

GROUNDING
&
METAPHYSICAL
EXPLANATION

WORKSHOP 2024
APPLICATIONS



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General Information

Contact Details

- Emergency services: The national phone number in case of emergencies is 999.
- Medical issues: If you need non-emergency medical treatment, you should call 111.

Venue

Lecture Theatre 3, Arts Complex, 17 Woodland Road, Bristol, City of Bristol, BS8 1TB.

Luggage

You are more than welcome to leave luggage in the lecture theatre (at your own risk). There should be plenty of room.

Accessibility

- We will put up signs to direct you to Lecture Theatre 3. All sessions will take place in this room.
- The room is wheelchair-accessible. (The front of the room is accessible via a door at the foot of the slope.)
- We are happy for personal assistants and service animals to attend.
- During the Q&As we will permit questions being written down instead of spoken aloud (the chair will read out your question).
- There will be a short break between each talk.
- The Workshop will be a hybrid event.
- Contact one of the [organisers](#) should you have any questions in advance of the conference.

Conduct

We will follow BPA/SWIP chairing guidelines. As such, the hand/finger method will be adopted, and we will ask that one question is asked at a time.

Handouts and Slides

We will not be able to print hardcopies of handouts for you. However, if you plan to present with slides, we can download them for you onto a computer, from which you can present them. Either bring a USB stick with your slides on or send them via email to GandMEphilosophy@gmail.com by Tuesday 23rd July. You will also be able to use your own laptop.

Schedule

Thursday 25th July

12:30	Introduction
	<u>Session 1</u>
12:40–13:55	Keynote speaker: Alastair Wilson <i>Testing Grounds</i>
14:00–15:00	Marcelino Botin & Markel Kortabarria <i>Grounding Physicalism and the New Challenge of Consciousness</i> Chair: Naomi Thompson
15:00–15:20	Refreshments
	<u>Session 2</u>
15:20–16:20	Taylor-Grey Miller & Derek Christian Haderlie <i>Against Grounding Trinitarianism</i>
16:25–17:25	Andrew Stephenson <i>Kant and Kripke: Rethinking Necessity and the A Priori</i>
17:30–18:30	Annica Vieser & Kian Salimkhani <i>Grounding, Causation, and Emergent Spacetime</i> Chair: Jamie Gilchrist
19:30	Meal

Friday 26th July

	<u>Session 3</u>
09:00–10:15	Keynote speaker: Ralf Bader <i>Intrinsicity and Hyperintensional Compatibility</i>
10:20–11:20	Toby Friend (online) <i>Grounded in the God Equation</i> Chair: Jace Snodgrass
11:20–11:40	Refreshments
	<u>Session 4</u>
11:40–12:40	Samuel Elgin <i>The Higher-Order Foundations of Arithmetic</i>
12:45–13:45	Giacomo Giannini & Michael Wallner <i>Essential Dependence Is Not Fundamentality-Inducing</i> Chair: Will Moorfoot
13:45	Close

Abstracts

Testing Grounds

Alastair Wilson

University of Leeds

DAY 1, 12:40–13:55

This paper is about grounding explanations in science (especially in physics), and how they are justified. The idea that science is an important guide to what grounds what has been growing in popularity in recent years (e.g. Schaffer 2017; Bryant 2018; Giannotti and Kortabarría 2024). The thesis of the present paper is that successful theory-reductions and theory-unifications are our primary evidence base when it comes to identifying grounding relations in science. The argument applies the recent proposal of Robertson and Wilson (2023) concerning the transformability of ‘horizontal’ reductions into ‘vertical’ reductions to argue that, in general, major theoretical transitions in science are associated with the production of new evidence concerning the relevant grounding relations.

Grounding Physicalism and the New Challenge of Consciousness

Marcelino Botin & Markel Kortabarría

Universitat de Barcelona

DAY 1, 14:00–15:00

The philosophy of consciousness has recently undergone two important developments. First, arguments against physicalism no longer focus on the *old* challenge of explaining the lack of a priori entailment from physical to phenomenal concepts. Instead, they focus on the apparently substantive content carried by the latter. In particular, anti-physicalists argue that phenomenal concepts reveal the essence of phenomenal properties, and that this is incompatible with these properties being physical. The *new* challenge (Schroer, 2010; see also Goff 2011) for physicalism is that of explaining the intuition of revelation within a physicalist framework. Second, contemporary metaphysics has recently seen a surge of interest in the notion of metaphysical grounding, a notion that seeks to capture a primitive non-reductive relation of metaphysical determination. On the grounding view, reality is structured according to an order of ontological priority with absolutely fundamental facts giving rise to derivative facts up the hierarchy. Predictably, this notion has been put to work in the consciousness debate with the promise of providing a physicalist theory that nevertheless respects our intuitions about the phenomenon, in other words, a strongly realist physicalist theory of consciousness. Grounding physicalists thus hold that derivative facts involving phenomenal properties are grounded in, but are nonetheless distinct from, facts about the underlying physical properties.

