LAWS FOR METAPHYSICAL EXPLANATION

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> In everything I seek to grasp
> The fundamental:
>
> . . .
> The crux, the roots, the inmost hearts,
> The explanations.
> (Boris Pasternak, "In Everything I seek to grasp . . . ", 1956, trans. Avril Pyman)

What must reality be like, for there to be metaphysical explanation? I argue that, just like causal explanation requires laws of nature, so metaphysical explanation requires *laws of metaphysics*:

1. There are metaphysical explanations.
2. If there are metaphysical explanations, then there are laws of metaphysics.
3. There are laws of metaphysics.

In §§1-3 I lay out the argument, and in §4 I discuss some implications, offering a positive and minimal *functional conception* of the laws of metaphysics, and arguing that some are *fundamental*.

Talk of "laws of metaphysics" traces back to Rosen (2006; see also Schaffer 2010), and variants of this style of argument from metaphysical explanation are given by Kment (2014: 5, 167–73), Wilsch (2015a: 3294), Glazier (2016), and Rosen (*this volume*). But there are two key differences: (i) my assumptions are more minimal, in that I assume nothing about grounding or essences, and little about explanation; and (ii) my concluding conception of laws is likewise more minimal, since I characterize them as having just the structure of functions. So I offer both a streamlined re-vision

of the argument, and a streamlined re-conception of what laws of metaphysics are.

1. There are Metaphysical Explanations

Premise 1 says that there are *metaphysical explanations*. By a "metaphysical explanation" I mean a non-causal explanatory connection of the sort invoked in the following paradigm claims:

- Socrates's drinking hemlock was beloved by the Gods because it was pious (see Plato's *Euthyphro*)
- The proposition *that Socrates was wise* is true because Socrates was wise (see Aristotle's *Categories*)
- Socrates's heart existed because Socrates existed (see Aristotle's *Metaphysics Z*)
- Socrates's biological state of being alive obtained because of his physical state (see Quine 1981: 98)
- Socrates was wise or handsome because he was wise (see Lewis 1983)
- Socrates was pale because he was this specific skin tone (see Armstrong 1997: 50; Rosen 2010: 126)
- The set {Socrates} existed because its member Socrates existed (see Fine 1995: 271)

Further examples of these sorts of claims abound in the literature on grounding (see Schaffer 2009 and 2016a: 52–4; Correia and Schnieder 2012: 1).

By way of clarification, I say that these examples are *explanatory claims* with *metaphysical flavor*. As far as being explanatory claims, these examples have the look of explanatory claims in featuring paired sentences linked by 'because.' And they have the feel of explanatory claims, going beyond merely describing *what happened*, and offering accounts as to *why*. The reader who doubts this may work with other explanatory idioms, such as:

- That Socrates existed explains why {Socrates} existed
- A reason why {Socrates} existed is that Socrates existed

As far as having metaphysical flavor, these claims are clearly non-causal, and moreover have the feel of concerning the constitutive generation of a dependent outcome. I think of this in terms of *grounding* (and would say that a metaphysical explanation is an explanation backed by grounding relations), but the reader who dislikes the notion of grounding is welcome to insert her own preferred understanding of the metaphysical—unified or not—so long as it covers these sorts of examples of non-causal generation.[1]

I trust that these examples, so clarified, suffice to convey the intended notion of metaphysical explanation in a fairly theoretically neutral way.

My reason for believing 1 is simply that some of these claims seems *true*, and thus provide examples of actual metaphysical explanations. For instance, I think that the set {Socrates} existed because its member Socrates existed. But for present purposes I need only claim that there is some explanatory connection between the existence of Socrates and the existence of {Socrates}. Perhaps the true explanation actually runs from {Socrates} to Socrates, or from a common source up to both. But surely it is *no mere coincidence* that both facts happen to co-obtain. Likewise I think that the proposition *Socrates was wise* is true because Socrates was wise. But for present purposes I need only claim that there is some explanatory connection here as well. It is surely no mere coincidence that both of these facts happen to co-obtain.

Just as one can argue that there are bread boxes by pointing at examples, without trying to define the term or settle hard cases, so I have argued that there are metaphysical explanations.

Since I am after a minimal version of the argument from metaphysical explanation, it is worth flagging that I have not assumed anything about grounding or essences or any other "deeper" metaphysical notions, nor have I assumed anything the underlying nature or structure of explanation. Thus even foes of grounding can accept 1. For instance, Hofweber (2016; espec. 328–40)—a *grounding nihilist* who dismisses the notion of grounding as esoteric—accepts that there are metaphysical explanations of the sort listed above, but says that some of them are backed by mere counterfactual dependencies. (I have a dispute with Hofweber but it is primarily over premise 2: §2.1) And J. Wilson (2014; cf. Schaffer 2016b and J. Wilson 2016)—a *grounding pluralist* who would replace "big-'G' Grounding" with a host of "small-'g' grounding relations" with a mere nominal unity—can accept 1, and merely say that these explanations are backed by many different substantive metaphysical connections rather than one. As far as I can tell the grounding pluralist can accept not just 1 but the entire argument for laws of metaphysics.

