

RECONSTRUCTING BHASKAR'S TRANSCENDENTAL ANALYSIS OF EXPERIMENTAL ACTIVITY

Dustin McWherter

ABSTRACT: In this essay I attempt a thorough reconstruction and modification of Roy Bhaskar's "transcendental analysis of experimental activity" to show that this analysis contains a powerful critique of regularity theories of causal laws and a strong case for a transcendental realist, powers-based theory of causal laws. Despite the short and scattered places in which this analysis occurs in Bhaskar's texts, my reconstruction synthesizes these textual resources to formulate a unified analysis of experimentation that derives three distinct conclusions from four presuppositions and a complex of transcendental arguments. These conclusions are: 1) Extra-experimental reality is, to a significant extent, an open system, 2) Causal laws must be distinguished from constant conjunctions of events, and 3) Causal laws are the transcendently real tendencies of generative mechanisms.

KEYWORDS: Ontology; Causality; Science; Experiment; Critical Realism; Bhaskar

§1. INTRODUCTION

Perhaps the most prominent feature of Roy Bhaskar's early work in the philosophy of natural science is the claim that *ontology is inexorable*, which was advanced in opposition to the anti-metaphysical orthodoxy in the philosophy of science established by logical positivism. However, Bhaskar offers two different ways of justifying this claim. The first, which I have written on elsewhere¹, argues that the attempt to avoid ontology with a purely epistemological account of science unwittingly generates an *implicit* ontology. The most frequent target of this argument is the "empirical realist" approach to causal laws, which originated in Hume and is represented in the

¹ See §2.2 of Dustin McWherter, *The Problem of Critical Ontology: Bhaskar Contra Kant*, 1st ed., Basingbroke, Palgrave Macmillan, forthcoming 2012.

philosophy of science by logical positivism and neo-Kantianism. Bhaskar argues that this approach, which seems to circumvent ontology by analysing causal laws as regular sequences of perceived events, is actually committed to an ontology, namely, one consisting of such events². In other words, the anti-ontological philosopher of science implicitly presupposes what s/he explicitly denies: ontology.

However, whereas the general point of the foregoing argument is that any philosophy of science must contain some sort of ontology, Bhaskar's second way of arguing for the inexorability of ontology—which is the focus of this essay—contends that a particular ontology is necessary to accommodate scientific experimentation³. To make this case, Bhaskar offers an analysis which seeks the conditions that make the activity of experimentation an *intelligible* activity. Because of its concern with conditions of intelligibility and its use of transcendental argumentation to determine them, Bhaskar calls this analysis the “transcendental analysis of experimental activity”. The ultimate conclusion of this analysis is that only a non-regularity, powers-based theory of causal laws can sustain the intelligibility of experimentation. Therefore, this analysis is at the same time a critique of non-powers-based, regularity theories of causal laws—i.e., those that, like empirical realism, conceive of causal laws in terms of constant conjunctions of events⁴. To the extent that the regularity theorist concedes the presuppositions of Bhaskar's analysis (given below in §2), that critique is an internal one. However, Bhaskar does not grant any authority to the Humean

² Cf.: “Now it is clear that any theory of the knowledge of objects entails some theory of the objects of knowledge; that every theory of scientific knowledge must logically presuppose a theory of what the world is like for knowledge, under the descriptions given it by the theory, to be possible. Thus, suppose a philosopher analyses scientific laws as, or as dependent upon, constant conjunctions of events, he or she is then committed to the view that there *are* such conjunctions” (Roy Bhaskar, *Reclaiming Reality: A Critical Introduction to Contemporary Philosophy* (hereafter RR), 1st ed., London, Verso, 1989, p. 13) and “the general line of Hume's critique of the possibility of any philosophical ontology or account of being, and in particular his denial that we can philosophically establish the independent existence of things or operation of natural necessities, is accepted. Now it is important to see what Hume has in fact done. He has not really succeeded in banishing ontology from his account of science. Rather he has replaced the Lockean ontology of real essences, powers and atomic constitutions with his own ontology of impressions. (...) The empiricist fills the vacuum he creates with his concept of experience. In this way an implicit ontology, crystallized in the concept of the empirical world, is generated” (Roy Bhaskar, *A Realist Theory of Science* (hereafter RTS), 2nd ed., London, Verso, 1978, p. 40)

³ Cf. Roy Bhaskar and Alex Callinicos, “Marxism and Critical Realism: A Debate”, *Journal of Critical Realism*, Vol. 1, No. 2, 2003, p. B99, where Bhaskar (barely) distinguishes these two arguments. (This text is the transcription of a live debate that took place between Bhaskar and Alex Callinicos. Consequently, I have inserted a “B” or “C” before the page number in each citation of this text to indicate that the passage represents the words of Bhaskar or Callinicos, respectively.) Also cf. RTS 39-40.

⁴ In this essay I will use “regular sequences of events” and similar phrases synonymously with “constant conjunctions of events”.

sceptical problematization of natural necessity, in which most regularity theories have their historical basis. In fact, one of the upshots of Bhaskar's analysis is that if experimentation is adequately analysed in the first place, such scepticism need never arise⁵.

Hence it could be said that while Bhaskar argues that the empirical realist theory of causal laws is indeed *ontological*, the transcendental analysis of experimental activity entails that that theory is also *false*. Thus it is important to recognize that, although its arguments have a narrower focus, the transcendental analysis of experimental activity is the more potent (and more sophisticated) response to the positivist ban on metaphysics. Not only does it seek to refute the empirical realist theory of causal laws and justify an ontology of causal powers, but it does so on the basis of presuppositions that the empirical realist would accept and with respect to that facet of natural science in which sense-experience is so epistemically significant. In this way the positivist ban on metaphysics is shown to collapse in the impossibility of accounting for the intelligibility of experimentation without an ontology of causal powers, and the validity of a naturalistic metaphysics is secured. By establishing a general ontology of causal powers that does not depend upon any particular scientific theory⁶, Bhaskar's analysis shows that a philosophical discourse on nature is still possible, while it is the positivist project of eliminating the metaphysics of nature that must be deemed illegitimate.

In this essay I will reconstruct the transcendental analysis of experimental activity from the variety of texts and forms in which it occurs. I think a rigorous reconstruction of Bhaskar's analysis is very much needed to demonstrate its philosophical force, for wariness towards its arguments is a natural consequence of the often gnomic and enthymematic character of Bhaskar's articulation of them. In the secondary literature, both Andrew Collier⁷ and Ruth Groff⁸ have adequately conveyed the general thrust of the analysis in their respective works, but I think more detail is needed. As I reconstruct it, the transcendental analysis of experimental activity consists of four presuppositions regarding the nature of experimentation (§2) and a complex of transcendental arguments toward three distinct conclusions that collectively propose the conditions of the intelligibility of experimental activity

⁵ Cf. RTS 24 and Roy Bhaskar, *The Possibility of Naturalism* (hereafter PN), 3rd ed., Abingdon, Routledge, 1998, pgs. 9 and 14.

⁶ See Bhaskar's distinction between "philosophical" and "scientific" ontologies, e.g., at RTS 29-30.

⁷ Andrew Collier, *Critical Realism: An Introduction to Roy Bhaskar's Philosophy* (hereafter Collier), 1st ed., London, Verso, 1994.

⁸ Ruth Groff, *Critical Realism, Post-positivism and the Possibility of Knowledge*, 1st ed., New York, Routledge, 2007.

(expounded below in §3). I should point out that, at least as far as I am aware, the exact logical structure of the whole transcendental analysis of experimental activity as I present it here is not explicit in any of Bhaskar's texts or those of his expositors. Moreover, in some cases it conflicts with previous presentations and reconstructions, particularly at points where I think the formulation of the arguments needs improvement.

For example, at one point Bhaskar mentions two premises for an argument that I present in §3 as the argument for the second conclusion of the analysis⁹. Furthermore, these two premises are basically what I present in §2 as the first two presuppositions of the analysis as a whole, with the important difference that in Bhaskar's text they characterize experimentation as an "interference" and "disruption" of the course of nature. At another point, Bhaskar mentions three epistemically significant points of interest emphasized by empirical realism (and which he subsequently turns against the latter), one of which is the extra-experimental application of laws discovered through experimentation¹⁰. And at yet another point, Bhaskar claims, against Alex Callinicos, that in RTS he begins with the widely accepted premises of the significance of experimental activity and applied activity and that the open/closed system distinction is grounded in the premise that scientists "intervene" in the world when experimenting, which premise is supposedly widely accepted as well¹¹.

