PRIMITIVE GOVERNANCE

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Laws of nature are sometimes said to govern their instances. Spelling out what governance is, however, is an important task that has only recently received sustained philosophical attention. In the first part of this paper, I argue against the two prominent reductive views of governance—modal views and grounding views. Ruling out the promising candidates for reduction supports the claim that governance is *sui generis*. In the second part of this paper, I argue that governance is subject to a contingency requirement. Laws govern their instances only if those instances are metaphysically contingent. I end by defending the resulting account of governance from two potential objections.

1. Governance and Explanation

According to the governing conception of laws, laws of nature operate on the world. Governing laws are described as making something the case, or as guiding, restricting, directing, generating, or producing their instances. In short, governing laws determine their instances in some metaphysically robust sense.[1] However, governance itself is a somewhat puzzling notion. In what sense do laws determine their instances? Beebee (2000) famously argues that the governance conception of laws stems from a religious picture of divine legislation. However, we should not be too quick to provide an error theory of governance. The idea that laws govern their instances is very natural, and may even be required for scientific practice.[2]

To have a better sense of governance, it is instructive to examine its explanatory role. Proponents of the governing conception of laws argue that governance is a metaphysical dependence relation which allows laws to explain their instances—laws explain why their instances hold because they make it the case that they hold. This conception of laws can be demonstrated by its contrast with the Humean conception of laws. Humeans take laws of nature to supervene on particular matters of fact. At the fundamental level, there is just an array of spatio-temporally located qualities, often called the

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[1] See, e.g., Beebee (2000), Bhogal (2017), Emery (2019; 2022), Maudlin (2007), and Wilsch (2020). The discussion in what follows assumes deterministic laws, I will address complications raised by indeterministic laws in Section 5.3.

[2] See Emery (2022) for an argument that principles of scientific theory choice require a governing conception of laws.

Humean mosaic, from which laws of nature are somehow derived.[3] Laws are therefore not 'over and above' their instances, and do not produce their instances in any metaphysically robust sense. As far as Humean laws explain their instances, they do so by summarizing them, unifying them, or featuring in scientific explanations.[4]

To further illustrate the contrast between these kinds of explanation, consider the following cases:

- **Party 1:** Bouncer 1 lets anyone in or out of the party. At every moment during the party, the number of guests is prime.

- **Party 2:** Bouncer 2 only lets people in and out of the party if it makes the number of guests prime. He lets people wait outside until they form a group of the right number, or makes people leave such that he can let others in and maintain a prime number of guests. At every moment during the party, the number of guests is prime.

In both cases, if we ask why the number of guests at a given moment in a given party is prime, one explanation is that the bouncer lets people in and out such that the number of guests is prime. The nature of these explanations, however, is different. In Party 2, Bouncer 2 adds a real restriction and enforces it—he would only let people in or out if it made the number of guests prime. His actions explain why there is a prime number of guests because they *make it the case* that there is a prime number of guests. This is analogous to the sense in which laws of nature are taken to govern their instances.[5] On the Humean picture, laws operate more like Bouncer 1. The fact that Bouncer 1 lets people in and out of the party such that the number of guests is prime is derived from the instances—there being a prime number of guests at different time-intervals—and does not produce them.

In short, governing laws explain why their instances hold because they make it the case that they do. This kind of explanation is incompatible with Humeanism about laws of nature because it relies on some metaphysically robust relation between laws and their instances.[6] In what follows, I will call this kind of explanation 'productive explanation'. Importantly, I do not take productive explanations to presuppose a direction of time, such that governing laws produce later states of the world based on

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[3] According to Lewis's Best Systems Account (1987; 1994), for example, a regularity is a law of nature if and only if it is a theorem of the best systematization of all particular matters of fact. Laws of nature are ultimately descriptions of the mosaic's structure, and have a special status only as far as they are part of the best systematization of it.

[4] See Loewer (2012) and Bhogal (2020). The fact that Humean laws do not provide certain kinds of explanation is a challenge for Humeanism going back to Armstrong (1983). For contemporary versions of it, see Maudlin (2007) or Emery (2022).

[5] Note that this explanation does not depend on the bouncers being agents with intentions. If it makes things easier, think of them as swamp-robots. They are not agents, nor programmed by agents to set the rules that they do. I thank Bar Luzon for suggesting this illustration.

[6] Governance is widely taken to be incompatible with Humeanism about laws of nature. See Beebee (2000), Bhogal (2017), Emery (2019; 2022), Maudlin (2007), Shumener (2022), and Wilsch (2020); cf. Roberts (2008). Some even identify governance as the main point of disagreement between Humeanism and Anti-Humeanism (e.g., Beebee (2000) and Shumener (2022)), although there are non-governing views of laws which arguably count as Anti-Humean (see note 21).

earlier ones. While a temporal understanding of governance is common, some philosophers reject it.[7] According to Chen and Goldstein (2022), for example, governance is a relation of constraining possibilities in spacetime as a whole. Just as laws explain later states based on earlier ones, they explain earlier states based on later ones. Whether or not one has a temporal theory of laws, what matters for the governing conception of laws is that laws explain their instances because they make it the case that their instances hold. Depending on one's understanding of constraints, a constraint on spacetime as a whole can make it the case that some facts hold, and thereby provide a productive explanation of those facts.

Setting aside the question of whether laws do in fact govern their instances, the issue I am concerned with here is what governance *is*. What kind of relation would need to hold between laws of nature and their instances such that laws productively explain their instances?[8] The most familiar relation that provides productive explanation is causation, but laws do not cause their instances.[9] Instead, philosophers have suggested analyses of governance in terms of necessitation and metaphysical grounding. I argue against these accounts, and for a primitive account of governance. Governance is not a matter of necessitation (Section 2), or of grounding (Section 3), but a *sui generis* relation. Since it is a relation of productive explanation, it belongs to the same genus as grounding and causation, but it is a distinct species of that genus. Moreover, I argue that there is a contingency requirement on governance: a law governs its instances only if those instances are metaphysically contingent (Section 4). This requirement is not incidental, but captures something important about the nature of governed relata, and the role of governance in restricting possibilities. Finally, I address some objections to a primitive view of governance (Section 5).

2. Against the Modal View of Governance

Different accounts of governance agree on the claim that laws of nature necessitate what they govern, and therefore that they stand in certain modal relations to their instances. According to proponents

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[7] For temporal notions of laws and governance, see e.g., Emery (2019), Maudlin (2007), and Wilsch (2020). For non-temporal views, see Adlam (2022), Chen & Goldstein (2022), and Meacham (2023).
[8] Governance can either be understood as a metaphysical dependence relation or as an explanatory relation which is backed by a metaphysical dependence relation. In what follows, I assume the first understanding, but anything I say can be adjusted to apply to the second.
[9] The nature of causal relata is a controversial topic in itself, but most agree that laws of nature do not cause natural facts or events. They might *facilitate* causal relations (the movement of one billiard ball causes the movement of another in virtue of the laws of nature), but they do not feature in these relations themselves. See Schaffer (2016b) for an overview of theories of causation, and Emery (2019) for an argument against the claim that laws cause their instances.

of modal accounts, however, this is all that governance amounts to. For a law to govern just is for it to stand in a certain modal relation or have such a relation as part of its nature.

I should note that existing accounts of governance differ on what they take the relevant relata to be. First, there are the laws of nature themselves. These are regularities that scientific laws describe, such as Newton's second law of motion $F = ma$. Second, there is the *lawhood* of a law—the fact *that $F = ma$ is a law of nature*. Let us denote this using the operator L—where P stands for a law, L(P) stands for its being a law. Third, there are the *instances* of the law, which are facts about particular natural entities and events. As we will see, existing accounts of governance take one of three positions: some claim that L(P) governs P; some claim that P governs instances of P; and some claim that L(P) governs instances of P.[10] Here, I want to address accounts of governance on their own terms, so I will remain neutral on this issue. Where differences in relata do not matter, I will use the general claim that laws govern their instances; where they do, I will adjust my claims accordingly.