Overall I do not expect 1 to be very controversial. Perhaps its most controversial aspect is simply the allowance for non-causal explanation, since Scriven (1962), Salmon (1978), and Lewis (1986) have all defended something in the vicinity of the claim that all explanation is causal explanation.[2] By way of reply, I say that these examples of metaphysical explanation serve as counterexamples to the claim that all explanation is causal explanation. Examples of mathematical explanation serve as counterexamples as well (see especially Lange 2017). That said, it is worth keeping in mind that the primary appeal of causal accounts of explanation is their ability to provide a *direction* to explanation (Salmon 1978). But most contemporary inheritors of the causalist tradition (including Ruben 1990: 210, Kim 1994, Woodward 2003: 31, Strevens 2008: 179–80, and Skow 2016: 3; see also Schaffer 2016a: 83) explicitly adopt a more general directed notion of *dependence* to cover

the metaphysical and mathematical cases, at which point no conflict with 1 remains.

2. If There are Metaphysical Explanations, Then There are Laws of Metaphysics

Premise 2 is a conditional claim, saying that if there are metaphysical explanations, then there are *laws of metaphysics*. The guiding idea behind 2 is that, just as causal explanation requires laws of nature, so metaphysical explanation requires analogous principles. As Kment (2014: 5) nicely puts the point:

> [T]here is a far-reaching structural analogy between causation and grounding. Just as earlier states of the universe typically give rise to later ones by causing them, metaphysically more fundamental facts give rise to less fundamental ones by grounding them. Certain general metaphysical principles, which I will call "laws of metaphysics," play essentially the same role in grounding as natural laws do in causation.

I offer a specific development of this guiding idea, involving three inter-connected rationales.

But first I should clarify what I mean by a "law of metaphysics." By a "law" I mean the very minimal notion of a *counterfactual-supporting general principle*. I am not assuming that laws need to be fundamental or exceptionless.[3] I have more to say about the nature of laws of metaphysics later (§4), but that is not presupposed in the argument itself.

In saying that a law is "of metaphysics," I mean just that it is operative in the metaphysical realm, concerning the not-causal-but-constitutive generation of a dependent outcome. Again I think of this in terms of *grounding* (and would say that a law of metaphysics is a counterfactual-supporting generalization about what ground what), but that is not assumed here. The reader is welcome to use her own preferred understanding of the metaphysical, so long as it covers the cases to hand.

What I am arguing for—to put the matter as neutrally as possible—is that the sort of examples used to make the case for 1 (§1) require counterfactual-supporting general principles to impart explanatory force.

2.1. The argument from the role of explanation

My first of three interconnected reasons for saying that metaphysical explanations require laws of metaphysics comes from considering *the role of explanation*, with respect to *unification*, *manipulation*, and *understanding*.

Starting with unification, part of the role of explanation is to reveal patterns and unify the phenomena. The unificatory role of explanation can be seen as lying behind Putnam's (1975: 295–7) complaint against reductionist views, on which the macro-level generalization that one cannot fit a square peg through a round hole gets lost in a reduction to myriad diverse particle arrangements. The unificatory role of explanation can also be seen as the *ur*-intuition motivating unificationist accounts of the nature of explanation (Friedman 1974, Kitcher 1981). I am not saying that unificationist accounts are correct—indeed I doubt that they capture the asymmetry of explanation—but only saying that they have a plausible motivation.

The unificatory role of explanation clearly calls for explanations to involve generalizations, which serve to subsume a given case under a more general pattern. But it is also worth noting that the generalizations involved cannot merely happen to hold in our world, but must also be *non-accidental* generalizations which are counterfactually robust. And so the unificatory role of explanation requires the presence of counterfactual-supporting general principles, to serve as stable patterns.

Turning to manipulation, another part of the role of explanation is to convey recipes and provide a handle on the phenomena. The manipulationist role of explanation can be seen as connected to Woodward's (2003) guiding conception of explanations as serving to answer "what if things had been different" questions, and Skyrm's (1980: 11) idea that wiggling the value of one variable wiggles the value of another. The underlying idea is that part of having an explanation is having a sense of how the system sits with respect to what Nozick (1981: 12) calls "a network of possibility" involving connections across actual and counterfactual situations.

