Taking Mechanisms Seriously:
Causes, Causation, and Explanatory Pluralism

Jack Donnelly

Josef Korbel School of International Studies
University of Denver

jack.donnelly@du.edu

Draft: November 18, 2020

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Methodological pluralism is becoming the new normal in the social sciences.[1] Explanatory monism, however, continues to predominate. The hegemonic epistemic goal remains "causal inference;"[2] establishing what causes what.

"In many fields of science[,however] … a satisfactory explanation requires providing a description of a mechanism."[3] In particular, "mechanistic approaches are near ubiquitous in the causal interpretation of biological and neuroscientific experimental work."[4] "The bulk of biology is a search for mechanisms."[5]

Working from this divergence, I argue that focusing excessively on what-causes-what explanations unnecessarily and counter-productively restricts our ability to scientifically understand and effectively engage the world.

The growing popularity of "causal mechanisms" in multimethod research might suggest acceptance of such a view. In practice, however, "causal mechanisms" often turn out not to be mechanisms. And even when they are, they usually are employed as subordinate methodological tools of causal inference, effectively reaffirming explanatory monism.

My argument for explanatory pluralism[6] is rooted in causal pluralism.[7] Causality, I argue, involves not only causes and their effects but processes of causation – both of which need to be addressed in International Studies.[8]

1. Mechanisms

1.1. *What is a Mechanism?*

A mechanism, in ordinary language, is "a system of mutually adapted parts working together in a machine or in a manner analogous to that of a machine" or "an ordered sequence of events involved in a biological, chemical or physical process."[9] This sense is also standard in the philosophy of Biology, especially "the new mechanical philosophy."[10] I ask the reader to accept for now, for the sake of argument, that that there are mechanisms in this sense that merit exploration in International Studies and that the life sciences are sufficiently similar to the social sciences to make comparison potentially fruitful.

Peter Machamer, Lindley Darden, and Carl Craver in their seminal article "Thinking About Mechanisms" (which is widely referred to in the Philosophy of Biology as MDC) define mechanisms

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[1] See, for example, (Seawright 2016), (Goertz 2017), (Beach and Pedersen 2019). (Beach 2020) is a recent overview.

[2] See the first paragraph of §2 and the second paragraph of §5.

[3] (Machamer, Darden, and Craver 2000, 1).

[4] (Leuridan and Lodewyckx 2020, 1). Cf. (Machamer, Darden, and Craver 2000, 24), (Bechtel 2011, 533).

[5] (Craver and Darden 2013, 196. Cf. 15-16).

[6] (Mantzavinos 2016) provides a wide-ranging defense of explanatory pluralism in the sciences. (Jackson 2017) advocates a pragmatist explanatory pluralism much like what I have in mind. Cf. also (Van Bouwel and Weber 2008).

[7] See, for example, (Cartwright 2004), (Godfrey-Smith 2009), (Illari and Russo 2014, ch. 23), (Glennan 2017, 153-154).

[8] Although my argument certainly applies well beyond IR, references to the social sciences in general probably go too far. "International Studies" is meant to suggest broad but somewhat indeterminate "scope conditions."

[9] *Oxford English Dictionary*.

[10] (Machamer, Darden, and Craver 2000) was seminal. (Glennan 2017), (Glennan and Illari 2017), and, more briefly, (Craver and Tabery 2019) are excellent overviews. The label underscores the rejection of early modern mechanical philosophies (e.g., Hobbes, Descartes, Newton, Laplace). (Glennan 2017, 5-11) briefly distinguishes "new" and "old" mechanical thinking.

as "entities and activities organized such that they are productive of regular changes from start or set-up to finish or termination conditions."[11] Looking at "mechanisms across the sciences," Phyllis Illari and Jon Williamson find that "mechanistic explanations begin with (a) the identification of a phenomenon or some phenomena to be explained, (b) proceed by decomposition into the entities and activities relevant to the phenomenon, and (c) give the organization of entities and activities by which they produce the phenomenon."[12]

For example, sugar production is the phenomenon to be explained in photosynthesis, which in plants takes place in organelles called chloroplasts. Light energy initiates processes in the granum that, with the input of water, lead to the production of NADPH and ATP, which help to capture and reduce carbon dioxide in the Calvin cycle, producing glucose (which fuels life).[13]
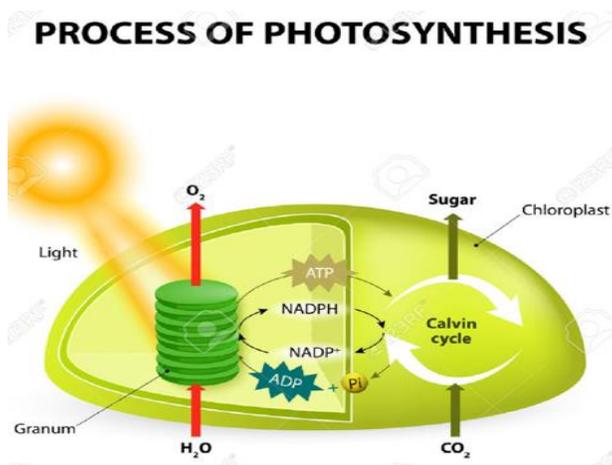
Source: https://www.123rf.com/photo_41854862.html

Mechanisms are "stable configurations of robust objects that produce stable outcomes."[14] Entities and activities are the interdependent elements of mechanisms.[15] Organization into productive processes makes these elements parts of mechanical wholes.[16] What mechanisms "do" is produce

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[11] (Machamer, Darden, and Craver 2000, 3). For citations in the social sciences, see (Hedström and Bearman 2009, 4), (Waldner 2012, 72), (Morgan and Winship 2015, 238-239), (Stolz 2016, 258-259), and (Beach and Pedersen 2019, 3, 30, 31, 38, 69, 70).

[12] (Illari and Williamson 2012, 123). Cf. (Bunge 1997, 414), (Mayntz 2004, 241), (Steel 2008, 40-42), (Bechtel 2016, 705-706), (Glennan 2017, 1, 17, 19-20). See also (Darden 2008, 965, Table 1), (Povich and Craver 2017, §2).

[13] (Nickelsen 2015) explores the study of the mechanism over the course of more than a century.

[14] (Craver and Kaiser 2013, 129). Cf. (Glennan 2002, S344-S346).

[15] (Machamer, Darden, and Craver 2000, 3), (Glennan 2017, 20-22, 29-36), (Illari and Williamson 2012, 125), (Darden 2008, 961-964), (Machamer 2004, 28-30, 32-34).

[16] (Machamer, Darden, and Craver 2000, 3), (Glennan 2017, 23), (Bechtel 2016, 719), (Illari and Williamson 2012, 127), (Bechtel and Abrahamsen 2005, 430).

particular phenomena.[17] The "doing" is central to the mechanism.[18] And the essence of mechanismic[19] research is discovering such productive processes and studying their operation.

To use a framing familiar in IR, mechanisms are systems:[20] elements of particular types organized and operating to produce emergent outcomes.[21] ("Emergence indicates dependence of a system property upon the mode of organization of parts of that system."[22] Those leery of mystical overtones in "emergence" may prefer William Wimsatt's language of non-aggregativity.[23] "Active organization distinguishes mechanisms from mere aggregates."[24])

More precisely, mechanisms are functionally organized.[25] "A mechanism is a structure performing a function in virtue of its component parts, component operations, and their organization. The orchestrated functioning of the mechanism is responsible for one or more phenomena."[26] "Mechanisms are always 'for' something, and they are identified by what they are for."[27]

1.2. How Do Mechanisms Explain?

To explain, in ordinary language, is "to make plain or intelligible …to describe or give an account of in order to bring about understanding."[28] "Explanation is a matter of representing what depends upon what;"[29] of showing that something we want to understand (the explanandum) depends on something else that does the explaining (the explanans).

Most explanations can be formulated "Because of…" Scientific explanations, though, employ different kinds of "becauses."

"To explain an event is to give an account of why it happened."[30] "Why?" questions, though, have different types of answers.

"Biologists explain why by explaining how;"[31] "by describing the mechanism that produces that phenomenon."[32] More generally, mechanismic explanations "mak[e] intelligible the regularities

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[17] (Machamer, Darden, and Craver 2000, 5), (Illari and Williamson 2012, 130). Cf. nn. 26-27. I will use "produce" in the broad sense of "produce, underlie, or maintain." (Craver and Darden 2013, 15).

[18] (Machamer 2004), (Illari and Williamson 2013). Cf. §1.4.