Now it should be clear from my reconstruction of the transcendental analysis of experimental activity that I do not fully accept any of these characterizations of that analysis's logical structure. This is mainly because I do not think there is any need to *begin* with the notions of extra-experimental application or intervention in nature since they can be derived in the course of the analysis, properly reconstructed. (In §3 I will

⁹ "It should be stressed that the result that there is an ontological distinction between causal laws and patterns of events depends upon only two premises: (i) that men are causal agents capable of interfering with the course of nature and (ii) that experimental activity, the planned disruption of the course of nature, is a significant feature of science" (RTS 54).

¹⁰ "Empirical realists have seized on (1) experimental establishment, (2) knowledge and (3) practical application of laws as of prime epistemic significance in science. For this tradition empirical regularities or instrumental successes are at least necessary (transcendental idealism) and perhaps sufficient (classical empiricism) conditions for causal laws and other items of general or instrumental, i.e. implicitly general, knowledge; and causal laws etc. are analysed as dependent upon, or just as, constant conjunctions of events (or states of affairs) perceived or perceptions. By contrast, for transcendental realism an ontological distinction between causal laws and patterns of events is a condition of the intelligibility of (1)-(3). If this can be shown, then an immanent refutation of the Humean and Kantian orthodoxies and a transcendental vindication of ontology will have been obtained" (Roy Bhaskar, *Scientific Realism and Human Emancipation* (hereafter SRHE), first published by Verso (1986), Abingdon, Routledge, 2009, p. 27).

¹¹ Bhaskar/Callinicos, "Marxism and Critical Realism: A Debate", pp. B97-9.

show how they arise in the complex argument for the third conclusion of Bhaskar's analysis.) Furthermore, I hope it is also clear that my reconstruction as a whole can function as a response to Callinicos's criticism that Bhaskar's analysis *begins* with a contentious interpretation of experimentation¹². Again, though, it is easy to see how Callinicos and others can get these kinds of impressions, given the nature of Bhaskar's writings, and so it is easy to see why a thorough reconstruction of the analysis's arguments is needed.

§2. THE PRESUPPOSITIONS

The first presupposition of Bhaskar's analysis is that experimentation is a significant and intelligible feature of natural science. This claim is rarely contested and so seems uncontroversial as a presupposition. *How* experiments are significant in science, on the other hand, is a more contentious matter of debate which Bhaskar's analysis problematizes and attempts to resolve, as we shall soon see. The second presupposition is that humans (qua scientists) initiate the sequences of events that are experienced in an experiment. For example, when event A is followed by event B in an experimental setting, this sequence owes its occurrence in this particular case to the involvement of the experimental scientist(s). In the end, though, this presupposition just points out the rather obvious fact that experimental settings are *constructed* and experiments themselves are *executed*, such that the generation of the conjunctions of events to which experiments afford experiential access are due to this construction and execution by humans¹³. This too seems an uncontroversial presupposition. The third presupposition of Bhaskar's analysis is that constant

¹² "Bhaskar (...) seeks to establish an account of the structure of the world based on an interpretation, not (explicitly, at least) of the *content* of scientific theories, but on an interpretation of scientists' practice: thus his transcendental argument moves from the claim that scientific experimentation involves the creation of 'closed systems' in which events form a uniform sequence to the inference that the mechanisms that are thereby revealed exist independently of human activity and, further, that, in their 'natural' state, they form, with other mechanisms, an 'open system' where the result of their interactions produce perceptible effects very different from those isolated in experiment. (...) The difficulty with this is that the starting point of this argument is precisely an *interpretation* of what scientists do: it is open to others to contest this account of scientific practice and to offer their own rival interpretations. It would seem better to strip away the transcendental superstructure that obscures what is interesting and original in Bhaskar's work and offer it simply as a philosophical presentation of the world as revealed to us by the sciences." (Alex Callinicos, *The Resources of Critique*, 1st ed., Cambridge, Polity Press, 2006, p. 159); "without the distraction offered by Bhaskar's account of scientific practice (which arguably presupposes the distinction that he is seeking to establish), we can directly consider the strengths and weaknesses of his ontology compared to those offered by others" (ibid 160). Cf. Bhaskar/Callinicos, "Marxism and Critical Realism", pp. C92-3.

¹³ What I am here calling the "construction" and "execution" of an experiment is basically what Bhaskar eventually dubs "experimental control" and "experimental production". See RTS 53 and 256.

conjunctions of events prevail (or at least *can* prevail) in experiments. (Incidentally, this is what makes experimental settings, by definition, “closed systems”, in Bhaskar’s terminology, for this term should initially be understood to denote just any domain wherein constant conjunctions abound¹⁴.) The *constancy* of conjunctions in experimental settings is perhaps just an index of the *repeatability* of experiments¹⁵, which itself perhaps follows from the constructed character of experiments. Finally, the fourth presupposition of Bhaskar’s analysis is that the constant conjunctions of events exhibited in experiments in some way afford epistemic access to causal laws, however the latter may subsequently be conceived.

It is worthwhile to keep these assumptions in mind in what follows, for insofar as they are presuppositions of the transcendental analysis of experimental activity one can refuse to grant any or all of them and be free from the conclusions of the analysis. And if the analysis is sound one *must* reject them to be free from the conclusions¹⁶. Consequently, posing a substantive challenge in that case would require explaining how experiments are not intelligible or significant in science, how experimental sequences do not require human activity, how experiments do not exhibit regularities of sequences, and/or how the regularities of sequences exhibited in experiments have no bearing on our knowledge of causal laws. Such explanations cannot be ruled out *a priori*, of course (and they may or may not have their own presuppositions that shift the burden up a level), but I will say nothing more about them here. Any remaining disputes will have to concern the analysis itself, to which I will now turn. In each of three cases, I will first state a conclusion of the analysis, thoroughly explicate it so that what is being argued for is clear, and then proceed to the argument(s) for that conclusion.

§3. THE ARGUMENTS

Given the foregoing presuppositions, Bhaskar contends that the conditions of the intelligibility of experimental activity are the following.

1. *Extra-experimental reality is, to a significant extent, an open system.* This claim should be interpreted quite parsimoniously at first. That is, at this point in the argument,

¹⁴ Cf. *ibid* 70 and SRHE 27. The reason why I say this term should be “initially” understood in this way is that the notion of a “closure”, and what it means to construct a closed system, will eventually take on greater significance, and will be shown to be enriched *in the course of* Bhaskar’s analysis, not at the beginning of it.

¹⁵ Cf. Collier 33-4.

¹⁶ Cf. RTS 260 and Bhaskar/Callinicos, “Marxism and Critical Realism”, pgs. B97 and B98.

“extra-experimental reality” should be understood just as the domain of that which is outside experimental settings and which we experience as such. Furthermore, by “open system” Bhaskar just means any domain wherein “no constant conjunction or regular sequence of events is forthcoming” (RTS 33)¹⁷. Therefore, to say that extra-experimental reality is, to a significant extent, an open system is just to say that constant conjunctions or regular sequences of events do not, to a significant extent, prevail outside experimental settings. Any further characteristics that may pertain to extra-experimental reality—e.g., whether it exists independently of our experience of it or not, whether it is undifferentiated, structured, or whatever—are not yet at issue here and so remain (as of now) undetermined.

Now, the reason why the open-systematic character of extra-experimental reality is a condition for the intelligibility of experimental activity is that there would be *no reason* to construct the settings for an experiment and repeatedly initiate sequences of events if those same sequences could be consistently registered *without* experiments—i.e., if extra-experimental reality exhibited relatively abundant regularities of sequences. In other words, the experimental initiation of a sequence A-B would be redundant if A were *always* followed by B (rather than A-C, A-D, C-B, etc. sometimes occurring) outside experimental settings. Consequently, if the initiation of constant conjunctions of events in experimental settings is not an exercise in superfluity, then *it must give us something that we did not already have*. Bhaskar complains that “The weakness of previous analyses of experimental activity is that they have not appreciated the significance of the fact that conjunctions of phenomena have to be worked for practically” (RTS 54). To begin to understand that significance, we must ask *why* those conjunctions are worked for practically in experiments rather than just passively observed. The answer, again, is that extra-experimental reality, whatever else it may be, cannot be relied upon to regularly display the sequences of events scientists produce in experimental settings¹⁸. And to say that extra-experimental reality cannot be counted on to exhibit the constant conjunctions of events that experiments do is just to say that extra-experimental reality is to a considerable degree an open system. Any conclusion to the contrary makes the experimental initiation of sequences of events a dispensable and arbitrary facet of natural science. If we could just passively observe constant conjunctions outside experimental settings we would not need to initiate them within experimental settings, and so the fact that we do initiate them in

¹⁷ Basically the same is said at RTS 13, PN 9, SRHE 27, and RR 16. Cf.: “in open systems the instantiation of the antecedent of a lawish statement is by definition not invariably accompanied by the realisation of the consequent” (SRHE 28) and “the criterion of open-ness is the non-invariance of empirical relationships” (RTS 132).

