause. He argues that we should be looking past Hume and his empiricist's approach to secondary causation to bring the core metaphysical, issues he believes are still lingering, into sharper focus.

Hill walks us backwards from Hume's empirical critiques of powers in the *Enquire* and *Treatise* to Locke's presentation of the "popular" view that experience lead us to postulate powers as a response to occasionalism. This, he suggests, reveals that the early modern debate about causal powers to tracked not the divide between Scholastics and mechanical philosophers but the divide between realists and occasionalists and revolved around a confusion between them regarding what was at underlying question of the debate. For the occasionalists, it was not really about whether or not causal powers did exist, but about explain how they could exist (pp). This leads Hill to explore the metaphysical worries animating seventeenth-century occasionalists.

Beneath the four central arguments presented in favor of occasionalism, Hill identifies three metaphysical worries that, he says, ought to be of concern to contemporary practicioners: the conceptual clarity regarding the category of causal powers; the vaguenesses surrounding characterizations of and boundary conditions for an effect (Hill calls it the problem of full determination); and the nature and grounds of natural necessity as an ontological category. Hill then considers how the occasionalists developed these worries and why they found them so pressing within the modern, mechanistic scientific framework. He begins with the lack of conceptual clarity and argues that the basis for Malebranche's rejection of the idea of power was very different from (and much more powerful than) Hume's empiricist's attack precise because it focused on the inadequacies internal to the concept of a causal power (pp). Then he turns to showing how Malebranche's No Knowledge Argument and La Forge's No Transfer Argument for occasionalism exploit the worries about fully and properly specifying the extent and boundaries of the operations of a causal power. Conceptually speaking, every effect must be made fully determinate when it is actualized. This requires wading through a very complicated set of intersections, and Malebranche was only able to comprehend this as a set of choices and decisions by a knowing agent, hence his No Knowledge Argument. But the idea of agency limiting Malebranche's conception is a red herring, according to Hill, because the real pressue on the realist comes from the need to make sense of the complexity of the many intersections by making effects (and

powers) properties that emerge from states of affairs involving many substances and relationship rather than being inherent or *per se* properties of substances (pp). To avoid this "by connecting the full determination of a power's activiation to the force or energy necessary to activate the power" (pp) is, Hill argues, to run right into La Forge's No Transfer Argument. This argument pressures the realists by forcing them to conceptualize force or energy into the category of a "special" substance, which threatens, among other things, a viscious infinite regress, or into the category of mode, property, or state of a substance, which undercuts it fulfilling the causal role realists require of it (pp). The final worry explored by Hill was that involving natural necessity. He argued that this reached back to the medieval debates between voluntarists and intellectualists regarding the limitations on divine omnipotence. Their debate, Hill suggests, came down to whether or not natural necessity needed a metaphysical ground. Malebranche, following the volunterists, emphasized that the only thing conceivably capable of grounding natural necessity is the divine will rather than the Divine Ideas. But the core problem is even worse for contemporary realists than it was for the medieval and early modern intellectualists in that they had God to fall back on but we don't and trying to identify a properly naturalistic grounds for systematically supporting natural necessity seems much harder to get off the ground.

Chapter 6, "The Case Against Powers" by Walter Ott (Virginia Tech)
Key Words: René Descartes, Powers, Problem of Fit Objection, Independence Thesis, Power Holism, Relations

Walter Ott presents much the same take-home message as Hill, that there is a central, underlying metaphysical worry that animated early modern thinking against causal powers that is still unresolved. But he emphasizes a different, though related, worry—the specter of power holism embedded in the Aristotelian's commitment to intrinsicality. Ott sees this as the worry expressed in Descartes's "little souls" argument against powers, which he sees as an important precursor to Neil Williams's recent "problem of fit" objection to neo-Aristotelian causal powers (pp). And it is this "problem of fit" that highlights the connection between intrinsicality and powers holism.