[19] I use the term mechanismic, following (Bunge 1997, esp. 462), to underscore that "one should not think of mechanisms as exclusively mechanical (push-pull) systems." (Machamer, Darden, and Craver 2000, 2).

[20] Although very simple mechanisms may not be systems (Illari and Williamson 2012, 121), the mechanisms of interest to social scientists are. In IR (Jervis 1997) is the standard work on complex systems.

[21] (Ablowitz 1939, 2-4) remains an especially clear brief statement of the basic idea of emergence. (Humphreys 2016) is a thorough philosophical exposition. In IR, see Jervis (1997, 12-17).

[22] Wimsatt (2007 174). Cf. (Craver and Tabery 2019, §§2.4.1, 4.2).

[23] Wimsatt (2007 168, 174-175, 280-281, 286-287).

[24] (Craver and Darden 2013, 20. Cf. 16).

[25] (Garson 2019, ch. 10), (Machamer, Darden, and Craver 2000, 6), (Craver 2001), (Craver and Darden 2013, 23-24).

[26] (Bechtel and Abrahamsen 2005, 423). Cf. (Illari and Russo 2014, 134), Glennan (2017 66), (Povich and Craver 2017, 107-111).

[27] (Glennan 2016, 789).

[28] *Oxford English Dictionary.*

[29] (Glennan 2017, 212. Cf. 237).

[30] (Elster 1989, 3). Cf. (Seawright and Collier 2010, 329. Cf. 325), (Waltz 1979, 5). But see §15.

[31] (Bechtel and Abrahamsen 2005, 422. Cf. 421, 439).

[32] (Illari and Russo 2014, 121). Cf. (Machamer, Darden, and Craver 2000, 3, 21, 22, 24), (Mayntz 2004, @238).

being observed by specifying in detail how they were brought about;" they "identify the entities, activities, and relations that jointly produce the outcome to be explained."[33]

Although causes operate within mechanisms, mechanismic explanations explain not by the attributes and interactions of constituent entities but by their relations/arrangement/organization and operation – which constitute them as parts of larger productive wholes. A mechanismic explanation "is explanatory precisely in virtue of its capacity to enable us to understand how the parts of some system actually conspire to produce that happening."[34]

Part-whole and cause-effect are different kinds of productive/causal relations that ground different types of explanations. The effects of causes and the outcomes of mechanisms are different "things" that are caused/produced differently – and therefore require (and provide) different kinds of explanations.

1.3. Hierarchy and Modularity

Mechanisms are "composite hierarchical systems."[35] "The parts of mechanisms can themselves be broken into parts, and the activities within mechanisms can be broken down into further activities."[36] More generally, Herbert Simon famously showed that modular "near-decomposability"[37] is central to constructing, maintaining, and transforming most complex systems.

Mechanismic explanations, however, focus on integrated productive processes. "Higher-level entities and activities are … essential to the intelligibility of those at lower levels, just as much as those at lower levels are essential for understanding those at higher levels. *It is the integration of different levels into productive relations that renders the phenomenon intelligible and thereby explains it.*"[38]

No level is privileged. "Mechanistic explanation is not always about the little explaining the big."[39] "In mechanistic explanation, successively lower level mechanisms account for different phenomena. Scientists construct a cascade of explanations, each appropriate to its level and not replaced by those below."[40]

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[33] (Hedström and Bearman 2009, 5, 8). Cf. (Glennan 2017, 223, 228-230), (Bechtel 2011).

[34] (Waskan 2011, 393). Cf. (Machamer, Darden, and Craver 2000, 22), (Illari and Williamson 2012, 123), (Craver and Darden 2013, 23).

[35] (Wright and Bechtel 2007, 45. Cf. 54-61).

[36] (Glennan 2016, 802).

[37] (Simon 1962, 473-476). Cf. (Craver and Tabery 2019, §4.2), (Wegner and Lüttge 2019), (Bechtel and Richardson 2010), (Darden 2002).

[38] (Machamer, Darden, and Craver 2000, 23 [emphasis added]). On levels in Biology, see (Povich and Craver 2017), (Eronen and Brooks 2018), (Brooks, DiFrisco, and Wimsatt forthcoming). On the fundamental difference between the mechanismic/systemic notion of levels of organization and IR's standard understanding of levels of analysis, see (Donnelly 2019, 907-912).

[39] (Illari and Williamson 2012, 126). (Sterelny 1996) nicely links levels of complexity with explanatory pluralism in the context of macroevolution.

[40] (Bechtel and Abrahamsen 2005, 426 [emphasis added]). Wimsatt (2007, Part Three, esp. 168-171, 195, 202-204, 241-242, 249-255, 274-277) nicely distinguishes between *non-eliminative* reduction and the eliminative sort of "reductionism" highlighted by Waltz (1979 60-78). Non-eliminative reduction is different from, but not incompatible with, mechanismic explanation. (It looks at "parts" separately but does not deny that they are also parts of a whole.) Eliminative reduction, however, aims to take the whole out of the analysis; to *reduce* the whole to its parts.

1.4. Processes

Mechanisms are processes, in the ordinary-language sense of "a continuous and regular action or succession of actions occurring or performed in a definite manner, and having a particular result or outcome."[41] For our purposes here we need not precisely distinguish (the overlapping sets of) "mechanisms" and "process" – because both explain by showing how something came to be.

The difference between seeing the world as made of "things" or of "processes," however, is crucial. Most Western ontologies have been "substantialist," understanding the fundamental "stuff" of the world as "things" with "essential" characteristics. Processualists, however, argue that the world is (fruitfully seen as) composed of doings (activities) in addition to beings (entities).[42] "Among the things discovered by science are things that are not entities, but doings extended in time."[43]

Focusing on processes suggests employing verbs (and adverbs and verbal nouns) in explanations.[44] For example, rather than see states as constrained by "structures" we should see international systems as "structured" or "structuring." And, I will argue, social scientists, in addition to studying causes – "things" that have effects – should study processes of causation.

2. Causes, Causation, and Explanations

Explanatory pluralism challenges mainstream social science's focus on *causal* explanations, understood narrowly as a matter of "causal inference;"[45] identifying and estimating "causal effects."[46]

Most (social) scientists today require more than mere "Humean" constant conjunction to consider an association causal.[47] "Interventionist" accounts, including counter-factual, manipulation, and potential outcomes theories,[48] along with Bayes net or structural model accounts,[49] currently predominate.[50]

Causality, in such understandings, is established through "a 'surgical' change in A which is of such a character that if any change occurs in B, it occurs only as a result of its causal connection, if any, to A."[51] If B changes after altering A, the "treatment variable," *while leaving everything else the same* – for

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[41] *Oxford English Dictionary.*

[42] (Rescher 1996, 2000) are accessible book-length introductions. (Dupré and Nicholson 2018) argue for a radically processual Biology. In IR, Patrick Jackson and Daniel Nexon (1999, 2019) link processualism to "relationalism," broadly understood.

[43] (Illari and Williamson 2013, 74). Cf. (Glennan 2017, 50-51).

[44] Cf. (Rescher 1996, 29), (Machamer, Darden, and Craver 2000, 4-5), (Glennan 2017, 20).

[45] See nn. 71-75.

[46] Causal inference, as typically understood, *is* the identification and estimation of causal effects. For example, Stephen Morgan and Christopher Winship's *Counterfactuals and Causal Inference* (2015) uses "causal effect" more than 700 times (and in the titles of two of the four parts and four of the ten chapters).

[47] (Illari and Russo 2014) is an accessible philosophical survey of approaches to causality in the natural and social sciences. More briefly, see (Frisch 2020), (Woodward 2016b), (Cartwright 2014). (Kurki 2008) is a wide-ranging discussion focused on IR.

[48] (Illari and Russo 2014, ch. 8-10), (Menzies and Beebee 2020), (Woodward 2016a).

[49] (Spirtes, Clark, and Scheines 2000) and (Pearl 2000) are classics. See also (Imbens and Rubin 2015). (Morgan and Winship 2012) provide a good brief introduction focused on the social sciences.

[50] See, for example, (King, Keohane, and Verba 1994, 76-85), (Morgan and Winship 2015, ch. 2), (Seawright 2016, 32, 192), (Goertz 2017, 30, 75-78, 208, 246ff.).

[51] (Woodward 2016a, §4).

example, through a controlled trial, thought experiment, regression modeling, or natural experiment – then we can say, with some degree of confidence, that A causes B; that B is a causal effect of A.