¹⁸ Cf. RTS 33 and 53, SRHE 27 and 28, RR 51, Collier 47, and Groff, *Critical Realism, etc.*, p. 33.

experiments entails that we do not normally observe (or otherwise access) them without experiments if that initiation is to be explicable. Thus the “significant extent” to which extra-experimental reality is an open system is commensurate with the extent to which experimental activity is non-redundant. In short, “It is (...) the ubiquity of open systems in nature¹⁹ that makes necessary an experimental rather than a merely empirical science” (ibid 91).

Furthermore, if the intelligibility of experimental activity requires that the constant conjunctions of events initiated in experiments are not arbitrary replicas of extra-experimental reality, then, by the same token, they should not be arbitrary departures from it either. In other words, the question as to why constant conjunctions of events have to be initiated in experiments rather than passively observed in extra-experimental reality points to the larger question of why and how such constant conjunctions are significant *at all*. Extra-experimental reality being an open system may condition the intelligibility of the experimental *initiation* of regular sequences of events, but this cannot alone condition the intelligibility of the sequences themselves. This leads to the second conclusion of Bhaskar’s analysis:

2. *Causal laws must be distinguished from constant conjunctions of events.* That is, causal laws cannot consist in (necessarily or contingently) invariant relations between events. Bhaskar, like the empirical realist, maintains that the significance of the constant conjunctions of events in experiments is that they afford epistemic access to causal laws. However, unlike the empirical realist, Bhaskar contends that these *empirical grounds* for our knowledge of causal laws must be distinguished from causal laws themselves. It should be noted that this conclusion makes a negative claim about causal laws since it only states what causal laws are *not*, and it is complemented by a further conclusion that makes a positive claim about what causal laws are instead (the third conclusion of Bhaskar’s analysis as I am reconstructing it). I will first present the argument for the second/negative conclusion and then proceed to the third/positive conclusion and its supporting argument, but here I just want to flag in advance the fact that the positive conclusion does much of the work of the negative conclusion insofar as that which the former identifies with causal laws is *not* regular sequences of events, such that an analytic consequence of the positive conclusion is that causal laws are not regular sequences of events (i.e., the negative conclusion). Nevertheless, the respective arguments toward these two conclusions are distinct, and the argument for the negative conclusion is not superfluous insofar as it adds to the case against regularity theories of causal laws.

¹⁹ I.e., extra-experimental reality.

To proceed to that argument, the reason why causal laws cannot consist in regular sequences of events is that if that were the case the experimental initiation of such a sequence would take on an ontogenetic function that nullifies the sequence's epistemic significance. For example, in being responsible for the occurrence (and reoccurrence) of the sequence A-B in experimental settings, the experimental scientist would be responsible for the *existence* of a causal law: e.g., either the law that A has always been followed by B or the law that if A occurs B necessarily follows. In that case, an experiment would not just *discover* causal laws, it would actually *generate* them, for if causal laws consist in regular sequences of events, and scientists are capable of initiating the latter in experiments, then it would follow that scientists are capable of generating causal laws: "Notice that as human activity is in general necessary for constant conjunctions, if one identifies causal laws with them then one is logically committed to the absurdity that human beings, in their experimental activity, cause and even change the laws of nature!" (PN 9)²⁰. This would endow scientists with a considerable power to determine what causal laws exist, but the real problem is that this would be a power whose exercise would be arbitrary and unconstrained enough to make it epistemically worthless. That is, if scientists produced causal laws when initiating sequences of events, there would be *no (epistemic) reason* for them to initiate a regular sequence *rather than not*. Why *must* they do so? Just as the ubiquity of constant conjunctions of events in extra-experimental reality would render the same ubiquity produced in experimental settings redundant, so the assimilation of causal laws to constant conjunctions of events would render the experimental initiation of the latter groundless. The *interrogatory* dimension of experimentation would be lost, because experiments would not be *inquiries* into causal laws but rather *productions* of them.

The only way to avoid these consequences, Bhaskar insists, is to distinguish causal laws and constant conjunctions of events²¹. In their initiation of regular sequences of events, scientists are responsible for the occurrence of something that allows causal laws to be known but which, for that very reason, cannot be the laws themselves: "what scientists produce in laboratories are not the laws of nature, but their *empirical grounds*; and it is upon the elision of the ontological distinction between them that the empirical realist account tacitly depends" (SRHE 28, emphasis added). This distinction is "ontological" because it concerns what constant conjunctions of events and causal laws *are* (and are not), and by differentiating causal laws from their empirical grounds it entails that the ontological (causal laws) cannot be reduced to or conflated with the epistemological (empirical grounds).

²⁰ Much the same is said at RR 15-6.

²¹ Cf. *ibid* 39-40, RTS 12, 33 and 54, and Groff, *Critical Realism, etc.*, p. 33.

For additional support of this negative conclusion Bhaskar notes some further consequences that follow from the identification of causal laws and constant conjunctions of events. These concern the disruption of sequences of events in extra-experimental reality and human error in the construction and execution of experiments. The basic point is that if causal laws consist in regular sequences of events, then these situations would entail the extreme fragility, or even the outright nonexistence, of many causal laws—consequences which regularity theorists would presumably want to resist. To use Bhaskar’s examples, we would not suppose that Newton’s laws of motion—which, together with his law of universal gravitation, explain how the planetary bodies maintain their regular orbital patterns—would be *defied* if a nuclear explosion destroyed Earth, thereby terminating its regular orbit around the sun. Similarly, we would not suppose that Einstein’s theory of relativity—which accounts for the precession of Mercury’s orbital pattern—would be *falsified* if something interfered with Mercury’s perihelion²². However, what the above examples allow us to see is that if these Newtonian and Einsteinian laws ultimately consist in regular sequences of events then they *would be* violated or the theories that describe them *would be* refuted in these counterfactual situations, because the latter exhibit serious disruptions in the regularities of the solar system. Such consequences can be avoided if causal laws are distinguished from constant conjunctions of events. Furthermore, Bhaskar argues, any “reasonably intelligent schoolboy or moderately clumsy research worker” (RTS 34) can easily interfere with the execution of the most carefully constructed experiment to a degree that affects the sequence of events the experiment yields²³, but we would not thereby suppose that such a person “*has the power to overturn the laws of nature*” (ibid, emphasis added). To take another example from Bhaskar, one can easily influence sequences of events in experiments that are constructed to test Coulomb’s law, which describes the electrostatic force that electrically charged particles exert on each other over a given distance. One can interfere with the operation of the torsion balance in various ways, e.g., by damaging or restricting the motion of the twisting fibre, or by entering the space between the two electrically charged bodies. In that case, however, we would not suppose that the meddlesome experimenter has the ability to upset *the law itself*, but that would seem to be the implication if causal laws consist in the regular sequences of events that experiments exhibit.

²² RTS 34.

²³ At ibid 34n14 Bhaskar cites J. R. Ravetz’s “4th law of thermodynamics”: “no experiment goes properly the first time”.

Furthermore, Bhaskar argues that similar difficulties arise if one who supports a regularity theory of causal laws maintains that science actually has discovered causal laws, because the fact of irregularities in extra-experimental reality coupled with an identification of causal laws with regular sequences of events results in a considerable impediment to the ubiquity or even the existence of causal laws in extra-experimental reality and/or our knowledge of them. In other words, if there is a considerable amount of irregular sequences of events in extra-experimental reality, as the above argument for the first conclusion of Bhaskar's analysis says there is, then one who identifies causal laws with regular sequences of events must either deny lawfulness to extra-experimental reality or maintain that science has discovered little if any causal laws that are operative in extra-experimental reality²⁴. As Alan Chalmers says, "If the view that laws describe exceptionless regular connections between events is taken seriously, then none of the claims typically taken to be scientific laws would qualify"²⁵. Chalmers takes as an example Galileo's law of fall, which states that bodies, regardless of their weight, drop through the same distance with a uniform acceleration that is proportional to the time of the fall (and which Galileo supposedly²⁶ experimentally established with metallic spheres rolled down an inclined plane). As Chalmers points out, the regularity theory of causal laws would entail the falsity of Galileo's law, for autumn leaves hardly ever fall to the ground with the uniform velocity that Galileo's law says all bodies do²⁷.