Let us start with Schaffer (2016a). Schaffer's discussion of governance takes place in the context of responding to the inference problem, which he understands as the problem of explaining why the lawhood of a law entails the law—why $L(P) \rightarrow P$.[11] The solution to the inference problem, according to Schaffer, is to have the relevant entailment as an axiom of lawhood. If $L(P) \rightarrow P$ is an axiom of the operator L, there is no remaining challenge as to why lawhood facts entail the corresponding regularity—the relevant entailment is simply part of being a law.[12] This answer to the inference problem is also supposed to explain how L(P) governs P. As Schaffer puts it, "I think that the non-Humean who accepts Inference [$L(P) \rightarrow P$] [...] as an axiom has made all the sense of governing she needs [...] The non-Humean is positing laws whose business it is to govern, end of story. That is as deep as "governing" gets and as deep as it needs to get." (p. 586).

For Schaffer, governance is not a relation of productive explanation, but a matter of solving the inference problem. He recognizes that some accept a stronger sense of governance on which laws produce their instances, but suggests that such views take *L(P) produces P* to be an axiom of L, and

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[10]According to DTA (the view independently developed by Dretske (1977), Tooley (1977), and Armstrong (1983)), the lawhood of a law of nature is analyzed as a primitive relation (N) between universals. One way to understand this claim is that facts of the form L(P) are analyzed as $N(F, G)$. Alternatively, one might think that DTA analyzes lawhood facts as properties of propositions, $L = \lambda p. \exists F \exists G (N(F, G) \wedge (p = \forall x (Fx \supset Gx)))$. As Cian Dorr brought to my attention, proponents of the latter might say that it is the primitive necessitation relation $N(F, G)$ that governs, which is neither a law nor a lawhood fact. Nevertheless, I set this possibility aside in what follows.

[11] For DTA, the question is why $N(F,G) \rightarrow \forall x (Fx \supset Gx)$. (2016a, p. 578)

[12] According to Schaffer, Anti-Humeans are justified in positing L as such. They posit fundamental laws as the best explanation for regularities in the world, which supports a notion of lawhood that entails a corresponding regularity.

does not offer an analysis of this production relation.[13] Thus, Schaffer does not seek to provide an account of governance as I understand it here.[14] Nevertheless, some may want to draw on his view, and analyze the productive notion of governance in terms of an entailment relation.

There are several ways of understanding what governance amounts to on a Schaffer-inspired picture. On the first, L(P) governs P just in case L(P) → P is true. According to this understanding, governance is tantamount to factivity. This is clearly a problematic overgeneralization of governance. Knowledge, truth, and any other factive phenomena accord with principles of the form X(P) → P, but the fact that P is true/known does not explain why P is the case. If anything, things are the other way around (the fact that P is the case explains why P is true/known). A second option is to say that governance consists in the fact that the entailment from a law's lawhood to that law is an *axiom* of lawhood. L(P) governs P just in case *L(P) → P is an axiom of L.* This is a more demanding account, but only slightly so. Principles of the form X(P) → P can also be axioms of knowledge or truth.

More generally, it is not clear why being an axiom is of metaphysical importance. We can introduce the same phenomenon with different axioms. For example, some take S5 to be the logic of knowledge, but S5 can be axiomatized with the T axiom, namely K(P) → P, or with other axioms that entail it. S5 is given by the axioms K, T, 5, but also by the axioms K, D, B, 4.[15] Similarly, a lawhood operator can be stipulated with the axiom L(P) → P, or with other axioms that entail it. What we take to be axiomatic has more to do with the way we represent a phenomenon than with the nature of the phenomenon itself. Thus, a more plausible Schaffer-inspired account of governance would take L(P) → P to be in the essence of L. L(P) governs P just in case *L(P) → P is essential to L.* This may be the thought underlying the axiomatic approach. L(P) → P is an axiom of L *because* it is part of the essence of L. The relevant entailment is not merely something we take to be an axiom of lawhood, but something we have a reason to take as an axiom of lawhood.

However, even on this understanding, the account overgeneralizes. As Schaffer admits (in a somewhat different context), there could be a knowledge-first theory according to which knowledge is metaphysically fundamental. Proponents of this account would have K as a posit, and K(P) → P as

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[13] See Schaffer (2016a, p. 581).

[14] Similarly, Adlam's (2022) modal understanding of governance does not allow for productive explanation. According to Adlam, laws of nature are constraints, where a constraint is defined as the set of Humean mosaics in which it is satisfied. L(P) necessitates P because it picks out the set of worlds where P holds. Adlam takes this necessitation to be equivalent to governance (see p. 28), but this is clearly not an understanding of governance as a productive explanation. Laws do not make it the case that certain regularities hold, they are merely sets of worlds in which they do.

[15] Whether S5 is the right logic of knowledge is highly controversial (see Rendsvig, Symons, & Wang (2023) for an overview), but the point about flexibility in axiomatizations stands independently of this debate.

an axiom of it. We can plausibly add that K(P) → P is essential to K. But even on such views, it is not the case that knowledge governs. The fact that P is known does not explain why P is the case, even if being factive is essential to knowledge.[16] In response, one might suggest that we restrict the account to certain relata. Not any phenomenon that essentially features in an entailment of the form X(P) → P governs, only lawhood facts do. Assuming that all laws govern their instances, this may get us the right extension. However, it still means that governing amounts to having factivity as part of one's essence. And this, as we have seen in the case of knowledge, is not enough to provide a productive explanation.

Wilsch (2020) proposes a more demanding account of governance, according to which it requires a certain modal essence. He takes laws of nature to be functions that map earlier states of the world to later ones. Where L is a dyadic operator, L(p,q) stands for the proposition that the laws of nature map p (an earlier state of the world) to q (a later state of the world). According to Wilsch, laws of nature govern later states of the world, conditional on earlier ones, just in case L has the constitutive polyadic modal essence □((L(P,Q)&P) ⊃ Q) (where the box stands for metaphysical necessity). It is important for Wilsch that this is the *constitutive* essence of governing phenomena, which need not be closed under entailment. In particular, he believes that phenomena with a constitutive essence of the form □((L(P,Q)&P) ⊃ Q) govern, whereas those with a constitutive essence of the form □(L(P) ⊃ P) do not.[17]

The appeal to constitutive modal essences allows Wilsch to avoid some of the counterexamples Schaffer-inspired accounts face. For example, Wilsch could argue that knowledge, even if it is essentially factive, does not govern because it has a constitutive essence of the form □(K(P) ⊃ P), not □((K(P,Q)&P) ⊃ Q). In fact, Wilsch argues that many factive phenomena, including knowledge, do not govern because they do not have a constitutive *modal* essence. Knowledge may be essentially such that K(P) ⊃ P, but not □(K(P) ⊃ P). Thus, it does not have a modal essence, let alone a modal essence of the right form. Nevertheless, I believe that Wilsch's account faces its own counterexamples. Consider the case of the material conditional (⊃). It is metaphysically necessary that if p ⊃ q, and p is the case, then q is the case. In fact, this seems to capture the essence of the material conditional. Thus, the constitutive essence of ⊃ is □((⊃ (P,Q)&P) ⊃ Q).[18] However, the material conditional is clearly not a

governing phenomenon. There are many trivial instances where material implication does not make it the case that the consequent holds in any productive sense.[19]

Shumener (2022) proposes a different kind of modal account. According to her, governance is a matter of productive necessitation. Where "[a] set of propositions Γ productively necessitates proposition Φ when Γ necessitates Φ and Φ is not part of the content of Γ." (p. 9) Shumener cashes out being 'a part of the content of' in terms of truth-makers. C is part of the content of A if and only if (1) every possible state that exactly verifies A contains a possible state that exactly verifies C; and (2) every possible state that exactly verifies C is contained in a possible state that exactly verifies A. (p. 8)