The manipulationist role of explanation—like the unificatory role—also requires counterfactual-supporting generalizations. A one-off "explanation" would not provide a recipe, and a counterfactually fragile "explanation" would not provide a stable pivot for intervention. It is through counterfactual-supporting generalizations that one can calculate the impact of potential interventions.

Switching finally to understanding, part of the role of explanation is to provide a basis for understanding the phenomena and so dispel wonderment and offer illumination. In this vein Kim (1994: 54) speaks of understanding as the central purpose of explanation: "[T]o seek an explanation of something is to seek to understand it, to render it intelligible." And Strevens (2008: 3) waxes poetic about the connection:

> If science provides anything of intrinsic value, it is explanation. Prediction and control are useful, and success in any endeavor is gratifying, but when science is pursued as an end rather than as a means, it is for the sake of understanding—the moment when a small, temporary being reaches out to touch the universe and makes contact.

The understanding role of explanation further requires counterfactual-supporting general principles. Thus Baumberger, Beisbart, and Brun (2017: 13) offer two "complementary" suggestions about how explanatory grasp and objectual understanding exceed merely knowing that *p* because *q*, involving both a conception of the underlying causal principle involved, and a grasp of counterfactual variations. And Grimm (2010: 340–1) offers an elegant example of understanding lift via grasping Bernoulli's principle, and being able to apply it to both actual and counterfactual cases.[4]

So putting this together, I have argued that explanations require counterfactually-supporting general principles to play their core roles with respect to unification, manipulation, and understanding. Laws are the stable patterns which unify the phenomena, provide recipes for manipulation, and guide understanding. So I conclude that if there are metaphysical explanations, then there must be counterfactually-supporting general principles in the metaphysical realm.

I am now in position to say why I reject Hofweber's view (2016; espec. 331–40), on which some metaphysical explanations are backed by nothing more than counterfactual dependencies.[5] My objection is that Hofweber offers no account of why such counterfactuals hold. Likewise he offers no account of why such counterfactuals form general patterns.[6] In the causal case, part of the "standard" account of why various counterfactuals hold, and form the general patterns that they do, is that they are supported by laws of nature. I am making the analogous inference in the metaphysical case. In that sense I agree with Hofweber that counterfactual dependencies are a crucial aspect of explanation (metaphysical and otherwise). I only add that such counterfactuals need to be supported by laws, in ways crucial to their explanatory force.

2.2. The argument from causal explanation

My second of three interconnected reasons for saying that metaphysical explanations require laws of metaphysics comes from considering *the structure of causal explanation*, and in particular the requirement of laws of nature to connect causes to effect. To begin, I say that causal explanation requires laws of nature. This requirement can be seen in leading accounts stemming from the classic deductive-nomological account (Hempel & Oppenheim 1948), to contemporary structural equation model accounts (Hitchcock & Woodward 2003), and also can be seen from considerations involving the role of explanation.

On the deductive-nomological account, an explanation of a particular condition requires (i) statements of actually occurring conditions, as one element of the *explanans;* (ii) statements of laws of nature (thus the 'nomological'), as the other element of the *explanans*, and (iii) a statement

of the outcome condition as the *explanandum*. Requirement (ii) brings in laws. I am not saying that deductive-nomological accounts are correct—indeed I doubt that they capture the asymmetry of explanation—but only saying that they are insightful with respect to requiring laws of nature to connect the conditions cited in the *explanans* to the outcome cited in the *explanandum*.

Structural equation model accounts require the specification of (i) a set of exogenous (/independent) variables, representing the initial input conditions; (ii) a set of endogenous (/dependent) variables, representing various resulting output conditions; and (iii) a set of structural equations (/dependence functions) linking the values of each endogenous variable to its "parents" and ultimately back to the exogenous variables. Requirement (iii) brings in laws, in the minimal sense at issue of counterfactual-supporting general principles. I am not endorsing any specific claim about what relationship between variable values counts as explanatory within these models (this is an open controversy), or even here endorsing accounts based on these models (though I do favor this approach, as detailed in Schaffer 2016a (see also A. Wilson *forthcoming-b*)). I am just saying the background technology of these models is getting it right in requiring counterfactual-supporting general principles to connect the values of variables.

What I am primarily rejecting at this stage are causes-only accounts of causal explanation. Scriven (1959) and Skow (2016) both hold something like this view, on which laws play no role in causal explanation.[7] Against such accounts, I would appeal not only to structural equation models but also back to the role of explanation (§2.1), and hold that such accounts fail to illuminate the connections between explanations and unification, manipulation, and understanding. For instance, consider a double-slit experiment in which repeated firings of a laser cause an interference pattern to appear on a screen. This is a quantum effect which cannot be understood from a classical perspective. My claim is that information about the causes (the firings of the laser) and is not enough to understand *why there was an interference pattern*. For that one also needs information about the laws (the quantum dynamics governing light), to reveal how the causes and the effect are connected.