In short, if irregularities in extra-experimental reality—which, remember, will be frequent since the latter is largely an open system—do not constitute breaches of causal laws or refutations of theories that posit such laws, and experimental accidents do not exemplify human physical activity's dominion over natural law, then causal laws must be something other than regular sequences of events. Therefore, if the ubiquity or even the existence of causal laws in extra-experimental reality is to be preserved, such laws must be distinguished from the regularities in experiments that are their empirical grounds. As George Molnar aptly summarizes the matter, "Regularity may be a significant guide in the search for causes, but it is not constitutive of causation. Hume's great idea was born from, and in turn reinforced, a

²⁴ Cf. PN 10, RR 16, and SRHE 28-9.

²⁵ A.F. Chalmers, *What is This Thing Called Science?*, 3rd ed., Maidenhead, Open University Press, 1999, p. 215. In Chalmers's vocabulary, "causal laws" are opposed to "regularities" since the former term is reserved for laws that are based in causal powers and the latter term refers to relations between events that have no such basis, whereas I am construing regularity theories of laws as theories of causal laws (i.e., ones that do not posit real causal powers at the basis of laws).

²⁶ See *ibid* 99 and 152-3.

²⁷ *Ibid* 215. Cf. RTS 14-5 and 119, RR 149, and Collier 34.

tangled mixture of epistemology and metaphysics that we are still trying to unravel to this day”²⁸.

So far my reconstruction of Bhaskar’s analysis has argued that causal laws are not regular sequences of events, but it remains to be seen what they are instead. It has also been argued that a regularity theory of causal laws cannot manage the largely open-systematic character of extra-experimental reality or account for the epistemic significance of constant conjunctions of events in experiments, but it remains to be seen what theory of causal laws can. The latter question is dealt with in the argument toward the third conclusion of Bhaskar’s analysis, and the former question is answered in the conclusion itself:

3. *Causal laws are the transcendently real tendencies of generative mechanisms.* To say that causal laws are “transcendently real” is to say that they exist independently from the conceptual (e.g. theories, concepts, and propositions), perceptual (e.g., observation of experimental and extra-experimental reality), and practical/material (e.g., construction and execution of experiments and technological augmentation of perception) conditions that enable them to be identified by humans²⁹. This is the central claim of Bhaskar’s *transcendental realism*, “which may be defined as the thesis that the objects and relations of which knowledge is obtained in the social activity of science both exist and act independently of human beings (and hence of human sense-experience)” (RR 197n80)³⁰. Hence Bhaskar’s use of counterfactuals to illustrate the kind of scientific realism his position entails:

We can easily imagine a world similar to ours, containing the same intransitive objects of scientific knowledge, but without any science to produce knowledge of them. In such a world, which has occurred and may come again, reality would be unspoken for and yet things would not cease to act and interact in all kinds of ways. In such a world the causal laws that science has now, as a matter of fact, discovered would presumably still prevail, and the kinds of things that science has identified endure. The tides would still turn and metals conduct electricity in the way that they do, without a Newton or a Drude to produce our knowledge of them. The Wiedemann-Franz law would continue to hold although there would be no-one to formulate, experimentally establish or deduce it. Two atoms of hydrogen would continue to combine with one atom of oxygen and in favourable circumstances osmosis would continue to occur. In

²⁸ George Molnar, *Powers: A Study in Metaphysics*, 1st ed., Oxford, Oxford University Press, 2003, p. 188. Cf. RTS 140.

²⁹ Cf. *ibid* 186, SRHE 47, RR 17 and 149, and Roy Bhaskar, *Philosophy and the Idea of Freedom* (hereafter PIF), 1st ed., Oxford, Blackwell, 1991, p. 8.

³⁰ Cf. SRHE 5.

short, the intransitive objects of knowledge are in general invariant to our knowledge of them³¹: they are the real things and structures, mechanisms and processes, events and possibilities of the world; and for the most part they are quite independent of us. They are not unknowable, because as a matter of fact quite a bit is known about them. (Remember they were introduced as objects of scientific knowledge.) But neither are they in any way dependent upon our knowledge, let alone perception, of them. They are the intransitive, science-independent, objects of scientific discovery and investigation. (RTS 22)³²

Now, what does it mean to say that causal laws are the “tendencies” of “generative mechanisms”? Let us take generative mechanisms first. According to Bhaskar, “There is nothing esoteric or mysterious about the concept of the generative mechanisms of nature, which provide the real basis of causal laws. For a generative mechanism is nothing other than *a way of acting* of a thing” (RTS 51, emphasis added)³³. As straightforward as this characterization is, further explication of this concept of a “way of acting” is possible and useful. As a way of *acting*, a particular generative mechanism is responsible for a particular kind of *action* which can in turn have a particular kind of *effect* if that action is unimpeded. In other words, when something *acts* (unimpeded) something else *happens*, and that something else is an *event* generated by the action³⁴. Hence *the way something acts* is essentially linked to *what something can do*. Crucially, though, a way of acting can be ascribed to a thing that does not *always* act in that way, because what something *can do* is distinct from what something *will do, is doing, or has done*. For example, considering Galileo’s law of fall again, bodies fall to the ground with uniform acceleration in the same amount of time. This is a way they can act, and the way specific ones (metallic spheres) did act when rolling down Galileo’s inclined planes. And so the generative mechanism in this case would be the property of bodies that enables them to fall with uniform acceleration in the same amount of time, namely, their susceptibility to another generative mechanism: the earth’s gravitational pull. However, they need not continue to act this way for this way of acting to be attributed to them, and thus for the law to apply to them. This is because the law of fall fundamentally concerns what they can do, and will do under certain circumstances, but not necessarily what they always do (though there may be mechanisms that are always active).

³¹ This is precisely what makes them “intransitive”. Cf. RTS 21-2 for Bhaskar’s introduction of the transitive/intransitive distinction. For the purposes of the present essay at least, it would suffice to say that “intransitive” is tantamount to “transcendentally real”.

³² Cf. *ibid* 27 and 47-8.

³³ Much the same is said at *ibid* 14.

³⁴ Cf. PIF 7 and Collier 43.

Consequently, a generative mechanism can also be characterized as a *power*, for a power is something that can be *possessed without being exercised*³⁵. As Collier says, “To say that there are unexercised powers is only to say that ‘can’ does not equal ‘does’” (Collier 9). More specifically, a generative mechanism can be characterized as a power (hence “mechanism”) to produce (hence “generative”) certain effects and thus as a *causal power*: “reference to causal laws involves centrally reference to *causal agents*; that is, to things endowed with causal powers. On this interpretation then the generative mechanisms of nature exist as the causal powers of things” (RTS 49-50)³⁶. It is for this reason that Bhaskar also describes a generative mechanism as “a ‘real something’ over and above and independent of patterns of events” (ibid 49), for it is responsible for the generation of certain events yet irreducible to them. (Furthermore, I should note that, as some of the passages quoted above show, Bhaskar often says generative mechanisms are “of things”, but whether generative mechanisms “inhere in” things distinct from them as their properties or are somewhat “ontologically autonomous”, so to speak, is not, as far as I can tell, decided by the transcendental analysis of experimental activity, which is probably a virtue since contemporary physics arguably shows both cases to pertain³⁷. Accordingly, my exposition of this part of Bhaskar’s analysis is intended to be abstract enough to allow both cases and will not offer any detailed discussion of the concept of a “thing” for that reason³⁸.)

³⁵ Cf.: “‘Power’ is a non-technical term, designating what something can do” (Collier 62).

³⁶ Cf.: “Bhaskar’s contention is that laws do not refer to such sequences at all, but rather to underlying causal mechanisms—that is, to *the powers of real entities to effect change*” (Groff, *Critical Realism, etc.*, pp. 34-5, emphasis added), “A mechanism in this sense is not necessarily mechanical in the sense of Newtonian mechanics. It could be an animal instinct, an economic tendency, a syntactic structure, a Freudian ‘defence-mechanism’” (Collier 43), and “A generative mechanism, we might say, is that aspect of the structure of a thing by virtue of which it has a certain power. For example, that aspect of the structure of an oxygen atom by virtue of which it can combine with two hydrogen atoms to form a molecule of water; that aspect of a DNA molecule by virtue of which it can replicate itself; that aspect of a market economy by virtue of which it can go into an overproduction crisis; that aspect of a person’s brain-structure by virtue of which he or she can acquire language” (ibid 62).