According to Shumener, laws of nature govern natural events if and only if the conjunction of all lawhood facts Γ, together with the conjunction of auxiliary conditions δ (initial conditions, past events, etc.), productively necessitates the conjunction of all propositions about natural events Δ.[20] This is supposed to account for the lack of governance on Humeans theories. According to Humeans, the propositions about the occurrence of natural events are part of the content of the lawhood facts. Therefore, the lawhood facts, together with auxiliary conditions, do not productively necessitate the propositions about the occurrence of natural events, which means that they do not govern them. By contrast, Anti-Humean proponents of governance maintain that lawhood facts are primitive, and have verifiers that do not verify propositions about natural events. Thus, propositions about the occurrence of natural events are not part of the content of the lawhood facts, and are productively necessitated by them. For example, for DTA, the exact verifier of $N(F,G)$ is the state where F-ness nomically necessitates G-ness. This state need not contain any object, so it does not verify Ga. Ga is not part of the content of $N(F,G)$ or of $N(F,G)\&Fa$, so Ga is productively necessitated by $N(F,G)\&Fa$.[21]

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to modus ponens. As far as I am working within Wilsch's framework of modal essences this seems right to me, although the complete essence of the material conditional would plausibly also include its introduction rule.

[19] Wilsch also discusses the case of logical consequence. As he notes, logical consequence can be expressed using a monadic notion of logical truth, as well as a polyadic notion of logical entailment. Depending on which of those is more fundamental, the constitutive essence of logical consequence ($\vDash$) is either $(\vDash (P) \supset P)$, or $((\vDash(P,Q)\&P)\supset Q)$. Since logical consequence is clearly not a governing phenomenon, Wilsch suggests that we construe it as having the non-governing essence $(\vDash (P) \supset P)$ (see pp. 926-927). The problem is that we *do* have reason to think that between the two, the essence of logical consequence is polyadic rather than monadic. First, reducing logical consequence to logical truth fails to distinguish between some very different logics (e.g., classical logic and the paraconsistent logic LP, which have the same logical truths). Second, a polyadic essence is more in line with our intuitive understanding of logical consequence as a property of arguments rather than of single sentences. However, as Wilsch notes, logical consequence is not a governing phenomenon, so this would be a counterexample to his view.

[20] With the restriction that the necessitated conjunction does not capture events found in the auxiliary conditions (δ).

[21] Shumener (2022, pp. 14-15). For more on DTA, see note 10. This is also the place to note that there are non-primitive Anti-Humean views, but that such views also deny that laws govern their instances. Most notably, necessitarian views claim that all laws of nature arise from the nature of things (e.g., properties or natural kinds). On these views, laws do not make it the case that their instances hold, and therefore do not govern them (see, e.g., Shoemaker (1980), Bird (2007, ch.6), Swoyer (1982) and Ellis (2001). For an overview, see Hildebrand (2020a).

I believe that Shumener points to an important difference between the ways in which Humeans and Anti-Humeans take laws of nature as a whole to relate to the Humean mosaic. However, Shumener's view does not account for governance as a relation between a particular law and its instances, which is the relation I set out to explain in this paper. Instead, Shumener provides an account of a relation that holds between *all* propositions about laws of nature and *all* propositions about natural events.

One could try to apply Shumener's account to particular laws by claiming that a lawhood fact φ governs a proposition about natural events ψ if and only if φ together with the conjunction of auxiliary conditions δ productively necessitates ψ. However, this account overgeneralizes. As Shumener notes, any proposition about physical laws (with auxiliary conditions) will trivially productively necessitate the proposition *that electron e has the property of either being located at region S or not being located at region S*. Because this necessitation is trivial, the law does not explain why the relevant fact holds, or make it the case that it holds, and therefore does not govern it. To avoid triviality, Shumener proposes that we understand governance as a relation that holds between *all* propositions about laws of nature and *all* propositions about natural events. Even if there are some trivially necessitated propositions, many others are not (e.g., *that electron e is located at region S*). So, the conjunction of all propositions about natural events is not trivially necessitated by the conjunction of all propositions about laws of nature (with auxiliary conditions).[22]

Thus, I take it that Shumener does not provide an account of governance as a relation between particular laws and their instances, and that her view cannot be modified to account for this explanatory relation. If we restrict her account to productive necessitation of particular instances by particular laws, the resulting account will overgeneralize to trivial cases. This is not to say that Shumener does not provide an account of a useful metaphysical relation. There may be many theoretically useful notions of governance. Here, however, I am interested in the governance of particular laws, which allows them to explain particular facts. As I will explain in Section 4, this notion of governance allows us to draw important distinctions between governing and non-governing laws, as well as between governed and ungoverned instances of governing laws. Shumener's notion of governance, given its relata, is not sensitive to such differences.

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[22] See Shumener (2022, p. 13).

3. Against the Grounding View of Governance

So far, I have argued against existing modal accounts of governance. The common problem these accounts face is one of overgeneralization, which is a symptom of the fact that modal relations hold for a variety of reasons, and do not always capture a relation of productive explanation.

As I have mentioned in Section 1, causation, necessitation, and metaphysical grounding are the natural candidates for an analysis of governance. Laws do not stand in causal relations, so ruling out modal accounts supports a grounding view of governance (if governance is analyzable at all). Grounding accounts of governance differ from one another on what they take the relevant relata to be: Rosen (2010) takes L(P) to govern P,[23] Bhogal (2017) takes P to govern instances of P,[24] and Emery (2019) takes L(P) to govern instances of P. However, they all agree that governance is a matter of metaphysical grounding (simply grounding from now on).

Grounding is a promising candidate for an account of governance. First, it is widely considered to be a metaphysically robust, explanatory, and necessitating relation. If A grounds B, then A makes it the case that B holds, A explains why B is the case, and it is metaphysically necessary that if A is the case, then B is the case. Thus, grounding views should have no problem accounting for the explanatory and modal roles of governance. Second, grounding accounts of governance do not face the counterexamples I raised for modal accounts. Knowledge of a proposition does not ground that proposition, and a material implication does not ground its consequent. Moreover, a view on which laws ground their instances is incompatible with Humeanism about laws of nature. If there is a grounding relation between laws and instances, Humeans would say it holds in the other direction.

Nevertheless, there are also good reasons to doubt that governance amounts to grounding. Grounding is usually taken to be a relation connecting more fundamental entities to less fundamental ones. If A grounds B, then A is more fundamental than B.[25] Indeed, some maintain that grounding is definitive of fundamentality,[26] or posit grounding *as* the relation that captures the order of

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[23] Rosen does not mention governance explicitly in this context, but he believes that this grounding relation accounts for the fact that L(P) explains P, and captures the fundamental Anti-Humean thesis (see 2010, p. 120). Therefore, this can be seen as an account of governance.

[24] To avoid explanatory circularity, Bhogal (2017) maintains that a law of nature (P) is not (partially) grounded in its instances. Since laws of nature are universal generalizations, this leads him to accept that some universal generalizations are not (partially) grounded in their instances.

[25] See Bennett (2017), Correia (2021), Fine (2012), Rosen (2010), Schaffer (2009, 2016c), and (Sider (2011).

[26] See Schaffer (2009; 2016c), Correia (2021), and Bennett (2017, chapters 5 and 6). Bennett analyzes fundamentality in terms of building relations more generally, which include grounding.

fundamentality.[27] However, it is far from obvious that governing laws are more fundamental than the instances they govern.

Here, it would be helpful to use Rubenstein's (forthcoming) distinction between two senses in which philosophers understand grounding and the corresponding fundamentality. On the first, grounding is taken to be generative. Grounding facts give rise to, build, constitute, or produce other facts, and are therefore ontologically more fundamental than what they ground. Some examples include facts about sets and their members (the fact *that {Socrates} exists* is grounded in the fact *that Socrates exists*), or facts about molecules and atoms (the fact *that an H2 molecule exists* is grounded in the fact *that some hydrogen atoms are bonded*).