Given that causal explanation requires laws of nature to connect causes to effect, I say that the analogous requirement is present in metaphysical explanation, requiring laws of metaphysics to connect sources (/grounds) to result (/grounded). That is, if causal explanation requires laws of nature, then metaphysical explanation likewise requires laws of metaphysics.

Indeed, I say that causal and metaphysical explanation—as forms of explanation generally, aptly modeled by structural equation models—have the general dependence structure of <*Sources*, *Links*, *Result*>. In thinking of explanation as tracking dependencies, I follow Kim (1994: 68; see also Ruben

1990, Woodward 2003, Reutlinger 2016), who says: "[E]xplanations track dependence relations. The relation that 'grounds' the relation between an explanans, G, and its explanatory conclusion, E, is that of dependence; . . . " He clarifies:

> The ontological contribution of dependence relations lies exactly in this fact: they reduce the number of independent events, states, facts, and properties we need to recognize. And that is precisely the unifying and simplifying power of dependence relations. Unity and structure go hand in hand; dependence enhances unity by generating structure.

My reason for thinking that the law requirement on causal explanation carries over to the metaphysical case is that causal and metaphysical explanation are both forms of explanation, and both involve the tracking of dependence relations. Explanation generally has a unified conceptual role involving such matters as unifying the phenomena, guiding manipulations, and yielding understanding (§2.1). Explanation generally has unified formal features such as asymmetry, and can generally be invoked via a package of univocal terms like 'explains,' 'why,' and 'because.'[8] These are the conceptual, formal, and semantic signs of a unified general notion.

Insofar as causal and metaphysical explanation are both forms of explanation, it becomes possible to use the structure of one to gain insight into the structure of the other. Insofar as causal explanation requires laws of nature (and overall involves a *<Sources, Links, Result>* dependence structure), metaphysical explanation has a structurally parallel requirement. Without linking principles, nothing connects the sources to the result, no general pattern of dependence is revealed, and a full understanding of why the result obtains remains elusive, in causal and metaphysical cases equally.[9]

2.3. The argument from paradigm cases

My third and final reason for saying that metaphysical explanations require laws of metaphysics comes from considering *paradigm cases*, namely those that motivate recognizing metaphysical explanation in the first place (§1). This is primarily a buttressing consideration, interwoven with the preceding considerations from the role of explanation and the structure of causal explanation, intended to show that it all looks plausible and makes sense when applied back to the starting point.

For instance, consider the connection between the existence of Socrates and the existence of {Socrates}, as a paradigmatic example of a non-causal connection with metaphysical flavor. In this case the operative metaphysical principle—assuming a hierarchical conception of sets, such as embedded

in Zermelo-Fraenkel set theory—is *set formation*. Set formation is a recursive operation which may be understood as the smallest function from any plurality *X*s found up to stage *n*, to an entity *y* at stage *n*+1, where *y* is the set with all and only the *X*s as its members. Give Socrates to set formation as an input, and it will deliver {Socrates} as output.

My point is that, in order to explain the existence of {Socrates} from the existence of Socrates, the principle of set formation is needed to give the connection. Without set formation, the existence of Socrates and the existence of {Socrates} are just two facts with no special connection, much less the kind of asymmetric dependence that backs explanation. It is though set formation that the general pattern connecting Socrates to {Socrates}, Plato to {Plato}, and Aristotle to {Aristotle}, etc. is revealed. It is through set formation that one can see how wiggling the existence of Socrates wiggles the existence of {Socrates}.[10] And it is through set formation that one can understand why {Socrates} exists, given that Socrates exists.

This connection can be aptly modeled through structural equation models, as follows:[11]

The making of {Socrates}

S1 = <{*Socrates*}, {*Singleton*}, **R1**>, where **R1** maps both *Socrates and Singleton* to {0, 1} where 0 represents nonexistence and 1 represents existence

L1 = {*Singleton* ⇐ *Socrates*}

A1 = {*Socrates* = 1}

The induced graph is:

Socrates → *Singleton*

The model *The making of {Socrates}* aptly represents the dependence of the existence of {Socrates} on the existence of Socrates, and thereby provides an explanatory understanding as to why {Socrates} exists. For present purposes the crucial point is that the model crucially includes an equation—a kind of "local" application of set formation—connecting the existence of Socrates to the existence of {Socrates}, showing up as the arrow in the induced graph. Without such an equation the variables would simply be inert and disconnected.