Unfortunately, grounding physicalists have neglected the transition from the old to the new challenge, offering grounding solutions to the former and not the latter (Schaffer 2017a). As a result, such physicalists have failed to prove their worth where it really matters. Indeed, anti-physicalists have argued that there

is a tension between revelation and grounding physicalism. According to Liu (2021, forthcoming), revelation is incompatible with the widely held view that grounding relations are mediated by essence. This is because if physical facts ground phenomenal facts, then the constituents of the latter must have physical essences. Yet, our phenomenal concepts do not reveal phenomenal properties as having physical essences. The conclusion is that if revelation is true, then grounding physicalism fails to meet the new challenge and to deliver on its promise of a strongly realist physicalist theory of consciousness.

One recent attempt to meet the new challenge is Moran (2023). Like Liu, Moran recognises the seemingly unresolvable tension between revelation and grounding. However, he argues that this need not spell disaster for the grounding physicalist project. According to him, not all cases of grounding relations are mediated by essences, instead, some display ‘Moorean connections’, where the explanation for why the relation holds does not appeal to the essence of the properties involved, but rather to some grounding laws (Schaffer 2017a, 2017b). The resulting view is a form of non-reductive physicalism, according to which phenomenal properties have phenomenal essences, but are nevertheless physicalistically acceptable because phenomenal facts are fully grounded in facts about the underlying physical properties.

The way we see the dialectic is in the form of a dilemma. Assuming that revelation is true, then either the grounding relation between physical and phenomenal facts is mediated by essences or it is not. If the former is true, then physicalism is false for the reasons previously discussed, and if the latter is true, then physicalists must explain why the connections hold. Moran argues that the first horn is a non-starter, and for this reason chooses to go for the second, appealing to the apparatus of grounding laws.

The purpose of this paper is twofold. First, we argue that, while Moran takes a step in the right direction, he fails to address the main challenge facing law-based formulations of grounding physicalism. Law-based formulations of grounding physicalism appear to be as metaphysically costly as their dualist counterparts. In a recent paper, Pautz (forthcoming) argues that grounding physicalism as complex and non-uniform as dualism. Moreover, both theories account for the problem of mental causation in analogous ways. If true, this undermines the motivation for a grounding physicalist response to revelation. We argue that these concerns are misplaced. Grounding physicalism has relevant metaphysical advantages over dualism. Law based formulations of grounding physicalism remain an attractive form of physicalism that can accommodate the new challenge.

Second, we argue that, arguments to the contrary notwithstanding, grounding physicalists can keep the idea that grounding relations are essence mediated and resolve the tension developing a grounding version of the phenomenal concept strategy (PCS). In our view, phenomenal concepts are translucent, i.e., they reveal part, but not the whole essence of phenomenal properties. Traditional versions of the PCS could not make this solution work because they ran into the problem of ‘dual carving’, namely, the problem of having two essential characterisations of the same property that are nonetheless not a priori connected. We show that grounding versions of the PCS successfully avoid this problem. In doing so, we also respond to a related objection concerning the alleged a priori connection between the essence revealing concepts of ground and groundee.

Against Grounding Trinitarianism

Taylor-Grey Miller & Derek Christian Haderlie

Brigham Young University

DAY 1, 15:20–16:20

Recently, Joshua Sijuwade (2022) has argued that the Cappadocian model of the trinity is usefully explicated in terms of the contemporary notion of metaphysical grounding. On this view, the existence of the Father metaphysically grounds both the existence and the divinity of the Son and the Spirit. We call this view grounding trinitarianism.

Sijuwade makes clear that in order for this to count as a satisfying and properly orthodox model of the trinity, then the nature of metaphysical ground had better guarantee that the trinitarian persons all exist when the Father exists as well as share in the essence of the Father. Sijuwade contends that such a conception of ground is both available in the extant literature and in good standing. We agree that such a notion is available and in good standing but it is importantly different from the one Sijuwade presents. This is because the conception of ground that Sijuwade appeals to is problematic in significant respects. He maintains, following Johnathan Schaffer (2015, 2017), that grounding is governed by functional laws. He also maintains, following Karen Bennett (2011, 2017), that grounding is a superinternal relation—that the essence of the grounds not only ensures that they ground what's grounded, but that what's grounded has the essence that it does.