³⁷ Cf. Bhaskar’s remarks at RTS 180 regarding those moments in scientific discovery when it is not clear whether a causal power has a non-power ontological base or not. Also see Molnar, *Powers*, pp. 125-42 for a defence (completely independent from Bhaskar’s work) of the metaphysical possibility of “ungrounded powers” on the basis of the (actual) *a posteriori* discovery and (at least apparent) nature of subatomic particles.

³⁸ One noteworthy facet of Bhaskar’s conception of things is that it cannot be assimilated to the common sense conception: “Now the things posited by science in its investigations may be quite recondite and abstract with respect to our ordinary experience. It is wrong to think of them as necessarily like material objects—they may be powers, forces, fields, or just complex structures or sets of relationships. Their metaphysical character, which justifies us labelling them as ‘things’ to mark their insusceptibility to analysis as ‘events’ or ‘experiences’, lies in their persistence and transfactual activity” (RTS 226); “The

Finally, we are now in a position to understand Bhaskar's conception of a tendency. First, to say that causal laws are the *tendencies of* generative mechanisms is not to say that causal laws (as tendencies) are "properties" or "attributes" of generative mechanisms, which are their "bearers" (in the way that generative mechanisms might be properties of things, for example). Rather, it is to say that causal laws consist in generative mechanisms *qualified in a certain manner*. The concept of a tendency is a *modification* of the concept of a generative mechanism. With the concept of a generative mechanism or a causal power we understand something that can be exercised or manifest but can just as well exist unexercised or unmanifest. With the concept of a tendency, however, Bhaskar intends to re-describe generative mechanisms in a manner that highlights the additional possibility of their exercise being *unfulfilled* (usually owing to the influence of countervailing factors)³⁹: "whereas powers are potentialities which may or may not be exercised, tendencies are potentialities which may be exercised or as it were 'in play' without being realized or manifest in any particular outcome" (RTS 50)⁴⁰. In short, the notion of a tendency is intended to designate a generative mechanism that not only actualizes a certain effect or manifests itself in a certain way but can also be exercised without its effect being actualized and be real without being exercised at all: "Tendencies may be possessed unexercised, exercised unrealized, and realized unperceived (or undetected) by men" (ibid 184)⁴¹.

As Bhaskar notes, it may feel strange to ascribe a tendency to a physical thing, whereas in the case of human behaviour the notion of a tendency is quite clear⁴². For example, a kleptomaniac has the tendency to steal whether or not s/he is actually stealing something, and that tendency is exercised unfulfilled when s/he is arrested for attempted shoplifting⁴³. A moment's consideration will show, though, that it is not difficult to conceive of non-human phenomena in terms of tendencies. Galileo's law

class of 'things' is far wider than that of 'material objects': it includes fluids, gases, electronic structures, fields of potentials, genetic codes, etc.; so we must try to divest the concept of its normal material object connotations" (ibid 98-9).

³⁹ Cf. Collier 63. In the Appendix to chapter 3 of RTS Bhaskar introduces further specifications of the concept of tendency, leading to a distinction between "tendency₁" and "tendency₂". However, see Collier 124-5 for what I think is a convincing critique of Bhaskar on this point, which argues that the proposed distinction does not hold up.

⁴⁰ This passage may give the misleading impression that tendencies should be distinguished from powers when it is actually extending the concept of powers. Cf.: "Tendencies may be regarded as powers or liabilities of a thing which may be exercised without being manifest in any particular outcome" (RTS 14) and the passage from ibid 184 quoted below.

⁴¹ Cf. ibid 18, 50, and 229, PN 9, SRHE 34, RR 16, and Collier 37.

⁴² RTS 99.

⁴³ Cf. ibid 232-3 and Collier 37.

of fall will help us once again. Bodies have the *tendency* to fall to the earth with uniform velocity. This tendency is exercised and fulfilled in metallic spheres on Galileo's inclined planes; it is exercised unfulfilled in autumn leaves that fall to the ground irregularly due to the disturbing influences of air-resistance and winds; it is possessed unexercised when such objects are not falling at all (and hence the *enabling conditions* of the tendency's exercise are not present)⁴⁴.

Now to the argument for the third conclusion of Bhaskar's analysis, which is complex and draws on the arguments for the previous two conclusions. *Firstly*, the fact that the experimental initiation of constant conjunctions of events gives us something that extra-experimental reality does not (argument for the first conclusion), and does so for an epistemic reason (fourth presupposition), entails that those constant conjunctions of events be *significant with regard to extra-experimental reality*. In other words, given that passive observation of extra-experimental reality alone is insufficient to empirically identify causal laws while the regular sequences of events in experiments are initiated in response to this insufficiency but are not causal laws themselves (this follows from the arguments for the first and second conclusions taken together), the epistemic value of experiments *must extend beyond experimental settings*. Whatever of significance we gain from experiments must be in some way *applicable* to extra-experimental reality if experimental activity is to be intelligible, for experiments are obviously only pursued because we cannot get by without them, and the fact that we cannot get by without them already implies that they have some relation to what is by definition outside them: extra-experimental reality. They are constructed in response to circumstances that exceed them, and this, along with the fact that experimental sequences constitute only the empirical grounds for causal laws, entails that the relation between experiments and extra-experimental reality is of *epistemic* import⁴⁵. Furthermore, if this were not the case, experiments would be so *insular* as to be epistemically worthless, for—unless we allow experimental settings to exhaust our conception of nature (and if we did we would then have to explain, or explain away, extra-experimental reality)—experiments could not allow us access to laws *of nature* if they did not resonate into extra-experimental reality. Therefore, it is a condition of the intelligibility of experimental activity that experimental results be applicable to extra-experimental reality, for an experiment “is *epistemically significant* to the extent that the causal law it enables us to identify and test holds outside and independently of

⁴⁴ Cf. Chalmers, *What is this Thing Called Science?*, pgs. 216 and 218. Also cf.: “It is not true of every water-soluble thing that it dissolves when immersed in water, it is not true of every fragile thing that it breaks on being lightly knocked, etc.” (Molnar, *Powers*, p. 87).

⁴⁵ Cf. Groff, *Critical Realism, etc.*, p. 12 and Collier 34-5.

the experiment” (SRHE 28)⁴⁶. (Notice that if the extra-experimental applicability of experimental results is taken as a premise, an alternative argument for the second conclusion of Bhaskar’s analysis can be derived, as Groff and Bhaskar have shown⁴⁷.)

Secondly, there must be some *common basis for causal laws* between experimental sequences and extra-experimental reality that provides the link between experimental sequences and extra-experimental reality, thereby enabling the application of the former, as the empirical grounds for causal laws, to the latter. Furthermore, since extra-experimental reality is to a significant extent an open system while an (adequately constructed) experimental setting is not, the link between them must be based in something that is distinct from, yet compatible with, regular *and* irregular sequences of events. In other words, it must allow causal laws to obtain in closed and open systems alike since it conditions the link between them. Consequently, it cannot be limited to regular sequences of events, since this would forbid application to the open-systematic facets of extra-experimental reality, or irregular sequences of events, since this would exclude experimental results. Crucially, though, it must equally be distinct from sequences of events *tout court* if the epistemic significance of the extra-experimental application of experimental results is to be sustained. That is, it cannot consist in something like “sequentiality itself” or “relations between events in general” either. Even though the latter would be general enough to encompass regular and irregular sequences of events, it can only do so at the cost of depriving experimental sequences of a rationale. If bare sequentiality were the common basis for causal laws between experiments and extra-experimental reality, then an experiment’s regular sequence of events *would not give us anything more in the way of causal laws* than passive observation of open-systematic phenomena in extra-experimental reality would. This is because the latter’s irregular sequences of events instantiate bare sequentiality just as well as an adequately constructed experiment’s regular sequences of events does,

⁴⁶ Cf. RTS 33.

⁴⁷ “This belief, however—that experiments can tell us something about what the world is like *outside* the experimental setting—presupposes that while scientists do (and in general must) actively induce regularities, they do not thereby produce the *causes* of such regularities. If such a presupposition were not in place, and instead experimenters were thought to produce not just regular conjunctions but the laws governing such conjunctions, then such laws could not be expected to hold outside experimental settings.” (Groff, *Critical Realism, etc.*, p. 12) and “A sequence of events can only function as a criterion for a law if the latter is ontologically irreducible to the former. (...) But it can now be seen that not only the experimental establishment but the practical application of our knowledge depends upon this same ontological distinction. For unless causal laws persisted and operated outside the context of their closure, i.e. where no constant conjunctions of events obtained, science could not be used in the explanation, prediction, construction and diagnosis of the phenomena of ordinary life” (RTS 65). Cf. *ibid* 34 and SRHE 27.

for they are both (obviously) sequences of events. In other words, bare sequentiality would be *too* general to accommodate extra-experimental application: experimental results could not be applied in an epistemically significant way because they would be superfluous in the first place. Therefore, whatever it is about the basis for causal laws that enables extra-experimental application must be compatible with yet irreducible to relations between events *tout court*.