Likewise consider the connection between the fact that Socrates was wise, and the truth of the proposition that Socrates was wise. In this case the operative metaphysical principle is *truth-making*. That is what connects the facts to the truths. Without truthmaking, there is no special connection between the fact that Socrates was wise and the fact that the proposition that Socrates was wise is true, much less the kind of asymmetric dependence

that backs explanation. It is though truth-making that the general pattern connecting myriad facts to myriad truths is revealed. It is through truth-making formation that one can see how wiggling the facts wiggles the truths. And it is through truth-making that one can understand why it is true that Socrates was wise, given that Socrates was wise.

This connection can be aptly modeled (in a way isomorphic to *The making of {Socrates}*), as follows:

> *The truthmaking of the proposition that Socrates was wise*
>
> **S2** = <{*Wisdom*}, {*Proposition*}, **R2**>, where **R2** maps *Wisdom* to {0, 1} where 0 represents the fact that Socrates was foolish and 1 represent the fact that he was wise, and maps *Proposition* to {0, 1} where 0 represents the fact that the proposition that Socrates was wise is false and 1 represents the fact that this proposition is true
>
> **L2** = {*Proposition* ⇐ *Wisdom*}
>
> **A2** = {*Wisdom* = 1}

The induced graph is:

> *Wisdom* → *Proposition*

The crucial point again is that an equation is needed connecting the variables. Without the kind of "local" application of truth-making encoded in **L2** and showing up as the arrow in the induced graph, the variables would simply be inert and disconnected.

Similar points could be made for all of the paradigm cases that motivate recognizing metaphysical explanation in the first place.[12] In some cases the connecting principles, and even the true direction of explanation, are controversial. But in all cases, where there is explanation, there is a counterfactual-supporting general principles connecting the factors at issue, and revealing how the result to be explained depends on its sources.

Overall I would offer the rationales from the role of explanation (§2.1), from the structure of causal explanation (§2.2), and from paradigm cases of metaphysical explanation (§2.3) as a mutually supporting package of considerations in favor of 2.

3. There are Laws of Metaphysics

I have argued that there are metaphysical explanations (§1), and that if there are metaphysical explanations then there are laws of metaphysics (§2), so I am in position to conclude that there are laws of metaphysics, as per

3. This concludes the core argument for laws of metaphysics. It remains to discuss the implications (§4).

But first I want to flag three things that my argument for laws of metaphysics does *not* assume, which sets it apart from other arguments floating around in the literature, due variously to Kment (2014: 167–73), Wilsch (2015a: 3294), Glazier (2016), and Rosen (*this volume*):

- No claims about grounding are made
- No claims about essences are made
- No specific views of explanation are assumed (rather the general law-involving nature of explanation is argued for in various ways)
- No claims about the nature or structure of the laws of metaphysics are made (beyond their capacity to serve as counterfactual-supporting generalizations)

At most I have drawn on some general platitudes about the role of explanation (such as the connection with understanding), buttressed by a widespread picture of causal explanation, and by intuitions about the cases at hand. And so I claim to offer a minimal version of the argument from metaphysical explanation to the existence of laws of metaphysics.

This is not to say I reject other arguments (though in point of fact I do reject the arguments in the literature so far, either for their assumptions about grounding, or for positing essences, or for assuming something like the deductive-nomological view of explanation). There may be many sound arguments for positing laws of metaphysics. But it is useful to see how little needs to be assumed.

Laws of metaphysics are a strange entity few have considered. But I claim that there is a compelling argument for such things, from minimal and plausible premises about explanation.

4. Implications for the Laws of Metaphysics

Having argued that there are laws of metaphysics, I turn to considering some features of the entities that the argument from metaphysical explanation delivers. I offer a positive and minimal *functional conception* of the laws of metaphysics, and argue that some are *fundamental*. As a corollary, I claim that the notion of essence—invoked by many friends of grounding and laws of metaphysics stemming from Fine (1995), and picked up by Rosen (2010), Dasgupta (2014), and Kment (2014)—is *explanatorily inert*.

4.1. The functional conception of laws of metaphysics

I argue that, given the argument from metaphysical explanation, it is fitting to think of laws as individuated by their associated functions. By "function" I mean a set-theoretic entity, which can be illustrated by squaring, which is the smallest function from a base number x to its product x^2. This function can be represented "in extension," as a plurality of ordered pairs:

Squaring by result: <1, 1>, <2, 4>, <3, 9>, …

This function can also be represented "in intension," as a rule:

Squaring by rule: The <*x, y*> pairs such that $x \times x = y$

Nothing more is needed. Someone who claims to understand the function but still claims not to understand squaring is confused, for there is nothing more to understand.