Ground's superinternality guarantees that the trinitarian persons share the same essence, and ground's functional laws guarantee that the Son/Spirit exists when the Father exists. We argue that there are canonical patterns of ground where the operative laws cannot be functional, and superinternality trivializes the notion of essential dependence at the heart of the model. Unfortunately, this picture of grounding simply cannot, in a principled way, vindicate the theological commitments of central concern to the trinitarian.

After this negative argument we turn to a positive proposal. We show that there is a suitably unified conception of ground which we call grounding legalism that can deliver the theoretical goods of the rejected model without running afoul of its weaknesses. What is distinctive about laws of ground on the legalist framework is that they are generative *relations* rather than *functions*. We show how such an account offers a reduction of ground to laws and then operationalize such an account to the rescue of the trinitarian. We end by suggesting that given the flexibility of grounding legalism, no better framework for the grounding trinitarian account could be offered.

Having identified, in our view, the strongest form of grounding trinitarianism, we then turn to arguing against it. The main source of tension here is the distinctive explanatory character of the grounding laws. On the legalist view, laws of ground are explanatorily independent in a very strong sense, and this degree of explanatory independence is in tension with orthodox conceptions of God's explanatory significance. Our trinitarian will accept

Divine Ultimacy: Everything that exists depends upon God for its existence.

In the present ground-theoretic setting, we can understand this as a claim about God's relative fundamentality.

Divine Fundamentality: All facts are mediately, fully grounded in the fact that God exists.

We show that given the distinctive explanatory role laws play on the legalist framework, some facts will not be suitably grounded in any facts about God. These facts are all importantly *facts about the laws of ground*. Thus, the very status of the laws that allows them to articulate a minimally adequate model disqualify them from being properly sourced in God.

We show that the only principled way out of the argument is what we call *the meta-law gambit*. The trinitarian can help themselves to a natural and principled distinction between first order laws and meta-laws and then show why it is natural to think that the facts that elude grounding in God are facts about the meta-laws. With the distinction in hand, they can argue that facts about meta-laws are very good candidates for being zero-grounded.

By itself, this is not enough to help the grounding trinitarian. This is because being zero-grounded is not a way of being grounded in God. Unless, of course, the trinitarian makes an even bolder move: identifying God with the empty ground. On its face this may not seem particularly plausible. But there is some non-trivial pressure to take such a move seriously, or at least allow the theist to make their case that it is not wholly unmotivated. After presenting the case, we reject it on the following grounds:

Grounding necessitates. Thus, every fact grounded in nothing is necessary. If the empty-ground just is God, then all appearances of contingency are just that: mere appearances.

We are then left with a surprisingly strong form of necessitarianism. While, strictly speaking, this is possibly orthodox, we take it that very few theists will welcome this consequence, and suspect that they, like us, would reject it on independent grounds. We conclude that the meta-law gambit is at best a Pyrrhic victory for the grounding trinitarian.

There are no good ways forward for the grounding trinitarian. Either their view is at best piecemeal in its orthodoxy or devolves into an objectionably strong necessitarianism. The moral we draw from this discussion is that unlike so many other problems of philosophy, the nature of the trinity is not a problem of what grounds what.

Kant and Kripke: Rethinking Necessity and the A Priori

Andrew Stephenson

University of Southampton

DAY 1, 16:25–17:25

This talk reassesses the relation between Kant and Kripke on the relation between necessity and the a priori. Kripke (1971, 1980) famously argues against what he takes to be the traditional view, very roughly, that a statement is necessary if and only if it is a priori, where what it means for a statement to be necessary is that it is true and could not have been false and what it means for a statement to be a priori is that it is knowable independently of experience. Call such a view, suitably refined and clarified, the *Coextension Thesis*. Kripke and many others attribute the Coextension Thesis to Kant, thus Kripke and many others take Kripkean arguments against the Coextension Thesis to tell against Kant. I argue that this is a mistake. Kant does not endorse the Coextension Thesis that Kripke and many others attribute to him. He does endorse two quite different theses concerning the relation between necessity and the a priori, as he conceives them. One is a matter of definition and the other is a very substantial philosophical thesis indeed—to establish it is the aim of the entire *Critique of Pure Reason*. But Kripkean arguments against the Coextension Thesis tell against neither of Kant's theses, as they involve crucially different conceptions of necessity and the a priori. This superficial lack of disagreement masks deep disagreements, but these result from divergent views

regarding matters such as realism, modal epistemology, and philosophical methodology; views which Kant does a lot, and Kripke very little, to argue for.