Bhaskar argues that there is only one remaining option: that there must be “a ‘*real something*’ over and above and independent of patterns of events; and it is for the status of this real something that the concept of a *generative mechanism* is groomed” (RTS 49, emphasis added). A generative mechanism is compatible with yet irreducible to sequences of events, for, as we have already seen, it is a *power* to produce an effect and generate a sequence of events. As such, it is in principle *distinct* from the sequences of events that occur upon actual productions of that effect, and since it can exist without being exercised it is *independent* from those sequences (in the sense that its existence does not depend upon them). As Bhaskar points out, once it is allowed that generative mechanisms are real, it is possible to provide an account of causal laws that does not depend upon regular sequences of events, for the independence of causal laws from regular sequences of events will have its foundation in the independence of generative mechanisms from the sequences of events they produce⁴⁸. Furthermore, generative mechanisms are equally compatible with regular and irregular sequences of events (which is to say that they are equally compatible with open and closed systems). This is because a generative mechanism, as a distinctive causal power to produce a distinctive effect, can operate with *uniform* consequences if its activity is *unimpeded*, and it can operate with *variable* consequences if its activity is *impeded by other generative mechanisms*. Consequently, the existence of generative mechanisms allows us to further explain *why* experimental settings constitute closed systems and extra-experimental reality is largely an open system: in experimental settings generative mechanisms operate uninhibited, and in extra-experimental reality their activity can be offset by the activity of other generative mechanisms.

At this point in Bhaskar’s analysis, we can see that its conception of nature *qua* extra-experimental reality has been significantly enriched. Extra-experimental reality can now be seen to include a multiplicity of generative mechanisms that interact with each other in ways that determine whether or not some or other generative mechanism will bring about its characteristic effect (e.g., the conditions that would enable the operation of a generative mechanism may not be present, a generative mechanism may operate and be counteracted or somehow influenced by a more

⁴⁸ RTS 46.

powerful one, or it may operate uninhibited and bring about its characteristic effect)⁴⁹. Thus Collier notes that one consequence of Bhaskar's analysis is that there must be a multiplicity of generative mechanisms in extra-experimental reality, for if there were only one generative mechanism there would be a naturally closed system and therefore no need to initiate regular sequences of events in experiments to gain epistemic access to causal laws⁵⁰.

Most importantly, though, generative mechanisms being the common basis for causal laws between experiments and extra-experimental reality can ground the epistemic significance of experimental results and their extra-experimental application. That is, according to Bhaskar's analysis, the purpose of initiating constant conjunctions of events in experiments is to study the unimpeded activity of a generative mechanism, and this cannot be achieved without experiments to the extent that the activity of a generative mechanism would otherwise be impeded by the activity of other generative mechanisms or held in abeyance by the absence of enabling conditions. This also explains why experimental scientists need to initiate *regular* sequences of events—that is, why experiments need to be *repeatable*, and why experimental settings need to be *closed systems*—for if the purpose of experiments is to study the unimpeded activity of a generative mechanism, then scientists need to *ensure* that that activity truly is unimpeded and that the experimental sequences of events obtained are characteristic of the particular generative mechanism under study rather than others⁵¹.

This epistemic need to construct closed systems also reveals the sense in which experiments are *interventions* in the course of natural events. Other generative mechanisms have to be excluded from experimental settings and prevented from influencing the ensuing sequences of events that the experimenter(s) initiate. What this means is that scientists, to a significant extent—which is, again, the extent to which experimental activity is intelligible—have to intervene in the course of natural events because the objects of knowledge they seek (in this case, causal laws) are not

⁴⁹ Cf. Callinicos, *The Resources of Critique*, pp. 161-2.

⁵⁰ Collier 45-6.

⁵¹ Cf. Callinicos, *The Resources of Critique*, p. 162, RTS 134, and Collier 33-4. Also cf. Collier's qualifications: "What the experiment does, in short, is to isolate one mechanism of nature from the effects of others, to see what that mechanism does on its own. Of course, that mechanism is not *literally* 'isolated'. There cannot be needles or magnetic fields without a lot of other things as well. But we can know (fallibly, of course, like all knowledge) that other mechanisms are not interfering; we can *neutralize* the effect of other mechanisms, either by the way the experiment is set up (...) or, where a known mechanism other than the one to be tested is unavoidably present, we may be able to determine in what way and how much it is affecting the outcome, and make allowances" (ibid 33). See Molnar, *Powers*, p. 183 for a different view of the repetition of experiments.

immediately apparent in the passively observable flux of events in extra-experimental reality. (In fact, this latter point was already present in embryonic form in the above argument for the first conclusion of Bhaskar's analysis, since that argument contended that the regularity of experimental sequences must provide something that extra-experimental reality to a large degree does not.) As Chalmers says: "Observation of falling leaves will not yield Galileo's law of fall", for example, and so for the most part "it is necessary to practically intervene" with experiments to ascertain causal laws⁵². This is why Bhaskar sympathizes with Marx's claim that "all science would be superfluous if the form of appearance of things directly coincided with their essence"⁵³.

Nevertheless, the key point here is that experimental results can be applicable to extra-experimental reality precisely because generative mechanisms are operable in both the former and the latter. That is, knowledge of generative mechanisms obtained through the regular sequences of events exhibited in experiments can be used to make sense of the irregular sequences of events that result from the interaction of multiple generative mechanisms in extra-experimental reality⁵⁴. Bhaskar's contention is that this is only possible if there are generative mechanisms that "endure" amidst various outcomes of their exercise and between, before, and/or after intervals of their exercise. This is because that "endurance"—which is relative (at least) to the intervals between an instance of the exercise of a generative mechanism in experimental settings and a subsequent instance of that exercise in extra-experimental reality—ultimately provides the link between experiments and extra-experimental reality and conditions the relevance of the former to the latter:

At its [an experiment's—DM] core is the notion that the conditions for the production of a given type of effect can be separated into factors which can be varied independently of one another, so as to reveal the way the factors behave in their natural, i.e. non-experimental, state. The key assumption here is that the entities under study retain their identities (and dispositional powers), whether or not their circumambient conditions are held constant, as in the laboratory, or vary freely, as in extra-experimental reality. (SRHE 35)

Thus it is because Galileo's metallic spheres *retain* their disposition to fall with uniform velocity outside the experimental setup that we can know that their uninhibited behaviour on the inclined planes indicates a generative mechanism that is equally if not solely operative when the spheres fall from heights in less controlled

⁵² Chalmers, *What is This Thing Called Science?*, p. 28. Cf. *ibid* 28 and 216.

⁵³ Karl Marx, *Capital*, trans. David Fernbach, vol. 3, 3 vols., 1st ed., London, Penguin, 1991, p. 956. Cf. Bhaskar/Callinicos, "Marxism and Critical Realism", p. B99.

⁵⁴ Cf. Collier 35.

settings with irregular results. Hence whereas metaphysicians like Molnar advance metaphysical arguments for the existence of powers that are independent from their exercise⁵⁵, Bhaskar's advances the transcendental argument that experimental activity (and particularly extra-experimental application) can only be intelligible if there are causal powers/generative mechanisms that exist over and above their activity.

Moreover, if it is generative mechanisms that are at issue in the relation between experiments and extra-experimental reality, then we can also explain how scientists can initiate the sequences of events that constitute the empirical grounds for causal laws without producing the laws themselves. The experimental initiation of a sequence of events can now be understood as the attempted *activation* of a generative mechanism in relative isolation from others and in the presence of its enabling conditions, so that the mechanism under consideration—*not* the experimenter—produces its characteristic effect and concludes the sequence of events⁵⁶. As Collier argues, an experimenter can force a generative mechanism to operate that was not operating before (or operating with impediments), but that is quite different from bringing them into existence out of nonexistence⁵⁷. If experimentation did the latter, we would be back to the problem posed in the argument for the second conclusion of Bhaskar's analysis: experiments would have an ontogenetic function that nullifies their epistemic value. Again, then, it is a condition of the intelligibility of experimental activity that generative mechanisms exist over and above their activity, for they must pre-exist their actualizations if experiments only activate generative mechanisms instead of bringing them into existence (and they must continue to so exist if experimental results can be applied to extra-experimental reality).