There are two key points about functions, the first of which is that they are relatively coarse-grained relative to linguistic descriptions. For instance, the following are equivalent descriptions of one and the same squaring function:

- The <*x, y*> pairs such that $x_1 + x_2 \ldots + x_x = y$ (with *x*-many *x* summands)
- The <*x, y*> pairs such that $x \times x \times 1 = y$
- The <*x, y*> pairs such that not not $x \times x = y$
- The <*x, y*> pairs such that either $x \times x = y$ or $x \times x = y$

There is no question as to which rule is the "real" squaring function, for each rule induces the very same mapping from x to x^2. Indeed the standard mathematical conception of a function is as a mapping between two sets (the domain and the codomain), and it can be readily seen that all of these formulations induce the same mapping from numbers to numbers. In that sense the rule is not actually incorporated into the function, but merely serves as a means to "fix the reference" and point towards the mapping.

The second key point about functions is that they are no more than mappings. There is no further structure to these things. Imagine someone claiming to distinguish (i) the function *f1* from x to x^2 as God created on the first day, from (ii) function *f2* from x to x^2 as God created on the second day. This person would be confused for many reasons, but one minor respect in which they would be confused is that functions do not have a further slot for the day God created them, or anything else besides.

So much for functions. Now the functional conception of laws of metaphysics says that laws of metaphysics have the coarse-grained individuation conditions of functions. Just as squaring can be represented by result and by rule, so can laws. Schematically this looks like:

Law by result (*schematic*): $<Sources_1, Result_1>, \ldots, <Sources_n, Result_n>$

Law by rule (*schematic*):   The $<Sources, Result>$ pairs such that *Rule* $(Sources) = Result$

Specific version of these schemata suffice to individuate specific laws. To return to the case of set-formation as illustration:

Set-formation by result: $<\emptyset, \{\emptyset\}>, \ldots, <Socrates, \{Socrates\}>, \ldots$

Set-formation by rule: The $<Xs, y>$ pair such that the *Xs* arise at or below stage *n*, and *y* is the set at stage $n + 1$ with all and only the *Xs* as its members

The functional conception of laws of metaphysics does not identify laws of metaphysics with functions. Functions themselves are set-theoretic entities that lead a dependent life within the set-theoretic hierarchy. Rather the functional conception of laws of metaphysics says that laws can be *aptly represented* as functions (just as they are in structural equation models), and may be *individuated* by their representative functions. That means that any representation of set-formation that preserves the above mappings are to be regarded as equivalent re-descriptions of one and the same law.

The reason I recommend the functional conception of laws of metaphysics is that this is the minimal structure that the laws need to subserve metaphysical explanation. As functions they have the input-output structure that gives explanation the connection and the direction needed. (Here again I am saying that the technology of structural equation models is getting things right.)

I do not say that no finer-grained distinctions can be drawn, or that no finer-grained distinctions can be useful for other purposes. But I say that from the perspective of metaphysical explanation, no finer-grained distinctions make a difference.

The functional conception of laws of metaphysics stands opposed to accounts in the literature that impute more structure, in respect to finer-grained individuation by formulae, as well as to finer-grained "pinning" of the law on some specific entity or entities involved. With respect to finer-grained individuation by formulae, Glazier (2016)—building on technology

from Fine (2012)—treats laws of metaphysics in terms of linguistic formulae involving a primitive variable binding operator:

$$\varphi_1, \ldots, \varphi_n \ll_{\alpha 1 \ldots \alpha m} \psi$$

In this regimentation, $\varphi_1, \ldots, \varphi_n, \psi$ are sentences, $\alpha_1 \ldots \alpha_m$ are variables, and $\ll$ is an operator binding $\alpha_1 \ldots \alpha_m$. Formal details aside—and assuming standard individuation for sentences, this is going to individuate laws of metaphysics at a finer-grain than explanation requires, by a particular expression of the rule rather than the underlying mapping it induces.

With respect to pinning the laws, Kment (2014: 167) attributes at least some laws of metaphysics to essences, noting: "Unlike natural lawhood, essentiality is a *relativized* form of lawhood: any essential truth is essential to a *specific entity or entities*." This is also going to individuate laws of metaphysics at a finer-grain than explanation requires, with an additional slot for the entity or entities said to be the source of the law.

I say that both formulaic and pinning structure are explanatorily inert. Once one maps Socrates to {Socrates} as input to output, metaphysical explanation has all the connection and direction that it needs.[13] At that point any of the many descriptions of this mapping may be chosen at random, and the mapping may be pinned on any of the many entities involved at random, for these matters are explanatorily inert.

Indeed the irrelevance of formulaic and pinning structure should already be clear from the case of causal explanation. If the rock shatters the window, it will be explanatorily relevant that the rock and window have certain initial properties, and that the dynamics of temporal evolution map these inputs to a window shattering output. With this information, the fate of the window is sealed. One can then freely formulate this mapping in various ways, and pin it where one will, for these matters make no difference whatsoever to the causal workings of the world.[14]

4.2. *The fundamentality of some laws of metaphysics*

I argue that, given the argument from metaphysical explanation, some laws of metaphysics must be fundamental. By "fundamental" I mean that there are ungrounded facts about the existence of these entities.[15] At this point I need to bring in some assumptions about grounding and its connection to metaphysical explanation, insofar as fundamentality is a ground-theoretic status.