The talk has two parts. In the first part I consider Kant's conception of the a priori by attending to his oft-neglected distinction (e.g. in the B-Introduction) between the a priori in general and the absolutely a priori in particular. I argue that neither can be straightforwardly equated with Kripke's (and Frege's etc.) purely epistemic conception of the a priori. This provides a new argument for a more metaphysical reading of Kant's conception of the a priori as that which involves knowledge of something from its determining ontological grounds. This traditional metaphysical conception of the a priori is intimately connected to the modern epistemic conception, but only via the substantial premise that experience as such can provide us only with knowledge of something from its effects. Applying it to the case at hand makes better sense of what Kant says about the distinction between the a priori in general and the absolutely a priori in particular and it undermines the standard evidence in favour of attributing the Coextension Thesis to Kant.

In the second part I turn to Kant's conception of necessity and consider whether he nevertheless does hold some quite different form of coextension thesis for some notion of necessity and his own partly metaphysical notion of the a priori. I focus on Kant's conception of formal necessity, as that which is wholly grounded in the forms of

experience alone. Kant does hold a restricted and quite different form of coextension thesis for this kind of necessity and the work on the a priori from Part I helps to bring out his argument for such a view, which is quite different from either of the arguments considered by Kripke. Kant thinks that all and only formal necessities are a priori (in both epistemic and metaphysical senses) because he thinks we can have rational insight into the complete real essence of only our own rational capacities. Moreover, such a view is still untouched by Kripkean arguments against the Coextension Thesis, in a nutshell because truth in all formally possible (i.e. experienceable) worlds is required by but insufficient for formal necessity. Thus if Hesperus is Phosphorus or Water is H_2O then it can be true in all formally possible worlds that Hesperus is Phosphorus or that Water is H_2O without it being wholly grounded in the forms of experience alone that Hesperus is Phosphorus or that water is H_2O . Kant would think of Kripke's famous cases as epistemically a posteriori (though metaphysically a priori) and formally contingent. Formal necessity, like all of Kant's conceptions of necessity, based as they are in the notion of determining ontological grounds, is hyperintensional.

I conclude by noting some radically un-Kripkean consequences of Kant's view for the logic, metaphysics, and epistemology of modality and sketching how these points could transform contemporary debates. Arguably Kant's primary influence on contemporary debates in modal metaphysics and modal epistemology has been as a stalking horse for the incautious conflation of necessity and the a priori. Such a view radically underestimates Kant's view and its continuing relevance.

Grounding, Causation, and Emergent Spacetime

Annica Vieser & Kian Salimkhani

Université de Genève & Radboud-Universiteit Nijmegen

DAY 1, 17:30–18:30

This paper explores the consequences of what is often dubbed 'emergent spacetime' scenarios, particularly suggested by certain approaches to quantum gravity, for the relation between causation and grounding. It does so by connecting three contributions to the literature on grounding and causation: Wilson (2021)'s discussion of candidate demarcation criteria between causation and grounding in the face of non-fundamental spacetime; Bernstein (2016)'s presentation of differences between causation and grounding that questions whether appeal to causation can illuminate grounding; and a recent proposal by Baron and

Le Bihan (2023) to understand the emergence of spacetime in causal set theory as resulting from spatiotemporal relations being grounded in causal relations.

When trying to find a criterion for demarcating grounding from causation, a temporal criterion might come as a plausible candidate, capturing the intuition that causation is (usually) diachronic, whereas grounding is (usually) synchronic (see Baron et al. 2020 for a refined version of this view). Wilson (2021) argues that such a temporal demarcation criterion cannot apply if, as certain approaches to quantum gravity seem to suggest, spacetime is a merely emergent phenomenon; he thus instead advocates for what he calls the *mediation criterion*, which distinguishes causal from grounding relations through the kind of principle mediating them. We critically discuss Wilson's conclusion that if spacetime is emergent, then a temporal criterion cannot apply to distinguish grounding from causation at the more fundamental level. In analogy to a strategy considered in (Lam and Wüthrich, 2023) for the context of laws of nature, we examine the viability of 'insisting that the mere *existence* of spacetime—as opposed to its fundamentality—suffices for the analyses of [causal relations, A.V.] to accommodate whatever dependence they may have on spacetime' (Lam and Wüthrich, 2023, p. 2). This strategy cannot be dismissed as easily in the case of causation as in the case of laws of nature, or so we will argue.