On the second understanding, grounding is more a representational matter. Grounding truths represent the same facts as the truths they ground. They are more fundamental because they represent those same facts more perspicuously, that is, more similarly to the way the facts are in themselves. Since grounded truths represent the same facts as their grounds, just less perspicuously so, this sense of grounding is reductive. It is the notion philosophers have in mind when they say that grounded entities *consist* in their grounds, *collapse* into their grounds, or are *nothing over and above* their grounds.[28] Paradigm cases include grounding truths about heat in truths about molecular motion (<the room temperature is y> is grounded in <the mean molecular energy of the air in the room is x>), or grounding truths about determinables in truths about their determinates (<the ball is red> is grounded in <the ball is crimson>).[29]

The reductive sense of grounding is clearly not apt for an analysis of governance. The claim that a law governs its instance is not the claim that a law represents the same fact its instance represents, but more perspicuously so. Facts abouts laws of nature are distinct from the laws, which are distinct from facts about their instances. Relatedly, governing laws provide a different kind of explanation of their instances than grounds (in the reductive sense) do. As Fine (2012) puts it, grounding provides

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[27] As Schaffer puts it, "Once one distinguishes more from less fundamental entities, it is natural to posit *a relation linking certain more fundamental entities to certain less fundamental entities which derive from them*. Grounding names this directed linkage." (2016c, p. 145, his emphasis)

[28] As Solomyak (2022) argues, there is a conflict between the claim that grounding is a relation between distinct facts, and the claim that grounded facts are nothing over and above their grounds. Here, I take it that these claims correspond to two different notions of grounding. Solomyak (2022) argues that they correspond to two different perspectives on reality. For more on the connection between grounding and realism, see Solomyak (2020).

[29] Where '< >' denotes truths rather than facts. These examples, as well as the ones used earlier, are controversial. Whether or not these are cases of productive or reductive grounding depends on other theoretical commitments. For example, if one takes determinates and determinables to be ontologically distinct properties, facts about determinates are distinct from facts about determinables, and this is a case of generative grounding.

the strictest form of in-virtue explanation, which leaves no gap between the explanans and the explanandum:

> "... if we were to claim that the particle is accelerating in virtue of increasing its velocity over time (which is presumably a statement of metaphysical ground), then we have the sense that there is – and could be – no stricter account of that in virtue of which the explanandum holds. We have as strict an account of the explanandum as we might hope to have." (p. 39)

The example Fine uses seems to be an instance of grounding in the reductive sense. (<the particle is accelerating> represent the same fact as <the particle increases its velocity over time>, just less perspicuously so.) In this sense, grounding explanations leave no gap between the explanandum and the explanans, because there is no gap between the relevant facts. However, governing laws do not provide this kind of explanation. If we take the case above, a governing explanation of the particle's acceleration will be something along the following lines: the particle is accelerating in inverse proportion to its mass given the force acted upon it (a=F/m) because F=ma is a law of nature. Here, however, there is an explanatory gap between explanans and explanandum. The stricter account of the particle's acceleration in inverse proportion to its mass would cite the particle's velocity over time, its particular mass, and the amount of force acted upon it.

The generative notion of grounding is much better suited to account for governance. On this understanding, grounding is taken to hold between distinct facts, and to provide productive explanation. However, if we take governance to be generative grounding, this implies that governing laws are more ontologically fundamental than the instances they govern, which is still objectionable. The fact *that a particle is accelerating at a certain rate* does not seem to be less fundamental than F=ma, or the fact *that F=ma is a law of nature*. At least, it should be possible for proponents of governance to maintain that both facts are fundamental.

In response, one might insist that relative fundamentality is part of the notion of governance. According to Hildebrandt (2020b) for example, productive explanations require the ontological priority of the explaining entities, and therefore their relative fundamentality. In order for the fact *that Socrates exists* to explain the fact *that {Socrates} exists*, the first fact must exist *prior* to the fact it produces. Since governing laws productively explain their instances, they are more fundamental than their instances, independently of whether governance amounts to grounding.

Although there is something compelling about the thought that productive explanations require relative fundamentality, I think it should be resisted. Causation is a relation of productive explanation, but causes are not necessarily more fundamental than their effects. Causes may be temporally prior to

their effects, but causes and effects can operate at the same level of fundamentality.[30] Consider the event of one billiard ball hitting another. A natural causal explanation of the fact *that the second ball moves* is *that the first ball hit it with a certain force*. We can describe the cause at a more fundamental level, by appealing to the particles that compose the first ball, but the same can be said of the effect. In short, both cause and effect can be described at the same level of fundamentality. Thus, not all relations of productive explanation entail relative fundamentality.

Moreover, on some views, it is plausible that facts about laws, as well as facts about their instances, are fundamental. For example, Chen and Goldstein (2022) consider fundamental laws that govern purely spatial distributions of matter.[31] Some instances of such laws (for example, the fact *that electron e is located at region S*), may also be fundamental.[32]

To be clear, I am not denying that laws are more fundamental than their instances. All I argue here is that this is not entailed by our notion of governance. Relative fundamentality is not generally required for productive explanation, and one can have a governing conception of laws while accepting that some of the instances they govern are fundamental. This is a significant disanalogy between governance and grounding, and a reason to reject the grounding view of governance.

Of course, one might claim that governance is a special kind of grounding which does not involve fundamentality. However, this stretches our notion of grounding, and undermines the advantages of the grounding view. The main reason to analyze governance in terms of more familiar metaphysical relations is to avoid positing a *sui generis* metaphysical relation in addition to relations we already accept. Taking governance to be a distinct species of grounding, which shares only some of its features with other grounding relations, amounts to accepting this special grounding relation in addition to the familiar one. At this point, there is not much difference between accepting this grounding account and taking governance to be *sui generis*.

Alternatively, one might wish to revise our understanding of grounding, such that it does not involve fundamentality. This, however, would undermine a central theoretical role grounding relations play. As I have noted, grounding is often taken to be definitive of fundamentality, or posited as the

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[30] Cf. Bennett (2017).
[31] See Chen & Goldstein (2022, p. 43).
[32] You might think that an instance of a law cannot be fundamental, for fundamental facts are ontologically *independent*. These are facts that *nothing* makes the case, including laws of nature. This is a common understanding of fundamentality (see, e.g., Bennett (2017) or Schaffer (2009)). However, another common understanding of fundamentality is that of a *complete basis*. The fundamental facts are those which all other facts depend on (see, e.g., Wilson (2016) and Tahko (2018); see Leuenberger (2020) for an overview). On the *complete basis* understanding, fundamental facts can depend on other fundamental facts (creating a 'circle at the bottom', so to say), so both laws and their instances can be fundamental.

relation that captures the order of fundamentality. Given its theoretical use, I believe it is better to maintain our notion of grounding, and accept that there is a disanalogy between grounding and governance.

Before moving on, I should note that Emery argues for a different disanalogy between grounding and governance. According to Emery (2022), some of our best candidates for fundamental laws of nature are indeterministic, and indeterministic laws do not necessitate their instances. Grounding, by contrast, is usually understood as metaphysically necessitating. Therefore, Emery argues that we should reject grounding accounts of governance, or radically revise our understanding of grounding such that it is not necessitating.[33] Similarly, Hildebrand (2020b) cites indeterministic laws as a reason to take governance to be *sui generis*, or to adopt an expansive conception of ground. Contrary to Emery and Hildebrand, I believe that governing laws *do* necessitate their instances, and that this is not a disanalogy between grounding and governance. I address the governance of indeterministic laws in Section 5.3.

This concludes my arguments against analyzing governance. While I have not ruled out every metaphysical relation there is, I have argued against the most plausible candidates for an analysis of governance—necessitation and grounding—which supports the claim that governance is *sui generis*.[34] If we take laws of nature to govern, we should take governance to be a distinct relation of productive explanation.