The argument for the fundamentality of laws of metaphysics is driven by the idea that, since metaphysical explanations require laws of metaphysics, it is impossible to get "underneath" a given law of metaphysics save through

deeper laws of metaphysics. More carefully, let f be the fact that a given law of metaphysics L exists. (For instance, to pick up on the examples discussed in §1.2.3, f might be the fact that set-formation exists, or the fact that truth-making exists.) Either there is an explanation for f or not.

If not—if there is no explanation for f—then there is an inexplicable fact about the existence of L (already a strong result). Given the further assumption that grounded facts are explicable (from their grounds, via the laws), it follows that f is an ungrounded fact, and so follows that law L is fundamental.

If so—if there is an explanation for f—then by the lights of the argument for laws of metaphysics (§1), this explanation for f must involve both *sources*— the grounds of f—as well as *links*—laws of metaphysics connecting f's sources to f. Consider these laws $L1$-Ln. There are two cases worth separating (i) L is one of the laws in $L1$-Ln, and (ii) L is not one of the laws in $L1$-Ln. Case (i) can be ruled out for involving self-explanation, insofar as L is playing a role in explaining the fact of its own existence. It looks like the "explanation" for L's existence cannot really be explaining it but must already be presupposing it.

Case (ii) brings in further laws $L1$-Ln, and facts $f1$-fn about the existence of such laws that are in line for explanation. So let $f1$ be the fact that $L1$ exists, and repeat the argument for $f1$. Either it is an inexplicable fact, and so $L1$ is fundamental, or it is itself explained via some laws of metaphysics itself. Assuming that there cannot be limitlessly descending chains of ever deeper laws, at some point there is a fundamental law.

In no case is it possible to explain the existence of the law L, without bringing in laws to explain L's existence. Assuming that explanations cannot circle and must terminate, at some point one must hit fundamental laws that serve as root explanatory principles. (Some allow explanations to circle and some allow explanations to never terminate in particular cases, but few would want to say that circular or non-terminating explanatory structures are generally required in all cases, just to avoid fundamental laws of metaphysics.)

The argument that some laws of metaphysics must be fundamental supports a position about the laws of metaphysics that is analogous to the Carroll-Maudlin (Carroll 1994, Maudlin 2007) view about law of nature as fundamental ontological elements. But note that the argument itself does not generalize to the nomological case. There is no barrier to thinking that the laws of nature can be metaphysically explained from the regularities in a Humean vein—it is just that this explanation at some point must appeal to fundamental laws of metaphysics. (One can in principle be a Humean about laws of nature but a fundamentalist about laws of metaphysics.)

But the argument that some laws of metaphysics has an important corollary, with respect to purported attempts to explain the laws of metaphysics in "deeper" terms, such as by essences. For the argument shows that any attempt to explain the existence of a given law of metaphysics from essences will itself required a law of metaphysics to connect the essences to the

existence of the target law. There is no getting underneath the laws of metaphysics with essences, or any other allegedly deeper matter.

Whatever use essences may find elsewhere in metaphysics, I conclude that they should play no role in accounts of causation, grounding, dependence, or explanation. Fundamental functional laws of metaphysics are going to be needed anyway, and once they are admitted there is no need for more, at least as fat a explanation is concerned.[16]

Notes

1. For instance, Bennett's (2017) pluralistic notion of *building* would work equally well. Though Bennett herself (2017: 61–2) is non-committal with respect to explanation.
2. I say "in the vicinity" because all of the authors I mention qualify their views in various ways. For instance, Lewis (1986) restricts his account to explanations *of the occurrences of particular events*. He also allows causal explanations that do not actually cite causes but merely provide *some information about the causal history* of the particular event at issue. If none of these authors would oppose 1 in the end, all the better.
3. I am thus using "law of nature" in Hitchcock & Woodward's (2003: 3) non-controversial "inclusive sense." It is controversial that causal explanation requires fundamental and/or exceptionless generalizations. For instance—to take a case from Woodward (2000)—one might causally explain crop production by an equation treating crop production as a linear function from amount of rainfall, where the equation involved is neither fundamental nor exceptionless, and only holds for "intermediate" rainfall values (beyond which all the crops die from drought or from flood). It may be argued that there need to be fundamental and exceptionless background laws behind this rainfall-crop equation, but in the main text I remain neutral on the matter.
4. Indeed Grimm (2010: 341, fn. 23; also 2006: 532–3) explicitly connects explanatory understanding with Woodward's (2003) idea of answering "what if things had been different" questions. In this sense the manipulation and understanding roles are not independent, but interconnected aspects of the link between explanations and counterfactuals.
5. I say "some" because Hofweber says that others are backed by conceptual connections. I am focused on Hofweber's account of metaphysical explanation in the cases not backed by conceptual connections, which (as I read him) includes the Euthyphro example as well as the grounding of the moral in the natural.
6. Wilsch (2015b: 2; see also Rosen 2010: 130, Audi 2012: 697–8) puts this point about patterns nicely, with respect to grounding claims: "[C]onsider the grounding-truth expressed by the following sentence: 'That the tomato t is red grounds that t is colored.' It follows from this grounding-truth that any truth expressed by a sentence of the form 'o is red' grounds the corresponding truth expressed by 'o is colored.' . . . [G]rounding-truths exhibit general patterns."
7. Scriven (1959) holds that laws merely play an evidential role, in justifying causal explanatory claims connecting causes to effect. Skow (2016: espec. 81–91) holds