The project that Bernstein (2016) engages in with respect to the relation between causation and grounding is quite different from Wilson's, but, as we argue, equally affected by the potential non-fundamentality of spacetime. She presents a long list of logical, structural and dialectical disanalogies between causation and grounding, to dissipate the idea of causation being a useful analogy in illuminating grounding (*pace*, among others, Wilson 2018). We highlight the role spacetime plays in these disanalogies, and point to a further potential structural difference between causation and grounding that hinges on the nature of spacetime and thus on advances in quantum gravity: if spacetime is continuous, then, under certain additional assumptions, we cannot find a causal analogue for the notion of immediate ground. If, on the other hand, spacetime is discrete, the structural disanalogy disappears.

To better understand such criteria for demarcating grounding from causation, we will make explicit what is, arguably, only implicitly discussed by Wilson (2021) and others: precisely which spatiotemporal aspects prove crucial for the demarcation. If 'emergent spacetime' scenarios pose additional problems for demarcating grounding from causation, what structure is it exactly that is necessary but missing in these scenarios? This connects to recent criticism by Jakšland and Salimkhani (2023) who observe a widespread lack of clarity with regard to the concept of spacetime in the philosophy of 'emergent spacetime'. So our investigation can also be read as a new case study in this regard.

In the main part of the paper, we relate the discussions of (Bernstein, 2016) and (Wilson, 2021) to Baron and Le Bihan (2023)'s recent proposal of a new understanding of causal theories of spacetime. Roughly, they advocate an understanding of causal set theory, an approach to quantum gravity, on which the spatiotemporal should be analysed in terms of causation. Unlike traditional causal theories of spacetime, which identify spatiotemporal relations with causal relations (e.g., Reichenbach (1956) and Grünbaum (1973)), Baron and Le Bihan argue for an understanding according to which causal relations ground spatiotemporal relations. They dub their account the non-identity theory. The non-identity causal theory of spacetime has at least two important implications for the distinction between grounding and causation: On the one hand, Baron and Le Bihan's account invites a shift of perspective, from thinking about causal relations as (more or less) analogous to grounding relations, to thinking of causal relations *as* grounds for spatiotemporal relations. On the other hand, Baron and Le Bihan's account breaks with one of the ways in which causation and grounding differ according to Bernstein (2016): by grounding spacelike relations in the *absence* of causal relations, they allow for grounding cases in which absences figure as grounds, in strict analogy with causation by omission.

As for the first implication of Baron and Le Bihan's view, we argue that it makes their theory dependent on the success of the project of demarcating grounding and causation in which Wilson (2021) engages: only

if there is a criterion for distinguishing causation from grounding—be it a temporal, a mediation, or a different kind of criterion—can the theory get off the ground.

As for the second implication of Baron and Le Bihan's view, the grounding literature has so far been mostly silent on the of grounding by absence (but there has been an increased interest in the role of negative facts and the related issue of grounding nonexistence—see e.g. Muñoz 2019). We suggest that a particularly fruitful option to defend grounding by absence may build on an argument in favour of causation by absence by Mumford and Anjum (2011, pp. 56–58). They argue that in theories of causation without absence conditions, causes can never be sufficient. This is because the causes would not have led to the effect in the presence of a preventing factor. Sufficient conditions must therefore always include the absence of preventing factors. If the availability of grounding by omission is meant to support the analogy between grounding and causation, however, this argumentative strategy runs the risk of circularity: it presupposes, *pace* Bernstein, that the analogy with causation can teach us something about grounding. This leads us to some methodological considerations, which conclude the paper.

Intrinsicality and Hyperintensional Compatibility

Ralf Bader

Université de Fribourg

DAY 2, 09:00–10:15

This paper provides an account of intrinsicality in terms of hyperintensional compatibility conditions.

Grounded in the God Equation

Toby Friend

Freie Universität Berlin

DAY 2, 10:20–11:20

Physicists sometimes talk of a 'God Equation' (Kaku 2021), a single law of nature that explains the entire ongoings of the world. Such an extreme hypothesis deserves substantial support if it is to be believed, however physics is currently lacking in candidates that are not mired in controversy. My aim is to provide some philosophical support for this idea by showing that the world may be *grounded* in such an equation (or, more correctly, its truthmaker).

Emery (2022) observes that we see patterns in nature. She doesn't give criteria for a pattern, but the following seem to fit with her examples. A pattern is a sequence *S* of instances of some property *F* where,

Similarity *F* is a non-disjunctive kind.