Taking governance to be primitive carries a theoretical cost. How much of a cost it is depends on one's theory of laws of nature. For example, if one takes facts about laws of nature to be primitive, one can identify facts about laws with facts about governance. On such an account, laws of nature are simply generalizations that stand in the governing relation to their instances. The fact *that P is a law of nature* just is the fact *that P governs its instances*. So, if one is a primitivist about laws, one is a primitivist

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[33] In an earlier paper, Emery (2019) takes this to be a reason to deny that grounding necessitates, and adopts a grounding view of governance. In her later paper, Emery (2022) is neutral between revising grounding and accepting that governance is a novel dependence relation, but leans toward the latter. What Emery means by 'novel' here is that governance is not analyzed in terms of grounding or causation. She does not argue that governance is unanalyzable in general.

[34] For a detailed argument against other candidate relations, see Emery (2019), who argues that explanatory relations such as existential dependence, truthmaking, and dimensional constraint are not relations that laws of nature stand in, or can be subsumed under grounding or causal relations. I should note that Emery also rules out accounts that appeal to modal constraints. However, her argument against those is that they can be subsumed under grounding accounts. I do not share this understanding of grounding, and, as I have shown, have different reasons for rejecting modal accounts of governance. Nevertheless, I am happy to accept Emery's arguments against other candidates for an analysis of governance.

about governance, but this is not an additional theoretical cost.[35] (Note that on such a view, theorizing about the nature of governance amounts to theorizing about the nature of laws.)

However, if one does not have such an account, taking governance as a primitive is an additional theoretical cost. You might think the cost is so high that it is better to bite some bullets for modal or grounding views of governance. For those inclined to do so, it is important to note that there is a difference between my objections to each kind of view. Modal accounts of governance have a problem of overgeneralizing to cases that do not involve productive explanation. Admitting such cases undermines the explanatory role of governance, and thereby the central motivation for a governing conception of laws. If we compromise on the explanatory role of governance, we might as well give up on governance altogether. Grounding accounts of governance do not have this problem. Adopting a grounding view of governance may involve some unintuitive consequences—accepting that governance entails relative fundamentality, or denying that grounding does—but it does not undermine the explanatory role of governance. So, between grounding and modal views of governance, grounding views face less serious issues.

Whether it is better to have a primitive account of governance or a reductive one is ultimately a matter of personal preference. Here, I have laid out the costs each option involves, which lead me to favor a primitive view. In the following section, I argue that governance is subject to a contingency requirement: A governs B only if B is metaphysically contingent. This requirement, while central to our understanding of governance, is not a general requirement on modal or grounding relations, and has been largely overlooked by existing accounts of governance. I believe it captures an important feature of governance, and should be added to any account of it. However, as I argue in Section 5.2, incorporating the contingency requirement into modal or grounding accounts of governance will not help them avoid the challenges I have raised here.

4. The Contingency Requirement

"It is contrary to etiquette to yawn in the presence of a king," the monarch said to
him. "I forbid you to do so."
"I can't help it. I can't stop myself," replied the little prince, thoroughly
embarrassed. "I have come on a long journey, and I have had no sleep..."
"Ah, then," the king said. "I order you to yawn."

<div align="right">(Antoine de Saint-Exupéry, The Little Prince, p. 43)</div>

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[35] The case of realism about moral reasons might offer a helpful analogy here. According to Scanlon (2014), for example, *being a reason for action* is a primitive relation, and reasons are simply facts that stand in that relation. It is in that sense that reasons are primitive on his account. Similarly, laws of nature can be seen as generalizations that stand in the governance relation. This may be what Maudlin (2007) has in mind when he claims that laws of nature are primitive.

The king in The Little Prince enjoys complete subordination and universal rule. Even the planets obey his order to keep moving in their orbits. The reason his rule is ridiculous is that he does not really govern. The instances to which his laws apply would occur regardless of his laws, and therefore do not really obey them. I believe that a similar point applies to the governance of laws of nature. Things that are bound to happen regardless of the laws are not governed by these laws.

4.1   The Requirement

Recall that governing laws are described as *making it the case* that their instances hold, thereby providing productive explanations for their instances. However, if it is necessary that a law's instances hold regardless of the law, it is difficult to see how it is *the law* that makes it the case that they hold.

Recall that Bouncer 2 illustrates the governance of laws, in contrast with Bouncer 1:

- **Party 1:** Bouncer 1 lets anyone in or out of the party. At every moment during the party, the number of guests is prime.

- **Party 2:** Bouncer 2 only lets people in and out of the party if it makes the number of guests prime. At every moment during the party, the number of guests is prime.

Now consider the following case:

- **Party 3:** Bouncer 3 only lets people in and out of the party if it makes all the guests self-identical. At every moment during the party, all the guests are self-identical.

Unlike Bouncer 1, Bouncer 3 adds a restriction and enforces it (he is very adamant about having only self-identical people in the party, and checks everyone repeatedly). However, Bouncer 3 is also importantly different from Bouncer 2, for his restriction is powerless. Since everything is necessarily self-identical, Bouncer 3's restriction does not really make a difference as to who is in the party. His actions do not productively explain why, at any moment during the party, all the guests are self-identical, because they do not make it the case that they are. A similar point holds for other metaphysically necessary facts. Assuming that people are essentially human, and that we have a bouncer who only lets people in if they are human, the bouncer's actions do not productively explain why, at any time during the party, all the people in the party are human. All the people in the party are human because people are essentially human (and therefore necessarily so).

Note that this is not a general issue for productive explanations, but for governance in particular. Grounding is a relation of productive explanation, and holds of logically and metaphysically necessary facts. For example, on a productive understanding of grounding, the fact *that God exists* makes it the case *that {God} exists*, and thereby provides a productive explanation for it. This is so even if the

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existence of God and the existence of {God} are metaphysically necessary. On a reductive view of grounding, truths about determinables (<electrons are charged>) hold in virtue of truths about their determinates (<electrons are negatively charged>), regardless of whether they are necessary or not.

By contrast, governance seems to require contingency. A law of nature governs its instances only if these instances are not necessary. Roberts (2008) seems to have something similar in mind when he argues that laws of logic do not govern. According to Roberts, governance involves restricting possible ways for the world to be. Since there are no logical impossibilities, laws of logic do not pose such a restriction. As he puts it, "[a] 'government' that forbids nothing except that which is not there to be done anyway is not a real government." (2008, p. 364) Extending this thought, the lack of governance in the cases above can be explained by there being no possible ways for the world to be that the bouncers restrict. However, this explanation relies on controversial claims about whether there are metaphysically or logically impossible ways for the world to be. Besides, the motivation for the contingency requirement seems to be different. The important point, I take it, is that governance makes a modal *difference*. Even if there are metaphysically or logically impossible ways for the world to be, the bouncers do not govern if there are no alternatives that *the bouncers* restrict. Similarly, laws of nature do not govern what is necessary *regardless of the laws of nature*.

For an instance to be governed by a law of nature, that instance has to be contingent. For a law of nature to govern at all, at least one of its instances has to be contingent. Conveniently, this latter claim amounts to the same requirement for different candidate relata of governance. If the fact *that* $\forall x(Fx \supset Gx)$ (or that it is law of nature) governs any instances of $\forall x(Fx \supset Gx)$, then there is an x such that it is possibly F but not G, which, in turn, means that the following is true: $\neg \ \forall x(Fx \supset Gx)$.[36] Similarly, if the governed relatum is the law itself, $\forall x(Fx \supset Gx)$, for it to be contingent is for $\neg \ \forall x(Fx \supset Gx)$ to be true. Since laws are universal generalizations, the same goes for other forms of laws. If any facts about particular natural entities and events are contingent, so is a universal generalization about them.[37] Thus, whether one takes the governed relatum to be P or instances of P, the governing relatum (L(P) or P) governs only if P is contingent.