By this definition, though, mechanical and systems explanations are not causal explanations. The elements of systems and mechanisms are *inter*dependent. Surgical intervention therefore is impossible. As Robert Jervis nicely puts it, in systems you can "never do merely one thing" and processes of causation "cannot be captured by labeling one set of elements 'causes' and [the] other 'effects.'"[52] The notion of reciprocal causation in evolutionary Biology seems to me a nice formulation of the essential underlying idea.[53]

Debating what causality "really is" would serve no purpose here. Terminological clarity, however, is essential.

I will stipulatively use "cause," either in scare quotes or with the adjective independent-variable, to refer to variables or "things"[54] that have "causal effects." "Causes" thus construed, though, do not exhaust "causation" in the ordinary-language sense of "production of an effect," corresponding to the sense of "to cause" as "to effect, bring about, produce, induce, make."[55]

Causality, as I will use that term, involves more than "causes" and their effects. And different forms of causality require (and provide) different kinds of explanations. (If one insists on an interventionist definition of causality then mechanismic explanations are noncausal explanations[56] – which only strengthens my argument for explanatory pluralism.)

3. What-Causes-What versus How Explanations

Gary King, Robert Keohane, and Sidney Verba (KKV) in their immensely influential research-design text claim that "real explanation is always based on causal inferences."[57] This, however, is not true if we mean (as they do) that only independent-variable "causes" really explain. As Mario Bunge puts it, "whereas every social cause has (by definition) a social effect, not every social change results from a social cause. The methodological consequence is obvious: not every correct explanation in social science is of the causal type."[58]

I have already identified three interrelated differences between "causal" what-causes-what explanations and mechanismic how explanations.

- *Causes vs. causation.* What-causes-what explanations identify *causes*; "things" responsible for an outcome. Mechanismic explanations identify *processes of causation*; how an outcome is produced.

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[52] (Jervis 1997, 10, 48).

[53] (Laland et al. 2013, 725-728, 737-738), (Svensson 2018), (Buskell 2019, 268-270).

[54] Potential outcomes causality involves, strictly speaking, only relations between variables in a dataset. (KKV (1994: 80-82) are especially clear about this.) Relations between variables, however, are of *explanatory* interest only if tied to relations in the world. (Thus my reference to variables *or "things."*) But restricting attention to relations among variables would only increase the differences between mechanismic and "causal" explanations. Therefore, understanding "causes" to include "things" (as well as variables) is the harder case for my argument. It also avoids tying the discussion to a particular theory of causality.

[55] *Oxford English Dictionary*.

[56] On noncausal explanation, see (Reutlinger and Saatsi 2018), (Lange 2017), and, briefly, (Glennan 2017, 223, 230-237).

[57] (King, Keohane, and Verba 1994, 75 n. 1).

[58] (Bunge 1997, 434).

- *Causal effects vs. causal processes.* What-causes-what explanations identify associational *causal effects.* Mechanismic explanations identify productive *causal processes.*
- *Causal relevance vs. causal efficacy.*[59] What-causes-what explanations establish *causal relevance*; show that particular "things" are part of the story of causality. Mechanismic explanations establish *causal efficacy*; show how processes produce – actually *cause* – an outcome.

Much of what follows explores the nature and significance of these differences.

4. Mechanisms Are Not Reducible to "Causes"

I have assumed that mechanismic processes of causation often are of independent causal/explanatory significance. KKV, however, attempt to reduce mechanisms to chains of "causes" and effects.

They begin discussing "causal mechanisms" by noting that "some scholars argue that the central idea of causality is that of a set of 'causal mechanisms' posited to exist between cause and effect."[60] Many social scientists do think of causal mechanisms in this way.[61] This is not, however, the ordinary-language/new-mechanical sense.

A mechanism, rather than "something" lying between a "cause" and its effects, is an organized set of entities that operate to produce characteristic outcomes. And mechanismic explanations are alternatives, not supplements, to what-causes-what explanations.[62]

"What one wants to do in establishing and displaying mechanism is to show how one stage produces the next, and so on. … The causality lies in the production."[63] And the explanation is the demonstration that this mechanism is responsible for that result.[64]

The smaller units of analysis in mechanismic explanations are stages or modules in productive processes – not "causes" that operate within them. And neither startup conditions and initial inputs nor additional inputs and steps along the way to an outcome need be "causes."

Making a cake, for example, is not something that comes between the independent variables of flour, eggs, etc. and the dependent variable of cake. Flour, by the standard interventionist definition, is a "cause" of cake. (Remove it and you have no cake.) But flour does not cause (bring about) cake. It is an input in a productive process. And a cake is not the effect of (or effected by) its ingredients. It is the emergent outcome of a complex process.

Various chemical and physical processes in making and baking the batter can be fruitfully explained in "cause"-effect terms. (Not every occurrence within a mechanism is a mechanical effect.) These "causes," however, are secondary details *in a mechanismic explanation*. Causality/explanation *at the level*

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[59] (Machamer 2004, 36) uses this language. Glennan (2017, 150-151, 153-155) contrasts "causal relevance" to "causal production." Cf. (Rescher 1996, 48), (Steel 2008, 19-28).

[60] (King, Keohane, and Verba 1994, 85). Seeing mechanisms as "things" that "exist" (rather than "operate") between cause and effect focuses narrowly on entities ("causes") not activities (causation).

[61] See §6.

[62] (Darden 2013). Cf. (Cummins 2000), (Glennan 2002), (Bechtel and Abrahamsen 2005), (Wright and Bechtel 2007), (Bechtel 2011), (Illari 2013).

[63] (Machamer 2004, 35).

[64] Cf. §1.2 at nn. 33-34.

of the mechanism has little to do with "causes" and their effects. Knowledge *of* a mechanism is quite different from knowledge about what happens within it.

KKV thus entirely miss the point when they argue that "identifying the causal mechanisms requires causal inference … [T]o demonstrate the causal status of each potential linkage in such a posited mechanism, the investigator would have to define and then estimate the causal effect underlying it."[65] Establishing the causal effects of individual steps in a process, however, provides analytic/reductionist explanations that cannot get at mechanical/systems effects.

Conversely, a mechanismic explanation "succeeds when the mechanism discovered and described is the mechanism responsible for the phenomenon"[66] – even if our knowledge of the "causes" operating within it is seriously incomplete. What-causes-what and how explanations thus often provide different knowledge about "the same thing." For example, we knew that smoking was a "cause" of lung cancer before we knew how smoking causes cancers. And, *pace* KKV, consensus that smoking causes lung cancer was achieved only after we knew how.

As KKV admit, "any coherent account of causality needs to specify how the effects are exerted."[67] Independent-variable causal inference can give us valuable knowledge about "causes" and their effects. It cannot provide an adequate account of causality.

5. Causal Mechanisms

Multimethod social science[68] has come to embrace causal mechanisms. For example, Gary Goertz "argues for taking a causal mechanism view of research."[69] Andrew Bennet even calls for "[reorienting] International Relations theorizing around the idea of explanation via … causal mechanisms."[70]

KKV's claim that "real explanation is always based on causal inferences,"[71] however, continues to predominate. For example, Goertz notes that "multimethod in this book means complementary causal inference methodologies. How one does cross-case inference or within-case inference is less important than the causal inference goals."[72] As David Collier, Henry Brady, and Jason Seawright put it, "the central concern here is with causal inference."[73]

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[65] (King, Keohane, and Verba 1994, 86). In fact, though, we can *identify* a mechanism without knowing all the causes that operate within it. Note also the peculiarity of saying that causal effects underlie (rather than are produced by) mechanisms.

[66] (Illari and Williamson 2012, 123). Cf. (Machamer, Darden, and Craver 2000, 17), (Machamer 2004, 35), (Bechtel and Abrahamsen 2005, 430), (Craver and Kaiser 2013, 141).

[67] (King, Keohane, and Verba 1994, 85). Note the peculiar language of effects being "exerted" (rather than "produced," which suggests the operation of a mechanism). Cf. also n. 65.

[68] I take (Brady and Collier 2010), (Goertz and Mahoney 2012), (Bennett and Checkel 2015a), (Seawright 2016), (Goertz 2017), and (Beach and Pedersen 2019) as representative of "best practices" in contemporary mainstream multimethod social science.

[69] (Goertz 2017, 167. Cf. 2, 8).

[70] (Bennett 2013, 459).

[71] (King, Keohane, and Verba 1994, 75).

[72] (Goertz 2017, 5). Qualitative and quantitative research are united by "the employment of scientific methods for the generation of valid causal inferences." (Goertz and Mahoney 2012, 4).