Accuracy all instances of *S* precisely exemplify some further property *G*.

Universality *S* has multiple instances and nothing is an *F* and is not in *S*.

Exactness *G* defines a precise behaviour.

So, for example, one pattern Emery talks of is the energy-momentum lost during beta decay. Here, the sequence comprises instances of beta decay whose instances are all **similar**, in that they involve the loss of an electron via radiation; they all **accurately** lose the **exact** amount of energy-momentum; and this is true **universally**—all instances of beta decay (which are profuse) involve this loss.

Emery argues that it is the observation of patterns like this that justifies a metaphysically robust explanation. In the case of beta decay, the explanation comes from the neutrino, a previously unknown particle,

that is also produced in beta decay radiation. More generally, she argues that it is methodologically sound to reason according to the following schema.

A widespread pattern in nature deserves a metaphysically robust explanation.

S is a widespread pattern in nature.

So, S deserves a metaphysically robust explanation.

Emery argues that lawful regularities, such as massive bodies' widespread satisfaction of the relationship $F = ma$, also count as patterns in nature. Following the above criteria, the regularity satisfying $F = ma$ is a sequence of **similar** entities (massive bodies), **accurately** obeying an **exact** behaviour (specified by the relationship $F = ma$), and **all** instances (which are many) of this kind do so. Therefore, her conclusion is that we should likewise source a metaphysically robust explanation for such patterns too, in this case *laws of nature*.

What form do these metaphysically robust explanations take? By contrast with the case of the neutrino explaining energy-momentum loss in beta decay, Emery points out that the explanation laws give to their regularities cannot be causal. In an earlier article Emery suggests that the relationship is one of *grounding* (Emery 2019). However issues concerning the possibility of indeterminate laws have led her to back away also from this. To my mind, Emery dismisses the option that laws ground their instances too quickly. As she herself notes (Emery 2019), it is hard to come up with any alternative backing relationship for how laws explain regularities. Moreover, the concern about laws' potential indeterminacy may be overplayed. First, the uncontroversial dynamical law of quantum mechanics (Schrödinger's wave-equation) is decidedly not indeterminate, and the Kochen-Specker theorem of orthodox quantum mechanics tells us that not all observable properties can take on determinate values, so perhaps the law need only ground a world that intrinsically indeterminate anyway (Darby and Pickup 2019). Second, many popular 'interpretations' of quantum mechanics are deterministic (e.g., Everett's Many-worlds interpretation, 'flashy' GRW approaches). Third, it's not clear that indeterminacy at the level of individual *models* of a law of nature (i.e., models of systems whose dynamics is described by a law) demands that the law cannot ground them. The fact that a single indeterministic law doesn't generate a single model (and so cannot ground one world at the expense of others) is consistent with it grounding *multiple* worlds, each one isomorphic to one of its models.¹

We can pair Emery's conclusion with another collection of observations from foundations of physics. It is widely believed that a final theory should give us a collection of laws that cover *everything* (Einstein 1918 [2002], Feynman 1967, Hawkins and Mlodinow 2010, Weinberg 1992). If that's true, then in conjunction with Emery's argument we can infer that the laws of nature are a metaphysically robust explanation for all the ongoings in the world. This, however, makes salient another pattern. For if there is a final theory, then its laws of nature *themselves* will comprise a sequence S , all of which are **similar**, in that they are all entities of the same kind (law of nature); they are *accurate* metaphysically robust explainers of **exact** regularities in nature; and such laws are metaphysically robust explainers of **everything** there is to explain in nature. The laws of a final theory would therefore be instances of a *meta*-pattern. And Emery's argument says, of course, that we should infer from such patterns the existence of a metaphysically robust explanation. This, I suggest, is what the God Equation represents.

Of course, the God Equation is not typically thought of as a meta-law. Kaku describes the God Equation as 'a single formula from which, in principle, one could derive all other equations, starting from the Big Bang and moving to the end of the universe' (ibid., p. 1). This suggests that the God Equation will not describe how other laws explain the world, but rather be itself a (first-order) law explaining the world, albeit one from which the others can be derived. This can generate something of a dilemma: either the God Equation is a meta-law, and so provides a metaphysically robust explanation of (e.g., by grounding) the relationship

¹Further complaints have been made about the grounding view (Hildebrand 2013, Jaag 2021, Wilsch 2021). I'll respond to these if there is time.

between first-order laws and their regularities, but fails to match up with how it is typically thought of in physics; or it is a first-order law and so matches up with the science, but only explains other first-order laws via mere deduction, which may not satisfy our thirst for metaphysically robust explanation. To my mind, the response is obvious. The God Equation just is *the only* first-order law that truly grounds the ongoings of the world. We have no reason to posit any others.