Williams's "problem of fit" objection is squarely aimed at dispositional essentialism: assume that powers are intrinsic properties directed at their manifestions, yet not identical with or reducible to them, and that they are essentially dispositional in this way; recognize that powers come in "bundles" (pp) that are often distrubuted among several different substances (e.g., fire has the power to burn paper and paper has the power to be burned by paper, at least within an oxygen-rich environment); and then we can ask the simple question, "why are these powers bundled together and not others?" Dispositional essentialists need to provide an answer here, but it is not clear what theirs would look like or how they could answer it. For any bundle of powers, it is "perfectly mysterious," miraculous even, says Ott (pp), why they bundled together, and so perfectly suited to one another, and why can they not be bundled otherwise. But the mystery is even deeper, and the problem worse, when we recognize that background conditions and a myriad of laws of nature (themselves intimate connected to many other bundles of properties) directly impact the nature of powers: virtually every power is bundled with every other power within a possible world. This leads, Ott argues, directly to the absurdity of "power holism" (pp). Against a rich version of dispotional essentialism that requires integration of causal powers one with another, like Hilary

Kornblith's (1993), Ott's worry seems especially well placed. "If power holism is the cure," Ott colorfully states, "one might be forgiven wanting the disease back" (pp).

According to Ott, however, the lesson to take from the "problem of fit" is not that Humeanism is the proper position. He suggests instead that we return to a mitigate powers ontology like that found in Boyle and Locke. The idea here is that powers are really relational properties that cannot be reduced to any one of their relata (pp); they simply "are internal relations among the intrinsic properties of things" (pp).

Chapter 7, "The Return of Causal Powers?" by Andreas Hüttemann (Koln)
Key Words: René Descartes, Francisco Suárez, Nicolas Malebranche, Louis de la Forge, Powers, Substantial Forms

Andreas Hüttemann disagrees with Hill and Ott regarding the relevance of the early modern critiques of causal powers for contemporary practicioners. He argues that the contemporary acceptance of powers and dispositions is insulated against the early modern criticism because the emergence of powers nowadays is not a "revival of" or "return to" the Aristotelian or Scholastic version of causal powers. Hüttemann traverses two lines of argumentation in his defense of the contemporary metaphysics of powers.

First, he maintains that the early modern critics utilized a version of causation that because it was rooted in the doctrine of substantial forms was quite strong and restrictive and that, consequently, their criticisms don't apply to contemporary notions of powers, which utilize a counterfactual conception of causation. He suggests further that the early modern criticisms are in fact compatible with this counterfactual conception of causation, which someone like La Forge accepted as "quasi-causation" (pp).

Then, he turns in a different direction to defend Nancy Cartwright and Jeremy Hardie's use of the Extrapolation Argument in favor of the postulation of dispositions and powers. Cartwright and Hardie argue that the inferences involving extrapolation from one case to another, especially when the cases invovle important dissimilarities, is only possible because inherit tendencies and powers ground and "fix" a capacity between the different scenarios. According to Hüttemann, what is happening in these situation is that there are "different factors or tendencies that contribute to the actual behaviour that we want to explain" (pp) and so long as there are "laws of composition that allow us to estimate the contributions of the various factors" (pp), we can ground such extrapolative inferences as Cartwright and Hardie want. This allows for a distinction between the complete manifestion of a power and the partial manifestation of a power such that in cases where a power is only partially manifested it is nevertheless a full and proper instantiation of the power equivalent to its instantiation in cases where it is completely manifested (pp). In order for this to make sense, Hüttemann says, it is not necessary for the tendencies, powers, and dispositions undergirding an extrapolition to be causal. Indeed, he says, such dispositions are often "infinitely multi-track," which removes them still further from the classical notion of causal. Thus, contemporary references to dispositions and powers should not be too quickly subsumed under the early modern's conception of causal powers (pp).

Chapter 8, "Qualities, Powers, and Bare Powers in Locke," by Lisa Downing (Ohio State)

Key Words: John Locke, Qualities, Primary–Secondary Qualities Distinction, Realism, Anti-reductivism, "Mere Powers"

Lisa Downing focuses on the important issue of the metaphysics of Locke's primary–secondary qualities distinction. In recent years this has returned as a topic of scholarly contention. Downing is concerned by the anti-realist trends in recent work on the metaphysics of Locke primary–secondary qualities distinction (pp) and she is keen to defend the claims that Locke was "putting forward a kind of *realism* about secondary qualities" and that his realism does not readily appear to be a reductive form of realism (pp).