[73] (Collier, Brady, and Seawright 2010, 3). Cf. (Beach 2020, 163), (Beach and Pedersen 2019, 1, 2, 4, ch. 5), (Waldner 2015). (Seawright 2016) uses "causal inference" forty times in the seventeen pages of chapter 1.

This makes it "natural" to see causal mechanisms (as KKV do) as something – almost anything – "posited to exist between cause and effect."[74] This in turn helps to explain the diversity of things that go under that label. (Two decades ago, James Mahoney identified over twenty senses.[75])

The following sections examine several standard understandings of "causal mechanisms." "Causes," I argue, regularly squeeze the mechanisms out of "causal mechanisms." And even when not reduced to "causes," causal mechanisms usually are narrowly conceived to fit a causal inference framework – sacrificing most of the epistemic benefits of introducing mechanisms.

For terminological clarity, I use "causal mechanism" to refer to anything regularly identified as such. I use "mechanism" without an adjective in the ordinary-language/new-mechanical sense.

6. Intervening Variables

"The most widely used definition of causal mechanism is where they are seen as a series of intervening variables through which an explanatory variable exerts a causal effect on an outcome variable;"[76] "an intervening variable or set of intervening variables that explain why a correlation exists between an independent and dependent variable."[77]

Consider Goertz's "standard diagram used to conceptualize causal mechanisms."[78]

X	$\beta_X \gg 0$	M	$\beta_M \gg 0$	Y
	X is sufficient for M		M is sufficient for Y	
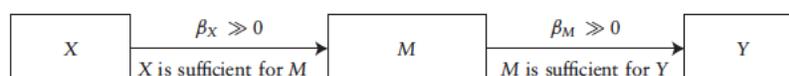
Source: Goertz (2017 31)

In this textbook representation of an intervening variable,[79] M is just another "cause."[80] Neither the positive association of M and Y nor M's sufficiency for Y tells us anything about the mechanism by which M produces Y.

Goertz illustrates the difference between causal-statistical and causal-mechanical explanations with Jon Pevehouse's account of the impact of democratic IGOs on democratic transitions.

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[74] (King, Keohane, and Verba 1994, 85).

[75] (Mahoney 2001, Table 1). Cf. (Gerring 2008, 177-179), (Waldner 2012, 72-73).

[76] (Beach 2013, 13, citing half a dozen examples).

[77] (Mahoney 2001, 578, citing half a dozen examples). Cf. (Gerring 2008, 163), (Seawright and Collier 2010, 317), (Imai et al. 2011, 765, 767), (Weller and Barnes 2014, 15), (Morgan and Winship 2015, 224), (Seawright 2016, 202).

[78] (Goertz 2017, 31). As Renate Mayntz puts it (2020, 2) "in the social sciences, mechanisms, if defined at all, have been represented by the formula X → M → Y." Goertz (2017 ch. 5) also identifies "interactive causal mechanisms" X_1 AND X_2 → Y and X_1 OR X_2 → Y.

[79] Glennan (2017, Fig. 8.1, 224-228) presents a nearly identical diagram for what he calls "bare causal explanations."

[80] As Mahoney notes (2001, 578), "a variable's status as 'mechanism' as opposed to an 'independent variable' is arbitrary." For example, (Weller and Barnes 2014, 12) distinguish a cause from a mechanism by whether or not the variable is measured in a dataset.

(a) Statistical model

(b) Causal mechanism in case studies
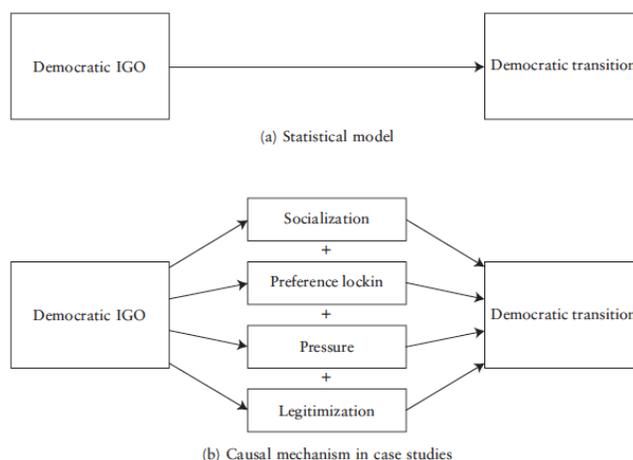
Source: Goertz (2017 7)

This difference, however, makes no difference *to the type of explanation*. The causal mechanism has the same form as the statistical model.

Understanding causal mechanisms as "mediating, intervening, and processual variables that can account for an association that is thought to be causal"[81] shifts the focus from mechanisms to "causes" and ignores the *organization* of entities/variables and the *activities* that they engage in – which are what make a mechanism out of a pile of parts. Rather than attempt to determine *how* an outcome is produced, more "whats" are added to a what-causes-what explanation (in order to increase confidence in the "causal" nature of the association between treatment and outcome variables[82]).

Such "causal mechanisms" are black boxes – which is pretty much the opposite of a mechanism. A mechanismic explanation "open[s] up the black box and show[s] the nuts and bolts, the cogs and wheels of the internal machinery."[83] "The basic idea of a mechanism-based explanation is quite simple: … proper explanations should detail the cogs and wheels of the causal process through which the outcome to be explained was brought about."[84]

Goertz, however, notes that "the M box of the causal mechanism figure is often called the 'black box.' This is because the causal mechanism is not known."[85] Less cryptically, a mechanism is hypothesized but remains black-boxed (because it is treated as an intervening-variable "cause").

I do not want to denigrate the epistemic significance of identifying black boxes – as a first step in investigating mechanisms.[86] For example, Machamer, Darden, and Craver (MDC) distinguish a "schema," understood as a more or less complete depiction of a mechanism, from a "sketch," which

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[81] (Morgan and Winship 2015, 226).

[82] Causal mechanisms provide "a nonexperimental way of distinguishing causal relations from spurious correlations." (Goertz and Mahoney 2012, 102).

[83] (Elster 1983, 24). Cf. (Falleti and Lynch 2009, 1147), (Hedström and Swedberg 1998, 9-10).

[84] (Hedström and Ylikoski 2010, 50). Cf. (Mayntz 2004).

[85] (Goertz 2017, 39. Cf. 54). Goertz (2017, 18, 20, 21) also claims that Jon Snow studied the causal mechanism of the transmission of cholera even though "Snow could not really get at the causal mechanism of cholera … [which] would require virus theory, Pasteur, and developments in biochemistry." (2017, 18 n6).

[86] I thank Jon Elster for highlighting this point during the discussion of an earlier version of this paper.

"has missing pieces, black boxes, which we do not yet know how to fill in."[87] Building on this, Craver and Darden identify an epistemic progression from "black box sketch to gray box sketch to glass box schema."[88]

In this understanding, a black box represents a problem (lack of knowledge of a mechanism) to be resolved by further research (to identify and describe the mechanism). And once we understand the mechanism, it may well turn out that (as in baking a cake) it is not particularly illuminating to say that X causes Y through M.[89]

Goertz's "standard diagram" thus ought to be understood as heuristic not explanatory. But, as is typical in multimethod social research, he treats black-boxed causal mechanisms as explanatory. "Causes" thus force mechanisms out of the story, (re)asserting explanatory monism.

7. Pathways and Chains

"Causation in the social world tends to involve a long sequence of decisions, actions, institutional patterns, and so forth that connect the treatment to the outcome."[90] Causal mechanisms therefore are often described as pathways[91] or chains.[92] These chains, though, usually are strings of intervening variables.

Consider the first substantive example in Goertz's chapter on "Causal Mechanisms," which models David Waldner's account of El Salvador's democratic transition.
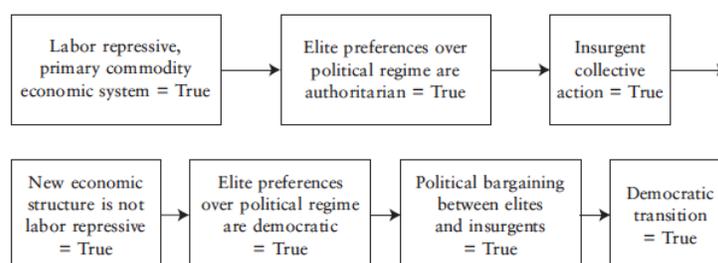
Source: Goertz (2017 32)

This says that Y happened because, starting at X, *a*, *b*, *c*, *d*, and *e* occurred (in that order). Each (black) box includes only the presence of a phenomenon (or the value of a variable) – *not the mechanism that produced it.*

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[87] (Machamer, Darden, and Craver 2000, 15-18, quote at 18).