that laws do not help to give a reason why the effect occurred, but merely supply a "second-order reason" as to why the causes caused the effect. I am sympathetic to Skow's claim that laws supply a second-order reason. I just think they also provide a first-order reason why, since I think they are needed for understanding why. But in any event, I need not have a dispute with Skow here, just so long as he would also accept that first-order reasons require the existence of law-involving second-order reasons. For that would suffice to make the existence of laws of nature into a requirement for the possibility of causal explanation, which is all I am after.

8. Shaheen (2017, *forthcoming*) contests the univocity of 'because,' arguing that it is *polysemous* between a baseline causal meaning and a metaphorically extended meaning that covers the metaphysical case. I disagree with Shaheen's judgments about key sentences but lack the space to discuss the matter. That said, I need have no argument with Shaheen here, since he (Shaheen 2017: 567–8) sees the metaphysical sense of 'because' as a *structural metaphor*, extending the baseline causal notion by holding fixed its structural aspects. Insofar as the involvement of laws is a core structural aspect of causal explanation, Shaheen's view equally predicts that metaphysical explanation requires structurally analogous laws of metaphysics.

9. I lack the space to discuss mathematical explanation, but want to flag it as a potential difficulty for the dependence-based view. The general picture I would like to defend sees the conclusion of a theorem as a dependent result, with the premises (and ultimately the axioms) serving as sources, and inference rules serving as linking principles (/laws of logic). But—unlike in the causal and metaphysical case—there seems to be no fixed order as to what should count as axiom or theorem, especially in cases of mutual inter-derivability (such as the cluster of propositions inter-derivable with Euclid's parallel postulate, in the context of the rest of Euclidean geometry). There is also the more subtle problem of saying why certain proofs (e.g. brute force proofs) lack explanatory power.

10. In some cases this involves counter-metaphysical conditionals. For instance, supposing that it is metaphysically necessary that the empty set exists with, one still wants to be able to say that if the empty set did not exist, then its singleton would not exist. See Schaffer 2016a (espec. 71–3) and A. Wilson *forthcoming-a* for further discussion.

11. *Notation*: S is the signature characterizing the system under study, via a triple of exogenous variables, endogenous variables, and a range function mapping variables to allowed values. L is the linkage adding the "dynamics" of the system, via a set of structural equations evaluating each endogenous variable as a function of other variables. A is the assignment setting the actual values of the exogenous variables. See Schaffer 2016a for further clarification of the formalism employed, and discussion of the applicability of such models to a wide range of metaphysical cases. (See also Koslicki 2016 and J. Wilson 2016 for criticisms.)

12. See Schaffer 2016 (espec. 76–82) for application of the structural equation framework to a wide range of paradigm cases of grounding.

13. It may be thought that pinning the law on {Socrates} rather than Socrates helps give direction to the explanation. But really the explanatory asymmetry in hierarchical set theory stems from the recursive structure of the set-formation machinery, which outputs set S at stage $n+1$ when fed the members of S at stage

n. It is the structure of the machinery that does the work, not any claims about essences.

14. It is controversial whether the causal asymmetry is sourced from the dynamical laws themselves, or from the external temporal order, etc. But surely the order of causal explanation between the throwing of the rock and the shattering of the window does not await an assignment of essences. It is not as if the physicist is incapable of giving a causal explanation of the window shattering, until she first settles the matter of essences.

15. My own view (Schaffer 2009) is that grounding relates entities—not just facts—so a fundamental entity is just an ungrounded entity. In the main text I treat a fundamental entity as one whose existence fact is fundamental, so that the discussion can be open to those (such as Rosen 2010) who restrict grounding to facts.

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