Downing begins with the traditional claim that Locke's distinction was driven by his understanding of matter theory within the new science, like many others in the seventeenth century (pp). From this perspective, she criticizes recent work on the nature and priority of primary qualities, which fail to root the primary in a metaphysical base (Stuart 2013) or connect them to the metaphysical base in the wrong way (Jacovides 2017; Pasnau 2011). Next, she turns toward explaining her own understanding of the subordinate status of the secondary qualities, which brings Downing to Locke's claim that secondary qualities are "mere powers" (pp) and what this meant metaphysically to him. It is here that Downing begins her defense of Locke's non-reductive realism about secondary qualities.

Her approach toward defending the realist position starts by critiquing the anti-realist and idealist interpretations recently pouring forth. She quickly knocks down Jacovides's (2017) interpretation that Locke is only offering a semantics for secondary qualities terms (pp), but then turns to attack the relational account of Ott (2009). Ultimately Downing cites "the unattractiveness of the view that relations simply do not exist, plus the deep connections Locke sees between modes and relations" as "sufficient grounds" for discounting the robustly anti-realist text in the *Essay* (II.xxv.8, 322) and for pushing any viable interpretation of the metaphysics of secondary qualities into a realist direction. So, she next turns to Stuart's (2013) notion of secondary qualities as degenerate powers (pp). Downing identifies a host of problems with this notion, however, including the consequences: that secondary qualities are actualities, not potentialities (pp); that secondary qualities are not stable and persistent, which also undermines the stability and persistence of kind membership (pp); and that this move to degenerate powers does not really avoid the problem of making them out to be relations, which don't really exist (pp).

After securing that the anti-realist interpretation is unacceptable, Downing considers the case for attributing reductive realism to Locke (Pasnau 2011; Ott 2009). Dowing does not find the reasons cited for requiring us to attribute reductivism to Locke as persuasive (pp). But her biggest concern seems to be with the absence of details regarding how the reductions are supposed to actually take place. For Downing the central notion behind Locke's position is that the secondary qualities that supervene on bodies as mere powers are not *res* in the technical Scholastic sense of being separable existents (pp). But the further claim that secondary qualities are not existents in any other sense is not obviously excluded by Locke (pp), so why should we attribute anything stronger to him seems to be what Downing is saying. But there is more to be said for the realist, anti-reductivist interpretation, according to Downing, when we examine what is necessary to prop up the epistemological claims Locke maintains regarding secondary qualities. The adequacy of our simple ideas requires that the

secondary qualities be real existents: "For the claim that all our simple ideas are adequate to come out true, it is necessary that our ideas be aimed at powers, that there *be* powers, and that those powers be completely known" (pp).

Chapter 9, "Hume on Causation and Causal Powers," by Peter Millican (Oxford)

Key Words: David Hume, Causation, Powers, Necessity, Cause

Peter Millican returns us to the issue of how to best interpret Hume's iconic passages on causation and causal powers and aims to cut through the various interpretations by fixing twelve "key points" (pp) and arguing that a reductivist reading makes best sense of them. His twelve key points are:

1. Whether A causes B is an objective matter of fact, and causes can be discovered by systematic investigation (pp);
2. Causes are understood to be prior and contiguous to their effects (pp);
3. The principle component of the concept of causation is necessary connection, which is essential to it (pp);
4. Causal necessity is not the same as conceptual necessity (pp);
5. Hume is a convinced determinist, although his basis for this is unclear (pp);
6. Necessary connection is one of a family of "power" terms, which Hume treats as virtually synonymous in this context (pp);
7. Understanding "power" terms involves having a certain simple idea, which is copied from a corresponding impression of reflection (pp);
8. The corresponding impression of reflection arises from observed constant conjunction and the consequent tendency to draw inductive inferences (pp);
9. Hume provides two definitions of cause (pp);
10. Hume also provides two definitions of necessity, which he applies to issues of "liberty and necessity" (pp);
11. When the two definitions of cause come apart, constant conjunction dominates (pp);
12. In EHU, Hume recognizes more sophisticated causal relations than in THN, mediated by quantitative powers and forces (pp).