[88] (Craver and Darden 2013, 31). Cf. (Bunge 1997, 427-430, 460-461).

[89] Imagine a causal-inference scientist approaching for the first time what we know as photosynthesis. After considerable study she might (not incorrectly) conclude that light "causes" oxygen (and that carbon dioxide is a critical causal mechanism). This entirely misses the point of the process – which is the production of *glucose*.

[90] (Seawright 2016, 57).

[91] (Gerring 2008, 163, 178), (Checkel 2015, 76, 77), (Seawright 2016, 80, 87, 90, 91, 94- 99, 101-03, 121, 122). Weller and Barnes (2014) title their book *Finding Pathways*.

[92] (Mayntz 2004, 241-242, 243-246), (Gerring 2008, 181, 182, 184), (Weller and Barnes 2014, 12, 13, 14, 15, 17, passim), (Waldner 2015, 130, 139, 140, 145). Cf. (Waldner 2012, 70), (Bennett and Checkel 2015b, 6), (Schimmelfenig 2015, 106, 127).

The assumption seems to be that "to be part of a causal pathway, a variable has to cause the outcome."[93] But not every step along the pathway need be a "cause" of the outcome. (For example, a labor repressive primary commodity system and authoritarian elite preferences are not "causes" (or mechanisms) of democratic transition. They are "causes" (or effects) of *authoritarianism*.) Nor are independent- or intervening-variable "causes" the only kinds of forces that operate along that path.

Likewise, in the following account of European integration the identified "mechanisms" are in fact "causes." And the three final "mechanisms" operate independently of one another. As in the democratic IGO example, they are not even modelled as having an impact as a whole.
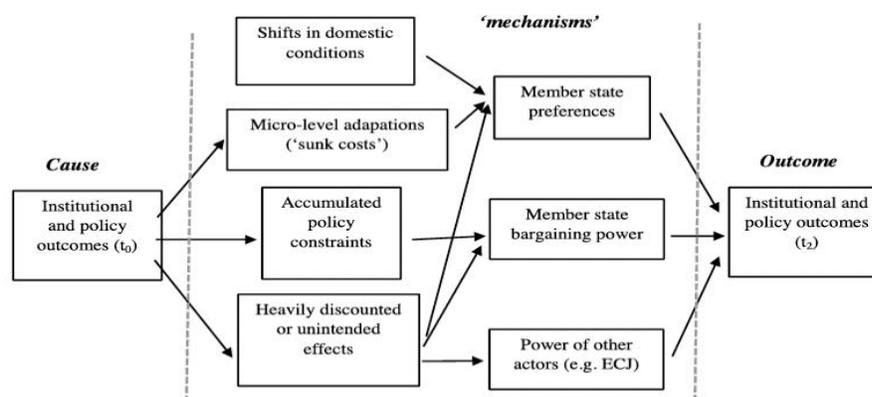

Fig. 3.1. The minimalist "causal mechanism" in Pierson's "Path to European Integration"

source: Beach and Pedersen (2019 65)

The aim is not to depict the organization and operation of a productive process but to identify "the causal steps that stand between the treatment and the outcome."[94] But stringing together "causes" in the correct temporal order establishes only when, not how, the elements of a causal mechanism operate. In mechanismic analysis, by contrast, "the focus is not the unfolding of a causal sequence over time, but the exact interdependencies between different factors and processes, jointly producing a specific outcome."[95]

If "causal mechanisms" were introduced simply to produce better what-causes-what explanations, such criticism might be inappropriate. Advocates of "causal mechanisms," however, typically claim to offer *how* explanations[96] – which, as we have seen, regularly is not the case.

8. Transmission Mechanisms

What I will call transmissive causal mechanisms are "'processes through which agents with causal capacities operate … to transfer energy, information, or matter to other entities."'[97] They "transmit

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[93] (Seawright 2016, 121).

[94] (Seawright 2016, 159). (Ross 2018) contrasts "pathways" and "mechanisms" in Biology.

[95] (Mayntz 2016, 485).

[96] (Beach and Pedersen 2019, 1, 2, 4, 5, 6, 7, 8, passim), (Goertz 2017, 12, 18, 25, 29-30, 31, passim), (Trampusch and Palier 2016, 442, 448), (Checkel 2015, 74, 76, 82, 89, 96), (Kay and Baker 2015, 2, 3, 11).

[97] (Bennett 2013, 466), quoting (George and Bennett 2005, 137). Cf. (Bennett and Checkel 2015b, 6, 12). (I set aside the problem of arbitrarily restricting causal mechanisms to the actions of agents.)

powers or forces between a cause (or a set of causes) [and] an outcome;"[98] "convey an initial causal impulse of some sort forward to an outcome."[99] Consider falling dominoes.

Transmissive mechanisms are mechanisms in the new-mechanical/ordinary-language sense. But a mechanism that (merely) "transmits [a] causal force, without adding to it, subtracting from it, or altering it, … to the dependent variable"[100] is of limited interest. And most social mechanisms are transformative or creative (not merely transmissive).

Mechanisms often do not transmit or convey anything. When something is transmitted, that often is only a small part of the story of causality. Even where A "causes" B, which "causes" C, which ultimately "causes" an outcome, the causality typically depends on an organized sequence of operations (not simply the transmission of a causal force or effect). And emergent (non-aggregative) outcomes are effects *of the mechanism* (not of something transmitted by it).

9. Rational-Actor and Micro-Foundational Mechanisms

Rational-actor models also are commonly identified as causal mechanisms. "Game-theoretic models constitute causal mechanisms."[101] "'Prisoners' dilemma,' 'Chicken,' and the other formal type games of game theory a[re] prototypes of rationalistic mechanisms."[102]

Explanations that treat actors *as if* they were rational, however, are neither causal nor mechanical. I therefore ignore them here – other than to note that they point to still another (analogical) type of explanation.

"Real" or "representational" rational-actor mechanisms, in which (a process of) rational action produces an outcome, typically offer a "micro-level (microfoundational) explanation for a causal phenomenon;"[103] "a micro-level causal link between macro-level variable[s]."[104] The idea of micro-foundations, however, rejects understanding mechanisms as integrated wholes.[105]

For example, Morgan and Winship quote MDC on different disciplines and research projects recognizing different "bottom-out entities." But rather than stress, as MDC do, that this reflects conventional methodological choices[106] – not only are a physicist's bottom-out entities different from those of a chemist but an astrophysicist's are different from a particle physicist's – Morgan and Winship argue that "one can conceive of causal analysis in the social sciences as the pursuit of explanations that bottom out."[107]

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[98] (Beach and Pedersen 2019, 38).

[99] (Seawright 2016, 57. Cf. 86, 89, 97). Cf. (Kay and Baker 2015, 5): causal mechanisms "convey the causal force from the causal to the outcome variable."

[100] (Bennett and Checkel 2015b, 6-7).

[101] (Goertz 2017, 165. Cf. 10 ("the game-theoretic model itself is a causal mechanism"), 26, 55, 174 ("the model is the causal mechanism"), 177).

[102] (Bengtsson and Hertting 2014, 716). Cf. (Zagare 2011, 25), (Goemans and Spaniel 2016, 28-29, 31), (Lorentzen, Fravel, and Paine 2017, 468, 474).

[103] (Gerring 2010, 1500).

[104] (Bengtsson and Hertting 2014, 710). Cf. (Mayntz 2004, 247-252).

[105] See §1.3.

[106] (Machamer, Darden, and Craver 2000, 13).

[107] (Morgan and Winship 2015, 239).

This is true. Standard causal explanations *are* reductionist. But this rejects MDC's argument, quoted above, that "higher-level entities and activities are … essential to the intelligibility of those at lower levels, just as much as those at lower levels are essential for understanding those at higher levels. It is the integration of different levels into productive relations that renders the phenomenon intelligible and thereby explains it."[108] Explanation through bottom-out entities is a reductionist "causal" alternative to systemic/mechanismic explanation.[109]

Micro-foundationalists also often claim that "intelligible social science explanations should always include explicit references to the causes and consequences of [individual actors'] action;"[110] even that "[individual] actions are the core activities that bring about the social-level phenomena that one seeks to explain."[111] The extent to which individual-level mechanisms produce social outcomes, however, is an empirical question (or ought to be in a scientific discipline).[112] No privilege attaches to micro-mechanical explanations. "Micro-level mechanisms are no more fundamental than macro-level ones."[113]

10. Type Mechanisms

It is also common, especially in Sociology,[114] to identify what I will call "type mechanisms."[115] Examples include elections, policy drift, mobilization, monopolization, coalition building, legitimation, and self-fulfilling prophecies. In IR, balancing and brokerage are familiar examples.