The Higher-Order Foundations of Arithmetic

Samuel Elgin

University of California

DAY 2, 11:40–12:40

It is difficult to identify the moment analytic philosophy was born. It is not the creation of a single person—nor even the product of a group pursuing a common aim. Rather, it reflected an increased deference to common sense, and the growing conviction that philosophical puzzles can—and should—be approached with the clarity and rigor of mathematics. Nevertheless, if we were pressured to identify a single time when the analytic tradition began, we would be hard-pressed to do better than the publication of *The Foundations of Arithmetic*.

The Foundations is renowned for its innovation and impact. Troubled by the development of non-Euclidean geometry—and recognizing that the axioms of mathematics were themselves open to doubt—Frege attempted to rest arithmetic on solid ground by reducing arithmetic axioms to logic. In the process, he developed second-order logic: a radically more powerful system than the Aristotelian one that had dominated Europe for millennia. He also laid the groundwork for modern set theory and metalogic—setting the course for decades of research to follow. *The Foundations* is a work whose ambition and significance is matched only by its complete and total failure.

Buried deep within Frege's system was an inconsistency. His Basic Law V amounts to the Principle of Universal Comprehension—the claim that, for every property (or, in his terms, 'course of values') there is a collection of objects bearing that property. This axiom led to the discovery of the Russell Paradox, which undermined Frege's program entirely. Frege never found a way for his program to recover.

Decades later, philosophers noticed that Basic Law V only occurred once in Frege's proof: in the derivation of Hume's Principle:

Hume's Principle: The number of *F*s = the number of *G*s just in case there is a one-to-one correspondence between the *F*s and *G*s.

To the best of our knowledge, Hume's Principle is consistent. This realization led to the development of neologicism, which remains a live possibility among competing theories of number.

As stated, Hume's Principle is a biconditional. More recently, philosophers have proposed an interpretation using the framework of grounding: a relation of metaphysical dependence. Perhaps the fact that the number of *F*s is the number of *G*s is grounded in—or holds in virtue of—the fact that there is a one-to-one correspondence between the *F*s and *G*s.

While this is a natural gloss on neologicism, it faces serious problems. Donaldson (2017) argued that it conflicts with standard assumptions about the logic of ground. First, the grounds of numerical facts are not well-founded; the fact that $0 = 0$, for example, has an infinite chain of grounds. Second, every fact

partially grounds the fact $1 \neq 2$ (and similarly so for other fact about inequality). This is both implausible and in violation of the irreflexivity of ground (since this fact partially grounds itself). Both of these problems arise from the conditions of one-to-one correspondence. Effectively, what grounds the fact that numbers are equal (or unequal) involves quantifying over every relation that they stand in. Given the standard logic of ground, this generates regress, in one case, and universal grounds in another.

The aim of this paper is to develop a theory that is immune to these problems. To that end, I draw on recent developments in higher-order grounding to reinterpret the grounds of arithmetic facts. Quite independently of this puzzle, Fritz and Elgin argue that there are higher-order structures that stand in grounding relations. Theories of ground typically seek to make fine-grained distinctions (for example, some hold that p grounds $\neg\neg p$, which requires distinguishing the propositions from one another). While accounts of structured propositions (that make such fine-grained distinctions) have come under sustained assault, there are higher-order relations that can consistently make the fine-grained distinctions structured propositions had been intended to make. Rather than appealing to the proposition Fa , we may appeal to the bihaecceity:

$$\lambda X.\lambda x.(X = F \wedge x = a)$$

This is not a structured proposition—for the simple reason that it is not a proposition of any kind. It is a relation between properties and objects, and is therefore not truth-evaluable. But it is a relation that allows for the recovery of a unique property F and a unique object a , and so distinguishes F and a from the relation between any other property and any other object. These terms can distinguish between expressions that differ in their syntactic structure, so we may appeal to them when fine-grained resources are needed. It is natural to suggest that they stand in grounding relations in general—and mathematical grounding relations in particular—where fine-grained structure is paramount.