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[36] I have said that there being an x such that it is possibly F but not G, i.e., $\exists x \Diamond(Fx \wedge \neg Gx)$, suffices for meeting the contingency requirement, but $\neg \ \forall x(Fx \supset Gx)$ is equivalent to $\Diamond \exists x(Fx \wedge \neg Gx)$, not $\exists x \Diamond(Fx \wedge \neg Gx)$. Moving from the former to the latter requires the converse Barcan formula: $\exists x \Diamond Fx \supset \Diamond \exists x Fx$. Since F is existence-entailing when it comes to instances of laws of nature, this should not be controversial.

[37] For $F = ma$, for example, the law or the fact that it is a law govern instances of $F = ma$ only if there is an x which possibly does not accord with the law, that is, only if $\neg \ \forall x (F_x = m_x a_x)$ is true. If it is $F = ma$ that is governed, for it to be contingent mean that the world does not necessarily accord with it—that there could be an x for which $F = ma$ does not hold. In other words, it means that $\neg \ \forall x (F_x = m_x a_x)$ is true.

P being contingent is a requirement on the governance of P or L(P). If one is willing to accept non-governing laws of nature, the contingency requirement distinguished between governing and non-governing laws. Alternatively, one might think that there are no non-governing laws—that part of what it takes for P to be a law of nature is for P (or L(P)) to govern. In this case, P being contingent is a requirement on P being a law of nature, and trivially a requirement on the governance of P or L(P). On some views, the contingency requirement may also distinguish between governed and ungoverned instances of governing laws. As I argue above, instances which are necessary regardless of a law are not governed by that law. [38] It is only when *all* of a law's instances are necessary that the law does not govern at all, or is not a law of nature to begin with.

4.2   The Relevant Modality

The contingency requirement captures the intuition that governance makes a modal difference. Laws of nature only govern what is otherwise contingent. But what kind of contingency is involved here? The difference-making intuition suggests that the relevant modality must be wider than natural necessity. Consider metaphysical necessity, which (I take it) entails natural necessity but not vice versa.[39] If a fact is metaphysically necessary, it is also naturally necessary, but it is so *regardless* of any laws of nature. Laws of nature do not make it the case that such facts hold, and therefore do not govern them. If a fact is metaphysically contingent, however, this does not entail that it is naturally necessary, so a law of nature can make it the case that it holds.

Generalizing from this case, the relevant modality for the contingency requirement must be such that if a fact is necessary on this modality, it is also naturally necessary, but not vice versa. This captures the thought that such necessary facts, although they are naturally necessary, are necessary *regardless* of any laws of nature, and therefore not governed by them. If a fact is contingent on this modality, however, a law of nature can make it the case that it holds, and that it is naturally necessary. In short,

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[38] Whether or not governing laws have instances which are necessary regardless of those laws (and therefore not governed by them) depends on which facts one admits as laws or their instances. To take one example discussed earlier, consider a law that governs the spatial distributions of matter. This law governs the fact *that electron e is located at region S,* but it does not govern the fact *that electron e is located at region S or not located in region S*, because this fact is necessary regardless of the law. If one accepts the latter as an instance of the law of spatial distribution, then it is an ungoverned instance of that law.

[39] I am assuming a nested picture of modality here, where natural necessity is entailed by metaphysical necessity (cf. Fine (2002) and Bhogal (2020)). My own view is that different modalities are grounded in different types of facts, which lie at different levels of fundamentality. Metaphysical necessity is a restriction posed by facts about essences; natural necessity is a restriction posed by facts about laws of nature. Since facts about essences are more fundamental than facts about laws of nature, metaphysical necessity entails natural necessity but not vice versa. For the purposes of this paper, however, it does not matter whether modality can or should be analyzed in this way. The important point is that there are distinct modalities, and that natural necessity is nested in a wider modality. Those who reject the claim that metaphysical necessity is this wider modality should feel free to use a different modality that has the right formal features.

the necessity that features in the contingency requirement entails natural necessity, but not vice versa. I take metaphysical necessity to have these features, and therefore understand the contingency requirement as follows: A law of nature governs an instance of it only if that instance is metaphysically contingent. Others may use a different modality with the relevant features.[40]

My proposed understanding of the contingency requirement allows different laws of nature, say P and Q, to govern the same fact f. As long as f is metaphysically contingent, it is contingent in the relevant sense for both laws. However, one might think that the motivation for the contingency requirement does not allow for this kind of overdetermination. Recall that the intuition motivating the requirement is that governance involves making a modal difference. A law does not govern instances that are bound to happen regardless of the law. But this seems to be the case even when different laws of nature are in play. If f is governed by P (or by the fact that it is a law), it is bound to be the case regardless of there being another law, Q, of which f is an instance. Q (or the fact that it is a law), does not make a modal difference when it comes to whether f holds, and therefore does not govern f.

Thus, the intuition that a governing law makes a modal difference can be taken to motivate a different contingency requirement. On this alternative understanding, the relevant necessity entails the restriction *posed by the particular law*, but not vice versa. For example, one may say that the relevant modality is given by the set of all laws of nature (Γ) except for P—call it Γ−{P}. A proposition is necessary$_{Γ-\{P\}}$ if it is entailed by Γ−{P}, and otherwise contingent. The contingency requirement is then understood as the claim that a law P (or the fact that it is a law) governs an instance of it only if that instance is contingent$_{Γ-\{P\}}$. If $\square_{Γ-\{P\}}f$, then f is not governed by P or L(P).

This version avoids the overdetermination issue above. If f is governed by P, it is necessitated by the set of laws that includes P and excludes Q ($\square_{Γ-\{Q\}}f$). Therefore, f is not governed by Q. However, the same can be said of P. Since f is an instance of Q, it is necessitated by the set of laws that includes Q and excludes P ($\square_{Γ-\{P\}}f$), and therefore not governed by P. So, if f is an instance of both P and Q, and necessitated by both, then it is not governed by either. Instead of overdetermination, we get underdetermination.

To illustrate, consider three possible worlds where a metaphysically contingent fact f obtains. In W_1, P is a law of nature and P governs f. In W_2, Q is a law of nature and Q governs f. In W_3, both P and Q are laws of nature. In W_3, f is necessitated by the set of laws that includes P and excludes Q (as in W_1), but f is also necessitated by the set of laws that includes Q and excludes P (as in W_2). On the

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[40] There might be several such modalities. I will continue to write about 'the' relevant modality for simplicity.

alternative version of the contingency requirement, f is not governed by either P or Q in W_3. This seems objectionable. If f is governed by each of these laws taken alone, why should it be completely ungoverned in a world where both laws obtain? On the initial version of the contingency requirement, f can be governed by both P and Q in W_3. Since f is metaphysically contingent, there is no reason for it not to be governed by either law.

The initial version of the contingency requirement employs the same modality for all laws of nature. Any law of nature only governs instances that are not necessary, regardless of *all* the laws of nature. The alternative version of the requirement employs a different modality for every law. I prefer the initial version for the following reasons. First, I prefer overdetermination to underdetermination in cases such as the one above. Second, I take it that when laws of nature restrict certain possibilities, they confer the same kind of modal constraint. An instance governed by one law is not necessary in a stronger sense than an instance governed by another law. One way of understanding this modal strength is by the set of possibilities that are restricted by the laws. A social necessity is 'weaker' than a physical necessity because the possibilities it restricts are contained within the possibilities restricted by the physical laws. If all governing laws restrict the same set of possibilities (that is, if the contingency requirement has the same modality for each law), then they confer the same strength of necessity. If each law restricts a different set of possibilities, this is not the case.

The thought that governing laws of nature confer the same modal force presupposes that such laws belong to a unified kind. However, one might think that laws of nature admit of different kinds, and in particular that some laws are more fundamental than others. Depending on how one understands non-fundamental laws, the reasons just cited can support a third version of the contingency requirement, which employs different modalities for different kinds of laws.