Let us consider an example used by Bhaskar: an experiment designed to test Ohm's law, which concerns the nature of an electrical current passed through a conductor (and specifically, its directly proportional relation to the electric potential and inversely proportional relation to the resistance between two points). In this case the experimenter must on the one hand ensure that the enabling conditions of the relevant generative mechanism of the electric current (i.e., the characteristic way of acting of the current with which Ohm's law is concerned) are satisfied and the mechanism itself activated. So, an electric circuit must be wired and an electric current generated. On the other hand, the experimenter must ensure that the generative mechanism produces its characteristic effect through the sequence of events s/he initiates. So, the experimenter must guarantee that appropriate resistance

⁵⁵ See Molnar, *Powers*, pp. 82-98.

⁵⁶ Cf. PN 171-2 and SRHE 35.

⁵⁷ Collier 36-7.

levels are maintained or that no extraneous magnetic field interferes with the working of the electrical circuit⁵⁸. Therefore, even though the experimenter is responsible for initiating the ensuing sequence of events, for activating the generative mechanism, and (just because of that initiation and activation) for the occurrence of the generative mechanism's characteristic effect in the experiment, s/he cannot be held responsible for the existence of Ohm's law if (and only if) that law has its basis in a generative mechanism that is irreducible to its actualizations.

Finally, however, if generative mechanisms provide the common basis for causal laws between experiments and extra-experimental reality, and experimental sequences provide the extra-experimentally applicable empirical grounds for causal laws, then an adequate conception of causal laws must countenance the difference between a generative mechanism's activity in open and closed systems. That is, if generative mechanisms operate unhindered in experiments but are often hindered in extra-experimental reality, then a causal law cannot be a law that stipulates what a generative mechanism *always* does, for in an open system, where irregularity often holds sway, it does not necessarily always do anything. In other words, the intelligibility of experimental activity requires a conception of causal laws that does not entail their violation (or the falsification of theories that posit them) upon observation of extra-experimental reality⁵⁹. However, the opposite extreme must be avoided as well. Causal laws must reflect *some* constraint on the activity of a generative mechanism, for otherwise experimental sequences of events would be neither informative nor applicable. That is, such sequences would be unable to tell us anything specific about generative mechanisms or the way they operate in extra-experimental reality. Consequently, Bhaskar contends, causal laws must consist in the *tendencies* of generative mechanisms, thereby stipulating the effect(s) a generative mechanism *tends to*—but need not actually or always—produce⁶⁰. Thus even though the actualization of a tendency may result in a sequence of events, it cannot be identified with or reduced to such sequences. It exists over and above them, for it retains its identity amidst various outcomes of its activity—i.e., whether it is actualized or counteracted—and it can exist without such activity since it can be possessed unexercised⁶¹. Thus if causal laws are taken to be the tendencies of generative

⁵⁸ Cf. RTS 53, 53n36, and 256.

⁵⁹ Cf.: “just as a rule can be broken without being changed, so a natural mechanism may continue to endure, and the law it grounds be both applicable and true (that is, not falsified), though its effect (i.e., the consequent) be unrealized” (PN 11) and Collier 35. Also cf. the supplementary argument for the second conclusion of Bhaskar's analysis above.

⁶⁰ Cf. RTS 50.

⁶¹ Cf. Chalmers, *What is This Thing Called Science?*, pp. 218-9 and Molnar, *Powers*, p. 199.

mechanisms, then the regularities of experiments and the irregularities of extra-experimental reality can be reconciled and the applicability of the former to the latter maintained.

Now, one might reasonably ask what has become of the *transcendentally real* character of causal laws, which was included in the third conclusion of Bhaskar's analysis above. However, this has already been established by the foregoing arguments, if only implicitly. For a start, if causal laws, as the tendencies of generative mechanisms, are independent from the actualizations of tendencies (in the sense that tendencies can be possessed unexercised and exercised unfulfilled, so that causal laws can exist as such in either case), then they must be independent from perception as well. This is because anything that can be perceived is the result of the exercise of tendencies—i.e., sequences of events and states of things. In other words, we may perceive particular actualizations of causal laws, but we do not perceive the laws themselves; we may perceive the effects of a generative mechanism's tendential behaviour, its manifestation, but we do not perceive the tendencies themselves. To test this claim, and recalling that tendencies are irreducible to their actualizations, just try to envision a situation in which we *directly perceive a tendency itself* rather than its effects. What does it look like? What is its size, shape, colour, texture, sound, taste, or smell? We can easily answer these questions with the *effects* of a tendency's exercise, and such effects can indirectly indicate the existence of the tendency, but we do not perceive the tendency itself.

Indeed, this imperceptibility of tendencies is precisely what informs a fundamental tenet of regularity theories and their various treatments of the problem of natural necessity. For regularity theorists, it is because causal powers are never directly given in perception that natural necessity has to be derived psychologically *a la* Hume or conceptually *a la* Kant. A typical (and canonical) regularity theorist argument of this kind can be found in one of Hume's arguments against the legitimate application of the concept of causal power on the basis of the absence of any corresponding sensible impression:

In reality, there is no part of matter, that does ever, by its sensible qualities, discover any power or energy, or give us ground to imagine, that it could produce any thing, or be followed by any other object, which we could denominate its effect. Solidity, extension, motion; these qualities are all complete in themselves, and never point out any other event which may result from them. The scenes of the universe are continually shifting, and one object follows another in an uninterrupted succession; but the power or force, which actuates the whole machine, is entirely concealed from us, and never discovers itself in any of the sensible qualities of body. We know that, in fact, heat is a

constant attendant of flame; but what is the connection between them, we have no room so much as to conjecture or imagine. It is impossible, therefore, that the idea of power can be derived from the contemplation of bodies, in single instances of their operation; because no bodies ever discover any power, which can be the original of this idea.⁶²

By the same token, if the tendency of a generative mechanism is something that can be exercised without actualizing its effect, then in such cases a generative mechanism's *activity*, not just its existence, is independent from perception as well since it is active without generating anything that can be perceived (i.e., its effects). Furthermore, insofar as generative mechanisms are real ontological powers to generate effects and are discovered *a posteriori*, they cannot be conflated with our concepts of them⁶³. Lastly, and perhaps most clearly by now, the independence of causal laws from the practical and material conditions that enable us to identify them—which independence consists in their prevalence in extra-experimental reality—is required for the intelligibility of those very conditions⁶⁴.

In short, transcendently real tendencies of generative mechanisms can be determined to exist by philosophical argument insofar they condition the intelligibility of experimental activity. They are independent from our practical and material activity since they must exist whether we intervene in the course of natural events with experiments or not; they are independent from the concepts and theories we have of them since they must be discovered *a posteriori*; and they are independent from perception because they themselves have no perceptible qualities (though they can generate such qualities). Therefore, establishing that causal laws are the tendencies of

⁶² David Hume, *Enquiries Concerning Human Understanding and Concerning the Principles of Morals*, 3rd ed., New York, Oxford University Press, 1975, p. 50. Cf.: “Hume had argued *ad nauseam* that the presence in an object of an unmanifesting power couldn't be established by sense perception alone. Testing for the presence of the power normally involves triggering a manifestation from the occurrence of which the existence of the power is then inferred. Powers are not among the perceptible properties, they are occult by their very nature. Only the qualitative, non-dispositional properties are knowable directly, that is, by sense perception alone. Powers are not manifest but are knowable only inferentially, if they are knowable at all” (Molnar, *Powers*, p. 167). (Also cf. *ibid* 135-6.) I assume this claim that the existence of powers can only be inferred applies mainly to cases where the existence of some particular power is at issue. Again, however, note that if Bhaskar's analysis holds up, then we have a transcendental argument for the general existence of powers—i.e., in abstraction from cases or scientific theories regarding particular powers. Needless to say, it is this argument that is intended to counter Hume's critique.

⁶³ Cf.: “Only because nature is an open system are experiments necessary. But since they are also *possible*, mechanisms must be real and distinct, not just schemes imposed by us on a ‘buzzing and booming confusion’; for the mechanisms (or some of them) can be *isolated* in experimentally established closed systems” (Collier 46).