With these twelve points regarding Hume's theory fixed, Millican turns toward adjudicating between reductivist, subjectivist, and projectivist interpretations.

First, Millican attacks subjectivist interpretations on the grounds that they emphasize melodramatic passages in tension with Hume's more considered claims, especially the first definition of necessity (fixed point #10). Indeed, Hume himself, Millican argues, backed away from the subjectivist ideas by the time he came to write the *Enquiry*: "His omission of the stridently subjectivist declarations of the *Treatise*, therefore, was both deliberate and appropriate" (pp). Millican backs up the critical comments about subjectivism with "a plausibly Humean account of what his 'impression of power or necessary connection' might be" (pp). Then he turns to projectivist interpretations. Here, he argues that projectivist readings can be accommodated by the reductivist reading he is defending (pp). After that, he turns to the "New Hume," who allegedly accepted "thick" causal powers, which push beyond the two definitions of cause. But Millican emphasises that Hume did accept causal powers in some thinner sense, powers that reduce to causal structures in the world that allow the discovery of laws and enable predictive success.

Chapter 10, "Resurgent Powers and the Failure of Conceptual Analysis," by Jennifer McKitrick (Nebraska)

Key Words: Powers, Dispositions, Conditionals, Counterfactuals, Mimics Finks and Masks

Jennifer McKitrick returns us to contemporary times and examines the causes moving many philosophers to pull Aristotelian powers out of history's dustbin, the failure to reduce or eliminate dispositional ascriptions from philosophical and scientific discourses. Although many see this failure as grounds for rejecting Humeanism and return to Aristotelianism, McKitrick aruges that only a more moderate reaction is warranted. She argues that restricting analysis to fundamental dispositions and adding a condition requiring the power ascription be grounded in or made true by the fact that the object possesses that fundamental disposition is the better reaction.

McKitrick canvasses the main twentieth-century attempts to reduce or eliminate dispositional talk. She begins with the Logical Positivists attempt to replace dispositional talk with material conditionals. Then, after briefly considering Ryle's version, she turns to Goodman and the move to replace material conditional analyses with "stronger-than-material conditionals, such as causal implication or counterfactual conditionals backed up by natural kinds and laws of nature" (pp). Next, she turns to Lewis' possible world semantics and concludes with a presentation of the "Simple Counterfactual Analysis," which states "x has D $=_{df}$ If x were in C, x would exhibit M" (pp). The legacy of these attempts, according to McKitrick, is the failure of the any of these analyses to actually get the right result because the relationship between antecedent and consequent is never narrow enough to exclude accidental coincidences.

But things get even worse in the late 1990s and early 2000s, maintains McKitrick, with the emergence of a slew of counter-examples to the Simple Conterfactual Analysis, mimics, masks, and finks. Mimics are objects that seem to manifest a disposition without actually possesing the disposition in question (pp). These counter-examples show that the counter-factual is not sufficient for ascribing a disposition to an object. Masks and antidotes show that the counter-factual is not necessary for ascribing a disposition to an object because they prevent the disposition from masking even though it is being activated as it ought to be. Finks and other alterations, like Martin's famous electro-fink, remove the disposition at the precise moment that its manifestion would normally be activated.

These counter-examples have pushed many philosophers to explore more sophisticated versions of the counterfactual analysis capable of avoiding the finks, masks, and mimics. None of theses, however, are satisfactory, according to McKitrick. Adding some kind of ceteris paribus constraint to the counterfactual seems to only be adequate when it packs reference to dispositions into its analysans, which undercuts the whole reductivist and eliminitivist program (pp). David Lewis' attempted revision puts structural properties at the base of an object's causal powers and requires the preservation of these causal bases in the analysis (pp). But this too threatens to undercut the whole reductivist-eliminitivist model by packing into its analysans a property which has causal oomph (pp). McKitrick ends her tour of reductivist-eliminivist attempts with Manley and Wasserman's Proportionality Account "N is disposed to M when C if and only if N would M in some suitable proportion of C–cases" (pp). Although this analysis goes farther toward resolving the problems with reductive, counterfactual analyses than others, it still struggles with intrinsic fink counter-

examples and with the need to refer to infinite sets of possibilia when specifying the C–cases. "PROP relies on the Lewis-Stalnaker semantics for counterfactuals, so as suggested earlier, the price of reducing disposition ascriptions might be a multi-verse of possible worlds" (pp). McKitrick's tour is a tour de force of the evolution and current state of reductivist-eliminivist attemps to avoid dispositions.