Let us suppose that some kinds of laws are more fundamental than others. If all the natural facts are determined by the fundamental laws, then non-fundamental laws do not seem to govern. Non-fundamental laws can be seen as useful generalizations, which provide a distinct kind of explanation, but they do not govern because they do not make it the case that any particular natural fact holds. If governance is part of what it takes to be a law of nature, such laws are not even laws of nature. On this understanding of non-fundamental laws, I suggest that we restrict our discussion of governance to fundamental laws of nature, as many in fact do.

Alternatively, one could understand non-fundamental laws as adding restrictions 'on top of' fundamental ones. For example, one can take biological laws to restrict possibilities left open by physical laws. If this is the case, I would say that biological laws *do* govern some natural facts. However,

I would also say that they confer a weaker necessity, precisely because they restrict possibilities left open by physical laws. If there is a unified kind of biological laws, the relevant modality for their contingency requirement would be physical necessity. (Assuming that physical necessity entails biological necessity but not vice versa.) Using physical contingency as a requirement on the governance of biological laws accounts for their distinctive modal force. Moreover, it captures a sense in which biological laws are less fundamental than physical laws—they pose a weaker restriction on the world.

Of course, this third version of the contingency requirement depends on controversial assumptions about non-fundamental laws of nature, which I will not explore here. I do not mean to defend this version of the contingency requirement, but to raise it as a possible option which I find attractive. In what follows, I will remain neutral between the first and the third versions of the requirement by focusing on fundamental laws of nature. I will discuss laws of physics, which are plausible candidates for fundamental laws, and use metaphysical necessity as the relevant modality.

4.3 Cases

Support for the contingency requirement can be found in its verdicts about particular cases. Governing laws have metaphysically contingent instances, and metaphysically necessary generalizations, which do not have metaphysically contingent instances, do not seem to be governing laws. Take for example Newton's law of universal gravitation $F = G\frac{m_1 m_2}{r^2}$. When I drop a pen it falls with a certain force, and must fall in this way, because certain laws of motion and gravitational force hold. But this is not metaphysically necessary. If we had a different law, say with r instead of r^2 in the denominator, the gravitational force on the pen would have been much larger, and the pen would have fallen more quickly. The fact that the laws of nature are as they are makes it the case that the pen must fall in the way that it does.

Conversely, plausible candidates for metaphysically necessary generalizations do not seem to exhibit governance. Suppose that it is in the nature of electrons to be negatively charged, and consider the proposal that it is a law that all electrons are negatively charged. There are no instances that can possibly violate this purported law, because being negatively charged is part of what being an electron is. Accordingly, this law does not seem to govern. The fact *that all electrons are negatively charged*, or *that it is a law that all electrons are negatively charged* does not explain the fact *that a particular electron e is negatively charged*. Any particular electron is negatively charged because this is just part of what being an electron is. If governance is necessary for lawhood, the above is not even a law of nature. In short, the contingency requirement makes the right predictions: where a purported law is metaphysically

necessary, the law or its lawhood do not govern; where a law or its lawhood govern, it is also the case that the law is metaphysically contingent.

Some cases, however, might not fit the contingency requirement as neatly. Take, for example, an electromagnetic field, and suppose that the behavior of the field is fully captured by Maxwell's equations. These equations seem to be laws that capture the nature of the electromagnetic field—to be an electromagnetic field *just is* to behave in accordance with those laws—but they also seem to govern the behavior of such a field. If this is the case, we have a counterexample to the contingency requirement. It is metaphysically necessary for the behavior of the electromagnetic field to accord with Maxwell's laws, and Maxwell's laws govern the behavior of the electromagnetic field.

Here, it is instructive to keep in mind that the concept of an electromagnetic field was introduced as an alternative to an action-at-a-distance theory of electromagnetic phenomena. According to the action-at-a-distance theory, electromagnetic forces operate directly between separate electrified bodies, across the space between them. By contrast, Faraday and Maxwell proposed that the operation of electromagnetic forces is mediated by elements in the space between electrified bodies. These contiguous elements and their properties are all that an electromagnetic field amounts to.[41] As Maxwell puts it, "The theory I propose may therefore be called a theory of the *Electromagnetic Field,* because it has to do with the space in the neighbourhood of the electric or magnetic bodies." (1865, p. 460)

The electromagnetic field was introduced as a theoretical posit, in order to explain observed electromagnetic phenomena. A field is the mode in which electromagnetic forces propagate. It is not an independent phenomenon that theories of electromagnetism explain, but part of certain theories of electromagnetism. Keeping this in mind, Maxwell's laws do not seem to govern the behavior of an electromagnetic field. Rather, the field an expression of the way in which electromagnetic laws govern the behavior of particular electromagnetic phenomena.

Maxwell's laws do seem to govern the behavior of particular electromagnetic phenomena, such as electromagnetic induction, but such phenomena also seem to be metaphysically contingent. If the laws of electromagnetism were different, these phenomena would have behaved differently. In short, electromagnetism does not pose a challenge for the contingency requirement. The behavior of an electromagnetic field is not governed, and the behavior of particular electromagnetic phenomena is not metaphysically necessary.

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[41] See Harman (1982, chapter 4) for an overview of the theories developed by Faraway and Maxwell.

5. Primitive Governance

5.1 A Primitive View of Governance

Governance is a relation of productive explanation that holds between laws and their instances. In this paper, I have argued against analyzing governance in terms of more familiar metaphysical relations, which supports the claim that it is *sui generis*. However, this is not to say that governance is entirely mysterious. Like other relations of productive explanation, governing laws explain their instances because they make it the case that those instances hold. Similar to grounds, governing laws necessitate their instances (given certain background conditions). Similar to causes, governing laws are not necessarily more fundamental than their instances.

In addition, I have argued that governance is characterized by a contingency requirement, which sheds some light on its nature. A law only governs if it restricts what is otherwise free, binds what is otherwise unbound, makes something the case when the possibilities are otherwise open. The result is a primitive view of governance, on which it is a *sui generis* relation of productive explanation, which is subject to a contingency requirement.

Although I take governance to have a contingency requirement, this is not a modal view of governance. Modal views maintain that governance consists in some necessitation relation—for a law to govern *just is* for it to stand in certain modal relations, or have these as part of its essence. The contingency requirement is a requirement, it is not the claim that governance *just is* the necessitation of otherwise contingent facts. According to the view I propose, governance is a *sui generis* relation of productive explanation, in virtue of which certain necessitation relations hold. Just as grounding is not merely a necessitation relation, but a relation of productive explanation in virtue of which certain necessitation relations hold.

I have not provided a full account of governance here, but defended a general primitive view. Different accounts of governance may fill out the details of this view by proposing different relata, or by using different modalities for the contingency requirement. In the remainder of this section, I address two important challenges for the general primitive view: a challenge to my arguments against modal and grounding views, and a challenge from indeterministic laws.

5.2 Incorporating the Contingency Requirement

My argument for a primitive view of governance relies on rejecting proposed analyses of it. However, I also argue that governance is subject to a contingency requirement, which is not a part of the accounts I rule out. A natural thought at this point is that adding the contingency requirement to

modal and grounding views will allow them to avoid the problems I have raised for them, thereby undermining my case for primitivism.

I believe that the contingency requirement captures an important feature of governance, and therefore that it should be incorporated into any account of governance. However, some important objections to reductive accounts of governance will remain unaffected by this addition. I have argued that accounts inspired by Schaffer (2016a), as well as the account developed by Wilsch (2020), face a problem of overgeneralization. More specifically, using the arbitrary proposition P, I argued that these accounts generalize to phenomena such as knowledge and material implication. Since none of the arguments I made rely on any particular proposition, none of them turn on the relevant propositions being metaphysically necessary. Therefore, adding the contingency requirement to the accounts above will not help them avoid these counterexamples.