⁶⁴ Cf. RTS 46, 92, and 236.

generative mechanisms in the way Bhaskar does simultaneously establishes their transcendently real character. Thus Bhaskar can claim:

These mechanisms (...) endure and act quite independently of men. The statements that describe their operations (...) are not statements about experiences (empirical statements, properly so called) or statements about events. Rather they are statements about the ways things act in the world (that is, about the forms of activity of the things of the world) and would act in a world without men, where there would be no experiences and few, if any, constant conjunctions of events. (RTS 17)⁶⁵

§4. CONCLUSION

Only if causal laws are the transcendently real tendencies of generative mechanisms can we explain how the experimental initiation of regular sequences of events is epistemically necessary (since it gives us empirical access to the characteristic effects of the operation of a generative mechanism, and thus indirect access to the generative mechanism itself) and extra-experimentally applicable to an open system (since the same generative mechanisms we individually identify in experiments are also active in extra-experimental reality alongside others that may frustrate their activity). Moreover, causal laws being tendencies can explain how the natural world can be *lawful* yet (at level of sequences of events) *irregular*: “once it is appreciated that events, though caused (...), are very rarely conjoined, it can be seen why *order in the world must be pitched at a level categorically distinct from events*” (RTS 144, emphasis added). This positive conclusion is the culmination of the transcendental analysis of experimental activity. If that analysis is sound, the regularity theorist accepts its presuppositions, and we are to maintain the intelligibility of experimental activity, then there simply remains no more room for regularity theories of causal laws, for such theories reduce causal laws to their actualizations in perception:

Patently, if it is the case that our causal activity is necessary for the realisation of the consequents of laws, they just cannot be glossed, without absurdity, as empirical regularities. That is, if it is not the case that whenever a then b then in making a claim about a causal law, we cannot, if we are to sustain the

⁶⁵ See *ibid* 251-2 where Bhaskar clarifies the ambiguity of the term “law” and claims that, were he to rewrite RTS, he would use this term only to denote the operations of a generative mechanism as opposed to *statements describing* the operations of a generative mechanism, whereas in RTS he uses the term in both senses. I have always used the term in the former sense and have interpreted the passages I cite from Bhaskar and other authors to be doing the same, although I have edited out an instance of the latter sense in the passage from *ibid* 17 above for the sake of terminological simplicity.

intelligibility of the experimental establishment and transfactual⁶⁶ application of our knowledge, be making a claim about a sequence of events. Instead we must be construed as making a claim about something that bears only a contingent relationship to the actual world (including that significant subset of it produced by human work). This claim, I have argued, is about the operation of a tendency of the working of a mechanism irrespective of its actualisation in any particular outcome. And if *that* is the case, then all the theories based on the flawed principle of empirical-invariance—from the consistency condition of monistic historiography of science to Feyerabend’s ‘dadaism’, from the Popper-Hempel theory of explanation to standard (empirical realist) analyses of counterfactuals (...), from the 2nd Analogy to Bachelard’s cogitamus—must all be radically wrong. (ibid 256-7)

Furthermore, such regularity theories of causal laws take a constant conjunction of events to be at least a necessary (and sometimes sufficient) condition for a causal law. However, if Bhaskar’s analysis is valid, then a constant conjunction is neither a necessary nor sufficient condition for a causal law, for a tendency can exist and operate without any constant conjunctions of events arising⁶⁷.

To summarize the transcendental analysis of experimental activity, let me succinctly reiterate the conclusions in the logical form appropriate to transcendental argumentation to underscore the analysis’s overall argument. As Bhaskar explains, a transcendental argument has the following syllogistic form:

Major premise: Only if Q , then P

Minor premise: P

Conclusion: Q

However, unlike other forms of philosophical argumentation, “the interest of a transcendental argument clearly does not lie in the formal derivation of the conclusion, which is trivial; but in the production of the knowledge of the major premiss (i.e. in the analysis)” (RTS 257). More specifically, the real work consists in establishing the antecedent to the major premise (Q) so it can be derived as the conclusion, for the consequent/minor premise (P) is supposed to be somewhat uncontroversial. In Bhaskar’s case, the intelligibility of experimental activity stands in for P , and each of the three conclusions discussed above alternately stand for Q . Therefore, we could summarize the results of this essay as:

⁶⁶ I.e., including but exceeding actual events.

⁶⁷ Cf. RTS 33 and 164, PN 9-10, and RR 16.

Major premise(s): Only if extra-experimental reality is an open system (Q_1), causal laws are not constant conjunctions of events (Q_2), and causal laws are the transcendently real tendencies of generative mechanisms (Q_3), then experimental activity is intelligible (P)

Minor premise: Experimental activity is intelligible (P)

Conclusion(s): Extra-experimental reality is an open system (Q_1), causal laws are not constant conjunctions of events (Q_2), and causal laws are the transcendently real tendencies of generative mechanisms (Q_3)

With this critique of regularity theories of causal laws and case for a realist ontology of causal powers Bhaskar deals a serious blow to the anti-metaphysical agenda of logical positivism (and much subsequent philosophy of science). For the transcendental analysis of experimental activity shows that the idea that metaphysics must be eradicated from philosophical accounts of natural science is itself inconsistent with the epistemic significance of one of natural science's most central features. Consequently, the reaction against the "speculative excesses" of nineteenth-century *Naturphilosophie* which motivated much anti-metaphysical philosophy of science may have severely overestimated the rationality of the decision to avoid metaphysics altogether. Indeed, Bhaskar places the ontology of causal powers discussed here within a broader philosophical framework whose ontological naturalism and metaphysical boldness might make it appropriate to be deemed a contemporary "philosophy of nature". Just within RTS, the picture of nature as consisting of multiple interacting generative mechanisms is expanded with the notions of *stratification*—reflecting the layered levels of generative mechanisms in nature (e.g., physical, chemical, biological, psychological, social)—and *emergence*—reflecting the status of many natural strata as dependent upon yet irreducible to more fundamental strata. Furthermore, these aspects of Bhaskar's philosophy of natural science are complemented with accounts of social mechanisms and the causality of intentional agency in works like PN and SRHE. And in Bhaskar's more systematically and ontologically ambitious later works, like *Dialectic: The Pulse of Freedom*, these earlier conceptions of natural and social causality are developed and dialectically related as modes of "absenting", connected by "rhythmic" spatiotemporal actualization and "holistic" intra-relational mediation⁶⁸. A critical reappraisal of these further elements of Bhaskar's philosophy with a view towards their potential value for contemporary

⁶⁸ Cf. Roy Bhaskar, *Dialectic: The Pulse of Freedom*, first published by Verso (1993), Abingdon, Routledge, 2008, p. 240.

metaphysics, epistemology, and philosophy of science may be an endeavour well worth pursuing.

dmcwherter@hotmail.com

BIBLIOGRAPHY

- Bhaskar, Roy, *A Realist Theory of Science* (RTS), 2nd ed., London, Verso, 1978.
- Reclaiming Reality: A Critical Introduction to Contemporary Philosophy* (RR), 1st ed., London, Verso, 1989.
- Philosophy and the Idea of Freedom* (PIF), 1st ed., Oxford, Blackwell, 1991.
- The Possibility of Naturalism* (PN), 3rd ed., Abingdon, Routledge, 1998.
- *Dialectic: The Pulse of Freedom*, first published by Verso (1993), Abingdon, Routledge, 2008.
- Scientific Realism and Human Emancipation* (SRHE), first published by Verso (1986), Abingdon, Routledge, 2009.
- Bhaskar, Roy and Alex Callinicos, "Marxism and Critical Realism: A Debate", *Journal of Critical Realism*, Vol. 1, No. 2, 2003, pp. 89-114.
- Callinicos, Alex, *The Resources of Critique*, 1st ed., Cambridge, Polity Press, 2006.
- Chalmers, A.F., *What is This Thing Called Science?*, 3rd ed., Maidenhead, Open University Press, 1999.
- Collier, Andrew, *Critical Realism: An Introduction to Roy Bhaskar's Philosophy*, 1st ed., London, Verso, 1994.
- Groff, Ruth, *Critical Realism, Post-positivism and the Possibility of Knowledge*, 1st ed., New York, Routledge, 2007.
- Hume, David, *Enquiries Concerning Human Understanding and Concerning the Principles of Morals*, 3rd ed., New York, Oxford University Press, 1975.
- Marx, Karl, *Capital*, trans. David Fernbach, vol. 3, 3 vols., 1st ed., London, Penguin, 1991.
- Molnar, George, *Powers: A Study in Metaphysics*, 1st ed., Oxford, Oxford University Press, 2003.
- McWherter, Dustin, *The Problem of Critical Ontology: Bhaskar Contra Kant*, 1st ed., Basingstoke, Palgrave Macmillan, forthcoming 2012.