Type mechanisms seem to me a particularly promising area of mechanismic research. (In addition to their substantive interest they can be deployed as modules in larger explanations of various sorts and research can both draw on and draw attention to work "on mechanisms" undertaken from other perspectives.) Here, however, I want to note an important caution.

Depictions of type mechanisms often are ideal-type representations of a class of mechanisms (rather than incomplete descriptions of a particular type of mechanism); analytical devices that cluster mechanisms by a few shared features (rather than sketches on the way to becoming schemas[116]). The label "type mechanisms" is meant to convey that they are ideal-type models of (more or less diverse) types of mechanisms; that they are, to coin a phrase, "doubly typified."

Serious research or explanation therefore usually will require that they be disaggregated or further specified. For example, legitimization and elite bargaining, to take two instances from the examples

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[108] (Machamer, Darden, and Craver 2000, 23).

[109] Cf. §1.3 at nn. 38-40. Whether "causal" reduction is eliminative or non-eliminative (see n. 40), it considers entities separate from the whole of which they are parts.

[110] (Hedström and Swedberg 1998, 11-12). If we replace "intelligible" with "complete" this claim might be defensible. As it stands, though, it is obviously false (or merely stipulative).

[111] (Hedström 2005, 26. Cf. 28). Why individuals should not be further decomposed is unclear. If, as I suspect, the answer is disciplinary convention, this removes most of the "foundational" force from "microfoundations" – which are (also) macrostructures with their own "microfoundations."

[112] The same is true of the extent to which social mechanisms produce individual-level outcomes and the extent to which the individual-level mechanisms that produce social outcomes are rational.

[113] (Falleti and Lynch 2009, 1149).

[114] This approach is usually seen (e.g., (Hedström and Udehn 2009), (Tilly 2010)) as rooted in Thomas Merton's work on middle-range theories, (especiallyMerton 1968, ch. 2).

[115] They are similar to what Jorg Friedrichs (2016, esp. 84-86) calls "process patterns." (Falleti and Lynch 2008, 334) use the label "mechanisms-as-types."

[116] See §6 at nn. 87-88.

above, are *classes* of processes that operate in very different ways. Unless we specify the particular type of "type mechanism" operating, we risk transforming a type mechanism into a black-box intervening variable – which is indeed how they are deployed above. Especially as type mechanisms become more abstractly specified, an outcome is easily confused with the processes that produce it – as occurs regularly in discussions of causal mechanisms.

11. Generative Mechanisms

Causal mechanisms are also sometimes referred to as generative.[117] Although such uses rarely are a central focus in the multimethods literature, they do suggest a new-mechanical/ordinary-language sense of mechanism.

Derek Beach and Rasmus Pedersen offer the most sophisticated and sustained such account that I know of among multimethod social scientists. They draw heavily on MDC (and other leading new-mechanical works), distinguish mechanisms from intervening variables,[118] stress that "the effects of a mechanism are more than the sum of their parts,"[119] and see the goal of mechanismic analysis as "enabl[ing] us to answer the question *How does it work?*"[120] Nonetheless, like most of their multimethod colleagues, they understand mechanismic explanations as "causal claims about the processes that link together causes and outcomes."[121] (Note the verbal displacement of mechanisms by causes. Mechanistic explanations are *causal* claims that link *causes* and their effects.)

Consider their abstract depiction of a simple mechanism.
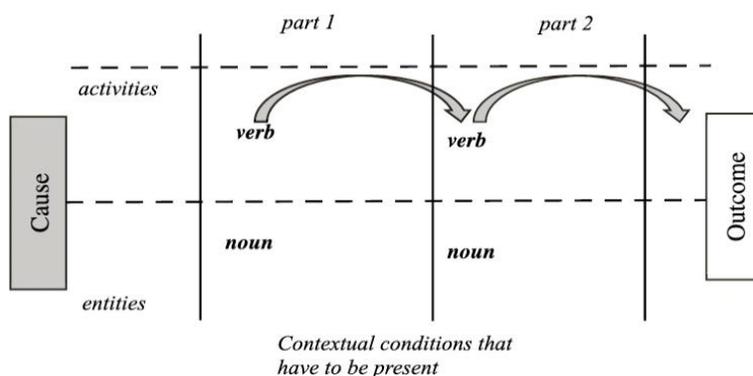
Source: (Beach and Pedersen 2019, 71)

Most of this figure is new-mechanical. (Entities and activities, represented by nouns and verbs, are organized and operate in ways that, in a particular context, produce an outcome.) Nonetheless, "mechanisms" are analytically subordinated to causes and outcomes. "Mechanisms in this understanding are defined as systems of interlocking parts that transmit powers or forces between a

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[117] See, for example, (Seawright 2010, 269, 271), (Gerring 2012, 13, 215-217, 310, 337, 369, 412), (Goertz and Mahoney 2012), (Waldner 2012, 66), (Mahoney 2016, 494). Cf. (Mayntz 2004, 244-246, 253). In the critical realist approach to mechanisms (e.g., (Archer 2015)), "generative" has a much stronger sense than in the multimethods literature. Agent-based modelling employs still another sense of generative mechanisms. See, for example, (Epstein 2006).

[118] (Beach and Pedersen 2019, 33-34, 55). Cf. (Waldner 2012, 67, 75).

[119] (Beach and Pedersen 2019, 3. Cf. 69-73).

[120] (Beach and Pedersen 2019, 69).

[121] (Beach and Pedersen 2019, 64. Cf. 1, 2, 3, 14, passim).

cause (or a set of causes) to an outcome."[122] Beach and Pedersen even title a section "Mechanisms Are the Link between Causes and Outcomes – And Nothing More."[123] Once again, a "causes" conception of causality largely strips the mechanisms out of causal mechanisms.

Truly mechanismic analysis requires shifting our focus from how *"causes"* produce effects (through mechanisms) to how *mechanisms* produce outcomes. Beach and Pedersen claim that "the essence of mechanistic explanations is that we shift the analytical focus from causes and outcomes to the hypothesized causal process *in between* them."[124] But this does not really shift the focus *to mechanisms*. It still sees causal mechanisms as something *in between* [their emphasis] cause and effect.

As the examples above illustrate, this encourages the scattershot identifications of eclectic "causal mechanisms" (rather than organized mechanical processes). And when many things are going on "in between," causal mechanisms tend to appear as contingent causal chains (rather than regularly operating generative mechanisms).

12. Process Tracing

Causal mechanisms are often employed in "process tracing" – which is often seen as "the best method to study causal mechanisms."[125] The standard understanding of process tracing as "the use of evidence from within a case to make inferences about causal explanations of that case,"[126] however, effectively precludes serious consideration of mechanisms. Consider Andrew Bennett and Jeffrey Checkel's state-of-the-art account.

In its most limited form, process tracing generates "diagnostic evidence;" evidence that "indicates the kind of process taking place, but does not transmit any independent effects to the dependent variable."[127] This may be all that we need where a (e.g., transmissive) mechanism is of minor intrinsic interest.

But "quite often … the events that lie temporally and/or spatially between the independent variable and the dependent variable are not fully determined by the specified independent variables and these events do have independent effects on the nature, timing, or magnitude of the dependent variable."[128] Such cases (which seem to me overwhelmingly the norm in International Studies) require a different explanatory strategy. As causality/explanation increasingly lies in the mechanism (rather than in something transmitted) we increasingly ought to focus on that mechanism as an object of intrinsic explanatory interest.

Bennett and Checkel, however, argue that when more is involved than transmitting the effects of independent variables "researchers have to make theory-building choices. Are they going to model

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[122] (Beach and Pedersen 2019, 38. Cf. 4, 38, 64, 69, 254).

[123] (Beach and Pedersen 2019, 50). Although I may be taking this passage somewhat out of context, they do insist that a mechanism *is* (essentially) a link between cause and outcome.

[124] (Beach and Pedersen 2019, 3).

[125] (Trampusch and Palier 2016, 15). Cf. (Goertz and Mahoney 2012, ch. 8), Goertz (2017 9).