For Shumener (2022), adding a contingency requirement will not make much of a difference. We can say that all laws of nature govern all natural events only if the conjunction of all propositions about natural events is contingent. This does not change the fact that Shumener does not take governance to be a relation between particular laws and their instances. The relation she accounts for holds between all laws of nature and all natural events. In fact, the motivation for the contingency requirement is somewhat at odds with Shumener's account. The contingency requirement is motivated by intuitive differences between governed and ungoverned instances of laws. On Shumener's account, there is no question about whether a particular instance, necessary or contingent, is governed by a particular law.[42]

When it comes to grounding accounts, adding the contingency requirement does not address the disanalogies between grounding and governance discussed earlier. Even if we only consider contingent facts, grounding is a relation of reduction or of ontological fundamentality, whereas governance is not. In addition, as I have noted earlier, grounding does not generally have a contingency requirement. Metaphysically necessary facts, such as the fact *that electron e is negatively charged*, are grounded in the nature of things. Logical truths are grounded yet (one might say) absolutely necessary ($p \lor \neg p$ is grounded in p, even though $p \lor \neg p$ could not fail to be the case). Adding the contingency requirement to grounding accounts of governance supports the claim that governance is unlike other cases of grounding. This strengthens the suspicion that such accounts admit governance as a special grounding

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[42] One could try to restrict Shumener's governed relatum to all *contingent* facts about natural events, and the governing relatum to all laws of nature *which have contingent instances*. This, however, strays far from Shumener's view, precisely because she wants to explain how the laws relate to all natural instances.

relation, in addition to the familiar one, and are therefore not significantly more parsimonious than primitive accounts of governance. In short, while there is independent reason to incorporate the contingency requirement into any account of governance, doing so does not undermine my arguments against modal and grounding views of governance.

5.3 The Objection from Indeterministic Laws

So far, I have assumed deterministic laws of nature, and accepted the claim that governing laws necessitate what they govern. However, indeterministic laws do not seem to necessitate the instances they govern. To take an example from Emery (2019), consider a case where you prepare a large number of carbon-11 atoms. After 20 min, half of those atoms have decayed. The fact *that half of the carbon-11 atoms decayed after 20 min* is explained by a fact about their half-life. Namely, *that it is a law of nature that any particular carbon-11 atom has a .5 chance of decaying within 20 min*. However, the fact that half of the carbon-11 atoms decayed after 20 min is not metaphysically or nomologically necessary.

Emery (2019) uses this case to argue that governance, as well as grounding (which she uses to analyze governance), are not necessitating. Although I reject the grounding view of governance, I believe that governing laws metaphysically necessitate their instances. Therefore, this argument applies to my view as well. In its general form, the argument against the claim that governance is necessitating can be fleshed out as follows:

1. Indeterministic laws do not metaphysically necessitate their instances.
2. Indeterministic laws govern their instances.
C. Therefore, governance is not metaphysically necessitating.

This argument can be avoided by rejecting either Premise 1 or Premise 2, depending on how one understands the instances of indeterministic laws. Let us start by accepting that indeterministic laws govern their instances, but maintaining that they necessitate them (rejecting Premise 1). This response is available if we take the relevant instances to be facts about *chance*. For example, the fact *that (given a certain experimental set-up) any particular carbon-11 atom has a .5 chance of decaying within 20 min*. This fact is metaphysically necessitated by the fact *that it is a law of nature that any particular carbon-11 atom has a .5 chance of decaying within 20 min*. This response is in line with several positions on the explanatory nature of indeterministic laws, which maintain that indeterministic laws only explain facts about chance.[43]

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[43] See e.g., Railton (1978), Elliott (2021), and Hicks & Wilson (2023). The kind of explanation they take laws to provide here is often called a 'causal' explanation, which is contrasted with 'expectability' explanations. While an expectability explanation shows that an explanandum was to be expected, a causal explanation provides an understanding of the mechanism that produced the event, which is a matter of understanding the physical facts about it and the laws that govern

However, as Emery (2019) notes, this response seems to leave us without an explanation for the fact *that half of the carbon-11 atoms decayed after 20 min*. We have an explanation for the fact *that any particular carbon-11 atom has a .5 chance of decaying within 20 min*, and for the fact *that there is a high probability that half of the carbon-11 atoms decayed after 20 min*, but there is an explanatory gap between the fact that an event has a certain chance of occurring, and the fact that the event occurs. In response, it is important to note that while we might not have a *governing* explanation of the fact that a chancy event occurs, we have other explanations of such facts. According to Elliott (2021), for example, facts about the chance of an event occurring explain the fact that the event occurs. Similarly, Hicks and Wilson (2023) argue that a particular chance fact, together with the setup facts, explains the fact that the event occurs.[44] Indeterministic laws only indirectly explanatorily relevant, because they explain the chance fact.[45]

A different response to the argument above is to maintain that instances of indeterminist laws are facts about the occurrence of natural events, and deny the claim that indeterministic laws govern their instances (rejecting Premise 2). This response is particularly available to those who take indeterministic laws to provide only *predictive* explanations (also called *expectability* explanations) for their instances. A predictive explanation of a particular event provides reason to expect the occurrence of that event. In this sense, indeterministic laws explain the occurrence of particular events, because they assign a high probability to their occurrence.[46] This, however, is clearly not a governing explanation, or a productive explanation more generally. A law does not explain what makes it the case than a particular event occurs, it only tells us that we should expect that event to occur.

Alternatively, one might claim that indeterministic laws merely approximate deterministic laws, and that only the latter govern facts about the occurrence of natural events. On this suggestion, indeterministic laws do not govern their instances but explain them in some other way. This kind of position is endorsed by those who take chance to be compatible with determinism. Every event is ultimately determined by a set of facts about laws and auxiliary conditions, and governed by those, but indeterministic laws explain the same event at a different level. Glynn (2010), for example, argues that indeterministic laws of biology provide an explanation for the occurrence of a particular event, even

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its behavior (see Strevens 2000). I take the use of 'causal' here to be somewhat unfortunate because laws do not figure into causal explanations, but the important point is that casual explanations are productive explanations—they explain what makes it the case that an event occurs—and therefore closer to governance. According to Railton (1978), Elliott (2021), and Hicks & Wilson (2023), such explanations are necessitating.

[44] However, since the setup does not guarantee the outcome, Hicks & Wilson believe that chancy events do not have a *full* explanation (see 2023, p. 294).

[45] There is also the option of biting the bullet and claiming that there is *no* explanation for the fact that a chancy event occurs. However, given the success of probabilistic explanations, this is a difficult bullet to bite.

[46] See Hempel (1965, chapter 12).

if the same fact is also explained by the microphysical laws and circumstances.[47] As long as one maintains that indeterministic laws provide a different kind of explanation from deterministic laws, and that only the latter govern, one can reject Premise 2, and maintain that indeterministic laws explain facts about the occurrence of particular events.

One might worry that some of our best candidates for fundamental laws, such as the standard interpretation of quantum mechanics, are indeterministic. If we deny Premise 2, it turns out that these are not governing laws. However, there is room to doubt that the fundamental laws are in fact indeterministic. Despite the predictive success of quantum mechanics, it is not fully understood, and there are deterministic interpretations of it (e.g., Bohmian mechanics and many-world interpretations). Nevertheless, if it does turn out that the fundamental laws are indeterministic, I think we should accept that they only provide predictive explanations of facts about the occurrence of particular events, and do not govern them. Physics may not tell us what the nature of governance is, but it might tell us if there are any governing laws.

Depending on how one understands the instances of indeterministic laws, one can make either of the responses above and be in good company. If the relevant instances are facts about chance, they are governed and necessitated by indeterministic laws. If the relevant instances are non-chancy facts, they are not necessitated by indeterministic laws, but also not governed by them. Either way, indeterministic laws do not pose a serious challenge to governance being necessitating.

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[47] Compatibilists about chance often argue from the explanatory role of chance to the claim that there is chance. See also Emery (2015), and Elliott (2021).

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