Despite these problems with providing analyses of dispositional ascriptions in terms of counterfactuals, McKitrick recognizes that "there is still an important connection between dispositions and counterfactuals. A thing's disposition is its property of having a certain kind of counterfactual hold of it" (pp). But she advocates restricting counterfactual analyses to fundamental dispositions and powers and requiring that they be "made true, or grounded by, the fact that the object has that power" (pp).

Chapter 11, "Causal Powers and Structures," by Brian Ellis (La Trobe)
Key Words: Powers, Dispositions, Cause, Dispositional Essentialism

Brian Ellis provides a detailed and systemic overview of his version of dispositional essentialism. Ellis is famous for having developed and defended a mixed ontology for scientific realism (Ellis 2011). His is a robustly Aristotelian ontology that involves a mix of categorical and essentially dispositional properties inhering as universal in individualized entities. In this contribution, Ellis briefly defends this defends this sort of ontology by arguing that it, or something very much like it, is necessary to provide an account of the system of reality discovered through modern science. It is, moreover, entirely adequate to the job of accounting for the ontology of modern science (pp). So really, what more could philosophers ask for?

He then turns to consider three objections to his ontology. The first is what other contributors will call the "directedness problem," which is the idea that powers are directed at their manifestation in a way analogous to the directedness of intentionality. The second is what other contributors call the "intrinsicness problem," which is the idea that causal powers are intrinsic to or inhering in their subject. The third is what other contributors call the "necessity problem," which is the idea that there is something important and distinctive about metaphysical necessity vis-á-vis logical necessity.

Next Ellis turns to more detailed outlines of the central features of his realist ontology. He presents first his account of what constitutes a physical causal process for him—"for one system to impact upon another, there must be some physical causal process involved, and typically the impact will involve a transfer of energy of some kind from the impacting body to the body impact upon" (pp)— and invokes a distinction between positively and negatively acting causes to accommodate cases of causal "interventions" (pp). Then he takes up what a "law of action of the causal power" should look like and the role played by the categorical properties of time and location in a casual law. He further argues against the suggestion that they are "quiddities, and therefore unreal" (pp). Therefore, to accomodate spatial and temporal properties as well as structural properties that directly impact the action of causal powers, Ellis adopts categorical properties into his ontology alongside the dispositional properties of fundamental particles. Ellis is, he avers, a categorial realist as well as a dispositional realist and holds what he thinks is a "fundamentally Lockean position" (pp).

Readers coming to this volume without strong grounding in the contemporary literature regarding dispositional essentialism will especially benefit from Ellis elegent

and detailed recount of his version of the ontology. But even experts will appreciate the clarity with which Ellis summarizes the main points motivating the commitment to dispositional essentialism and the firm defense of them Ellis gives here.

Chapter 12, "Induction and Natural Kinds Revisited," by Howard Sankey (Melbourne)
Key Words: Powers, Induction, Dispositional Essentialism

Howard Sankey returns to his previous work on this topic and reconsiders a special issue closely connected with causal powers, the problem of induction. Here he addresses a deep version of problem of circularity originally raised by Psillos, which afflicted his earlier work "Induction and Natural Kinds" (1997) and argues that the circularity can be avoided. The key is recognizing certain epistemically externalist results of the Megaric consequences of the commitment to dispositional essentialism. Circularity can be avoided, Sankey argues, because it is the way the world is, rather than the inductive inference itself, that grounds the reliability of the inductive inference in his previous account.