[126] (Bennett and Checkel 2015b, 4). Cf. (Beach and Pedersen 2019, 1), (Goertz 2017, 8), (Seawright 2016, 64). (Trampusch and Palier 2016, Table 1) surveys definitions (which do not vary nearly as much as definitions of causal mechanisms). Cf. (Beach and Pedersen 2019, 30-31).

[127] (Bennett and Checkel 2015b, 7). Cf. (Beach and Pedersen 2019, 35, 167, 168, 246).

[128] (Bennett and Checkel 2015b, 7). This, it seems to me, modifies Bennett's earlier argument (2010, 208) that "process tracing involves the examination of 'diagnostic' pieces of evidence within a case that contribute to supporting or overturning alternative explanatory hypotheses;" that process tracing "focuses on the diagnostic intervening steps in a hypothesized causal process." If restricted to diagnostic evidence, process tracing is of extremely limited value.

these intervening events as variables? If so, should they treat them as exogenous, complementary, or endogenous to the theory or explanation of interest?"[129] Mechanisms thus are, at best, reduced to intervening variables in "causal" explanations – with all the epistemic limitations discussed above.

The fundamental problem, from a mechanismic perspective, is understanding process tracing as a method to provide "causal explanation via reference to hypothesized causal mechanisms" by "developing or testing hypotheses about causal mechanisms that might causally explain the case."[130] Causal mechanisms are hypothesized – rather than discovered and investigated. They explain causally – rather than mechanically. And "cases" are understood as instances of a general "cause"-effect relation – rather than instances of the operation of a type of mechanism.[131]

That *mechanisms produce, and thus explain, outcomes* is never seriously considered. The goal is to find probative evidence for the claim that X causes Y (through M). ("The researcher looks for the observable implications of hypothesized ["cause"-effect] explanations."[132]) Rather than ask "What produces Y?" one asks "To what extent are we justified in saying that Y is a causal effect of X?" Although this produces better "causal" explanations, it leaves *mechanisms* largely unaddressed.

A stipulative distinction between mechanisms and processes may help to clarify my argument. In the terminology I will use here, all "mechanisms" are "processes" but not all "processes" are sufficiently organized to be considered "mechanisms." The labels are arbitrary. (For other purposes, we might prefer Charles Tilly's usage, in which "mechanisms compound into processes."[133]) The distinction, however, is crucial.

In this framing, every social outcome comes about through a process. Not every social process, though, is a mechanism – a productively *organized* set of entities and activities that *operate* to produce *a particular kind of outcome.*

Because process-tracing typically explores "processes" that are not "mechanisms," it is not surprising that causal mechanisms usually are understood either as transmissive or as temporal stages in causal chains. Furthermore, processes that are not mechanism are likely to be relatively unorganized, even one-off. They therefore may indeed be of interest primarily as sources of diagnostic evidence of "cause"-effect relations. This also explains the typical restriction of the study of causal mechanisms to within-case inferences.[134]

Mechanisms, however, because they are organized, are potentially repeatable or generalizable[135] – and thus of independent epistemic interest. But (mere) *process* tracing, understood as exploring the string of events between X and Y to validate or better understand X's impact on Y, does not even try to address mechanismic causality or explanation.

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[129] (Bennett and Checkel 2015b, 7).

[130] (Bennett and Checkel 2015b, 3, 7 [emphasis added]).

[131] Bennett and Checkel might reply that this reflects their narrow focus on process tracing as a style of causal inference. This seems fair – so long as it is taken to acknowledge the necessity of explanatory pluralism (which they do not address).

[132] (Bennett 2010, 208). Cf. (Kay and Baker 2015, 5), (Trampusch and Palier 2016, 6).

[133] (Tilly 2010, 56). Cf. (Tilly 2001, 25-26), (McAdam, Tarrow, and Tilly 2008, 308).

[134] "Mechanistic evidence is found solely within a case." (Beach and Pedersen 2019, 56. Cf. 1, 3, 4, 6, 11, 14, 26, 34, 40, 100). Cf. (Bennett and Checkel 2015b, 2, 4, 7, 8, 9, 13), (Waldner 2015, 126, 131), (Trampusch and Palier 2016, 6), (Goertz 2017, 30).

[135] One-off mechanisms are unlikely to be of much social-scientific interest. Therefore, I will ignore them here.

13. From "Causes and Theories" to "Mechanisms and Models"

Generalizable or repeatable mechanisms, in addition to being distinctive objects of inquiry, provide distinctive kinds of explanations. Glennan nicely contrasts mechanisms-and-models and laws-and-theories approaches to explanation.[136]

The standard mainstream social-scientific understanding is well expressed by Waltz: "Laws identify invariant or probable associations. Theories show why those associations obtain."[137] As Claudio Cioffi-Revilla puts it, "in science, laws describe and theories explain."[138]

In fact, though, probabilistic "laws" – "law-*like* regularities"[139] – do establish relations of explanatory dependence and thus provide a certain kind of explanation (understanding; intelligibility). Waltz and others draw attention, though, to the fact that such "what" knowledge does not indicate why (or how) causal relations obtain. Therefore, it usually is considered (merely) descriptive (rather than deeply, strongly, or robustly explanatory). The kinds of "causal explanations" social scientists typically seek, in addition to identifying "causes" and estimating their effects, explain why causal relations hold – which requires a theory. Again quoting Waltz, "theories explain laws"[140] in the sense that they "show why those associations hold"[141] or "why the range of expected outcomes falls within certain limits."[142]

Laws, however, in the strict sense of statements of universal or invariant relations (e.g., Newton's Law of Universal Gravitation)[143] explain "directly," without recourse to a theory.   The explanation is that a particular phenomenon or observation is an instance of the "operation" (i.e., applicability) of a law. And laws explain by showing *that* this is the way the world is – *not how or why*. (If there is an answer to "Why?" it is "Because. Period. That's just how the world is.")[144]

Mechanisms also explain without appeal to a theory – by showing a phenomenon to be an instance of a particular kind of productive process. Startup and termination conditions are not merely associated but mechanically linked. A mechanismic explanation therefore requires nothing beyond identifying the mechanism that is in fact responsible for an outcome. ("Why?" "Because that's how the world works." As we noted above, "Biologists explain why by explaining how."[145])

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[136] (Glennan 2017, 8. Cf. 1).

[137] (Waltz 1979, 5).

[138] (Cioffi-Revilla 2017, 247).

[139] (Waltz 1979, 116 [emphasis added]. Cf. 1, 2 n. *).

[140] Waltz (1979, 6). I suspect that Waltz may have adopted this formulation from (Campbell 1938, 316). Cf. (Dilworth 1994, 237), (Koslow 2019, 9).

[141] (Waltz 1979, 5. Cf. 6, 8, 60).

[142] (Waltz 1979, 69. Cf. 72, 90).

[143] I set aside the (lively) philosophical debate about the existence and character of "universal" laws of nature – see, for example, (Carroll 2016), (Cartwright and Ward 2016), (Roberts 2016) – and address how things like Boyle's law and Newton's laws explain.

[144] Waltz argues that Newton had a *theory* of universal gravity (1979 6) that employed "such theoretical notions as point-mass, instantaneous acceleration, force, and absolute space and time." (1979 5). But these concepts are "theoretical" in the sense that all concepts are. And "the whole Newtonian system – a package of interconnected concepts" is not "a theory" in the way that, for example, defensive structural realism is. "Gravity" explains attraction through the law – not a theory that tells us why or how that law holds (or how bodies attract).

[145] (Bechtel and Abrahamsen 2005, 422. Cf. 421, 439).

More precisely, mechanismic explanations employ models[146] that represent/depict "real" mechanisms. [147] They show us (a model of) *how* an outcome is produced – which *is* the explanation; what makes the outcome intelligible or understandable.[148] And mechanismic research is largely a matter of discovering mechanisms and then developing increasingly accurate models of how they work.

14. When Do We Need Mechanismic Explanations?

I lack the space (and the skill as well) to explore what mechanismic research in International Studies might look like. In this section, however, I argue that mechanismic explanations are likely to be fruitful (and "causal" explanations unfruitful) in at least four types of situations.

14.1. *When Causality Involves More Than Transmitting the Effects of "Causes"*

Mechanismic explanations are likely to be called for when what happens between "cause" (startup conditions and initiation) and "effect" is crucial to understanding an outcome.

Black-boxing mechanisms may be fruitful where "something" "does something to" "something else," making causality a machine-like transmission of some force or power. But when dealing with complex transformative or creative processes, hiding mechanisms in arrows or intervening variables produces, at best, severely incomplete explanations.

This is particularly true when there are multiple paths from "the same" starting point to "the same" outcome (equifinality). For example, decades of work on the "causes" of war (and ethnic conflict, human rights violations, and many other major social problems) has not produced much epistemic progress not because we have found only correlates (or have failed to identify some major "causes") but because there are many paths to "war," etc. The "causes" of war thus tell us little about how or why wars come about; do not explain in a way that is particularly penetrating or useful.

14.2. *When Causality Does Not Arise Primarily from the Values of Variables*

Causal inferences explain through *variables*; "things"[149] that can take different values. Whole-part relations, however, usually are not fruitfully thought of in terms of "variables."

When only a few things vary, variable-based explanations may prove powerful. As more variables are added, though, in more complicated configurations, explanation increasingly lies in the chain (or network, or web) rather than in the "causes;" in the organization and operation of a whole (rather than the character or capacities of the parts).[150]

Even in some simple mechanisms, interdependencies bear the bulk of the explanatory burden. (Consider the Lotka-Volterra predator-prey model, in which the stock of predators is in part a

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[146] See, for example, (Craver 2006), (Illari 2019). On scientific models more generally, see (Giere 2004), (Godfrey-Smith 2006), (Frigg and Hartman 2020). How models explain seems to me woefully understudied in the social sciences (in significant measure because of the hegemony of "causal"-theoretical explanations).

[147] Pictorial representations thus are usually central in reporting the results of mechanismic research. (Abrahamsen, Sheredos, and Bechtel 2017), (Bechtel 2017), (Sheredos and Bechtel 2019), (Craver and Darden 2013, 56-59).

[148] See §1.2 at nn. 31-34 and §4 at nn. 63-66.

[149] Cf. n. 54.

[150] Christopher Achen (2002) similarly argues that no more than about three coefficients in a regression equation can plausibly be interpreted causally.

function of the stock of prey, and vice versa.[151]) Such *inter*dependent variables are both "causes" and effects – making what-causes-what explanations impossible.

Furthermore, many (most?) mechanisms are relatively *invariant* processes.[152] (2 cups of flour, 2 sticks of butter … Or 6 CO_2 + 6 H_2O.) Thinking in terms of variables at best fails to comprehend, and often misrepresents the nature of, such phenomena.

14.3. *When Models of the Data Don't Fit Plausible Models of the World*

When dealing with relations between variables in a dataset,[153] how the world is organized and operates is not methodologically significant. When dealing with causality "in the world," though, ontologically arbitrary "causes" (independent variables) or "things" that are affected (dependent variables) often are problematic.

For example, per capita GDP is a "cause" of – is causally relevant to – many social outcomes. But it is a statistical artifact that neither *causes* anything nor stands for any thing(s) in the world that have independent-variable causal force. Therefore, identifying per capita GDP as a "cause" does little more than create a false sense of understanding and preempt investigating what does the real causal and explanatory work.[154]

Similarly, militarized interstate disputes (MIDs) – interstate disputes involving the threat or use of force short of full-scale war – have been linked to a variety of "causes."[155] But MIDs are not some kind of "thing" in the world. They are a set of rather heterogeneous "things." Therefore, they are not (cannot be) "caused" by any thing(s). (Compare asking for the causes of weather – rather than of clouds, rain, ...)

14.4. *When We Want to Act in the World*

Finally, acting effectively in the world often requires knowledge of mechanisms. What-causes-what knowledge of causal relevance often contributes little to efficacious action. But knowledge of the mechanisms that "produce, underlie, or maintain a phenomenon"[156] – of *how* to get from startup to termination conditions or *how* to sustain a particular state of the world – indicates where we might effectively intervene. As Craver and Darden observe, "Biology has taken a mechanistic turn in large part because of the instrumental value of mechanistic knowledge."[157]

15. Explanatory Pluralism

I want to close by extending the argument for explanatory pluralism by noting both additional types of causal explanations and a variety of types of noncausal explanations and by challenging the common understanding of explanations as answers to why questions.

We have already identified two kinds of causal explanations, in the broad sense of explanations that tell us how or why. Network and field explanations, which are increasingly common in International

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[151] The *Wikipedia* entry provides a good introduction.

[152] (Waldner 2016) is exceptional in the multimethod literature in drawing attention to this important point.

[153] Cf. n. 54.

[154] Per capita GDP does ground predictions. But the distinctive character of predictive explanations only strengthens the case for explanatory pluralism.

[155] (Gochman and Maoz 1984) and (Jones, Bremer, and Singer 1996) are classic discussions.

[156] (Craver and Darden 2013, 15).

[157] (Craver and Darden 2013, 13).

Studies,[158] are also causal in this sense. Network explanations, however, ignore "causes" and abstract from both the entities involved (in favor of abstract nodes and edges) and the particulars of the activities (in favor of more abstract connections).[159] Fields similarly are neither "causes" nor mechanisms, whether we think in terms of "strategic action fields,"[160] Bourdieu's capital-habitus-field conception,[161] or on an analogy to magnetic and other physical fields.[162]

Among non-causal explanations we have already noted laws of nature and (analogical) as-if models. Forecasting models – in International Studies, International Futures (IFs) is a leading example[163] – and integrated assessment models, which are common in climate research,[164] give us leverage tell us in understanding what outcomes are more or less likely without telling us how or why. (Causal and mechanical knowledge is embedded in these models but the explanations are "systemic.") In quite another vein, marketing firms employ models that can reliably guarantee a certain response rate to a solicitation (by a route and for reasons that are, at best, obscure).

There are many different forms of scientific knowledge of how the world is, how it works, and why. And all, I am suggesting, are explanatory; that is, they "make plain or intelligible."[165]

Social scientists in the last third of the twentieth century bet heavily on "causes,"[166] guided in part by (what now are generally considered to be misguided) ideas about the unity of science and a singular (nomological-deductive) model of explanation.[167] This bet seems increasingly problematic in a world that recognizes instead the diversity of the sciences (as represented here by mechanisms and Biology).[168] Perhaps most troublingly, by hewing to a peculiar prescriptive philosophical ideal, the practices and self-understanding of the social sciences have come to increasingly diverge from the practices and self-understandings of the natural sciences. As I have suggested above, much of what biologists do is not recognizably scientific, causal, or explanatory according to the dominant causal inference vision of scientific explanation.

But isn't explanation "really" (or at least ultimately) about saying why (not what or how)? Not, I am arguing, in any interesting sense. To explain is "to describe or give an account of in order to bring about understanding."[169] Explanation comes in many forms – many of which tell us what or how (not why). And even if we were to agree that why explanations are "the best kind" of explanation,

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[158] Arbitrarily chosen examples include (Oatley et al. 2013), (Avant and Westerwinter 2016), (Erikson and Occhiuto 2017), (Gade et al. 2019), and (Acuto and Leffel 2020) and (Lim forthcoming), (Nexon and Neumann 2018), (Dixon and Tenove 2013), (Go 2008), and (Steinmetz 2008).

[159] (Kadushin 2012) is an accessible introduction to social network analysis.

[160] See, for example, (Fligstein and McAdam 2012).

[161] (Bourdieu and Wacquant 1992, 14-26, 94-115, 228-232; and 1993) are useful very brief introductions.

[162] See, for example, (Martin 2011, ch. 7, 8). (Barman 2016, 445-452) briefly reviews contemporary varieties of field theories.

[163] (Hughes 2019), https://pardee.du.edu/access-ifs.

[164] (Weyant 2017) is a useful overview. The idea of shared socio-economic pathways (e.g., (O'Neill et al. 2014)) provides an interesting link between global forecasting and climate research.

[165] *Oxford English Dictionary.*

[166] (Abbott 1998) tells the story briefly and well. Cf. also (Abbott 1988).

[167] (Cat 2017) and (Woodward 2019, §2) are useful overviews. (Hempel and Oppenheim 1948) and (Oppenheim and Putnam 1958) are classic papers.

[168] (Fodor 1974) and (Dupré 1995) are two (very different) early statements of "disunity of science" views.

[169] *Oxford English Dictionary.*

other kinds of explanations still are explanations. (In particular, description, in some circumstances, *is* explanation; to *describe* to bring about understanding.)

In International Studies, I have argued, explanatory pluralism is not just an abstract possibility but a necessity. Many of the most important issues we address simply cannot be understood through causal inferences, no matter how well-grounded in theory they may be. Penetrating and useful social science requires knowledge not only of what causes what but of how the world works – and of many other things as well.

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