The several sections of Sankey's paper recaps for readers his previous work resolving the problem of induction and the charge of circularity lodged against it. Enumerative induction can be externally justified beause it is a reliable belief formation mechanism. The charge of circularity beneath this this resolition is that it uses an ampliative inference (inference to the best explanation, which justifies the metaphysical commitment to dispositional essentialism) to justify an ampliative inference (inductive inference) (pp). The key to avoiding this form of circularity is to recognize the uniformity of nature, Sankey says. The commitment to nature's uniformity is a metaphysical claim whose truth grounds the reliability of our inductive inferences. We use inference to the best explanation, however, only within the context of discovery and not within the context of justification when we ground the reliability of induction, argues Sankey (pp).

What are doing the work for Sankey here are the Megaric consequences of his adoption of Ellis' dispositional essentialism. The uniformity in question is one that stretches across possibile worlds: "nature is uniform in the precise sense that there are natural kinds whose members all possess a shared set of essential properties" (pp). As Normore emphasised in his contribution to this volume, the significance of this commitment lies in how the possibile and the temporal intersect through restrictions placed on the accessibility relation between the actual and the possible. *Ipso facto*, when considering questions about the future behaviors of objects, which is how Sankey understands the problem of induction to be, the uniformity of nature can ground the reliability of beliefs about those future behaviors precisely because the domain of possibility is restricted to those world accessible to the actual world, which is fixed by the commitments of dispositional essentialism. As Sankey puts it: "Unobserved members [and actually possible members, we might add] of a kind possess the same essential properties as observed members of the kind. The fact that observed and unobserved members of a kind possess the same essential properties is what makes induction reliable" (pp). Although Sankey limits himself in this paper to inductions "underpinned by the existence of a natural kind" (pp), we believe that focusing on the Megaric basis beneath Sankey's move would allow friends of powers to extend Sankey's

approach to causal powers more generally, including those of individuals and instances in which natural kinds play no apparent role.

3. Questions for Moving Forward

Moving forward beyond this book, it seems important to state a few issues or questions that we have not touched upon here or questions that are generated by the articles published below. Naturally, the scope of this book is limited to the period starting with the late medieval/early modern discussions of powers and moving into contemporary philosophy of science and metaphysics. We say very little about the concept of power or causal powers before Aquinas – even though some articles touch upon Aristotle as the most obvious background to our period. There is much more to be said about late ancient discussions as well as earlier medieval discussions. We also ignore the Arabic philosophical discussions, which were essential to Aquinas as well as many others in the Latin tradition and contains very interesting discussions of Aristotelian powers as well. There is, hence, much more to be said if we look back into history.

There are a number of unresolved questions about the later middle ages that future studies will have to address. The fourteenth century seems to have contributed a new trend in relation to powers, which is very similar to the negative attitude we can find in the seventeenth century. This poses some new and interesting questions, like how were causal powers construed in the *via moderna* tradition following Ockham and Buridan, what is the relation between the fourteenth century criticism of powers and the later seventeenth century one, and what influence did sixteenth century discussions of final causality and the scientific method have on the subsequent seventeenth century discussion of powers and laws of nature? Answering such questions will give us a better understanding of the seventeenth century conception of powers and fill in our history a bit more.

And yet, not only are there many historical questions to ponder if we look forward. But also, these unresolved issues about which there is a lot to be learned by blending historical and conceptual perspectives. One important issue, in our view, is the place of powers in the current scientific image of the world. While the critique of powers in the seventeenth century was associated with the emergence of a, by and large, new framework for doing natural science, viz., the so-called mechanical natural philosophy, it's not quite clear whether the current resurgence of powers is linked with developments in the sciences or whether it is due mostly to philosophical reasons. Some detail work on the status of power-based explanations of natural phenomena would be required if we were to have a clear account of the role powers in current science. And to what extent are the arguments against powers from within mechanical philosophy relevant to current debates? Similarly, to what extent can current arguments in favour of powers cast light on the seventeenth century debates? Besides, an important issue is the relation between powers and laws. Are either powers or laws enough to account for natural phenomena?

We could carry on. But the readers might well be anxious to delve into the various chapters of this collection and see for themselves how the blending of the historical and conceptual perspectives can be useful (perhaps, even indispensable) is thinking about

the twists and turns of the philosophical engagement with powers and their place in nature and in science.

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