With these structures at our disposal, the grounds of one-to-one correspondence can be interpreted in one of two ways. It might, as Donaldson suggests, be grounded in a universally quantified fact (i.e., grounded in a fact of the form $\forall x Fx$). Alternatively, it might be grounded in the relation involving the universal quantifier (i.e., grounded in a relation of the form $\lambda X.\lambda x.(X = \forall \wedge x = F)$)—which serves as a proxy for the universal fact. While the standard logic of ground requires that universal facts are grounded in their instances, it takes no stand on the grounds of relations involving the universal quantifier. By adopting the second interpretation, we may embrace the standard logic of ground while avoiding the problems Donaldson brings to light.

I close by addressing a potential objection: that this shift from facts to relations is unmotivated. On the contrary, I hold that this shift is highly motivated. I propose an account of the distinction between accidental and nonaccidental regularities. A regularity is accidental if it is grounded in its instances, and nonaccidental if it is grounded in the higher-order relation between the universal quantifier and the property of *being* F . This theory correctly predicts that arithmetic equivalence and distinctness arises from nonaccidental regularity.

Essential Dependence Is Not Fundamentality-Inducing

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DAY 2, 12:45–13:45

It is commonly thought that there is a very tight connection between essence, metaphysical dependence, and fundamentality. This often results in the endorsement of a principle linking Essence To Dependence (Fine 1994; Lowe 2006; Correia 2005; Koslicki 2012; Tahko and Lowe 2020)

(ETD) x essentially depends on y iff y appears in x 's essence.

And a principle linking Dependence To Fundamentality (Jaag 2014, Romero 2019, Wang 2019, Giannotti 2021) which can come in a stronger or weaker flavour:

(DTF_S) If x essentially depends on y , then x is less fundamental than y .

(DTF_W) If x essentially depends on y , then x is not more fundamental than y .

In this talk, we will argue against the second principle: we claim that essential dependence is not fundamentality inducing, i.e. it does not imply facts about the relative fundamentality of the dependent and the dependee.

We will offer four arguments against DTF. The first two are arguments from neutrality, and only target the stronger version of the principle.

In the first, we argue that DTF leads to counterintuitive results when paired with a Finean version of Origin Essentialism, for it entails that x 's parents are more fundamental than x . If (the suitably strong, Finean version of) Origin Essentialism is true, DTF should be rejected. But even if we do not assume the truth of Origin Essentialism, its tension with DTF is at least a violation of neutrality and a theoretical cost.

A similar, stronger argument can be formulated about Class Nominalism about properties. Assume that Kit is essentially human. Given Class Nominalism, the property of being human is identical to the class of all particulars that are human—Socrates, Plato, Taylor Swift, Kit, etc. Call this class ' Γ '. Since the property of being human is a constituent of Kit's essence, so is Γ , the class that being human is identical to. Therefore, by DTF_S, Γ is more fundamental than Kit. However, it is standardly believed that classes, as well as sets, have their members essentially (Fine 1994): members are part of the set's constitutive essence. Given DTF_S, this means that Socrates is more fundamental than Socrates. Since Γ includes Kit, Kit is more fundamental than it. But now we are caught in a contradiction: Kit is both more and less fundamental than Γ . Again, insofar as Class Nominalism is a plausible view, this is a cost.

The third argument also only targets strong DTF. We note that Strong DTF is inconsistent with the existence of symmetric or reciprocal essences—cases where y appears in x 's essence, and x appears in y 's. We then offer two arguments to the effect that there are, in fact, cases of reciprocal essences (and therefore that essential dependence is not an asymmetric relation). The first argument, building on Ditter (forthcoming), shows that reciprocal essences follow from accepting that i) Sources are Constituents, i.e. if $\Box_x p$, then x is a (Russellian) constituent of the structured proposition p (Glazier 2017; Wilsch 2017), and ii) that the relation of being a constituent is transitive. The second argument for the existence of reciprocal essences moves from cases of (real) inter-definitions: plausibly, it is essential to necessity that it is the dual of possibility.

But it is also essential to possibility that it is the dual of necessity. If this is so, then necessity and possibility symmetrically essentially depend on each other. But if DTF were true, this would lead to inconsistency, given that relative fundamentality is asymmetric.

The fourth and final argument targets both the strong and weak version of DTF. The one targeting strong DTF runs as follows:

1. $[x \text{ is crimson}] < [x \text{ is red}]$. [Assumption]
2. If $[p] < [q]$, then $[p]$ is more fundamental than $[q]$. [RF]
3. $[x \text{ is crimson}]$ is more fundamental than $[x \text{ is red}]$. [1, 2]
4. F is more fundamental than G iff, if x is as fundamental as y , $[Fx]$ is more fundamental than $[Gy]$. [Facts To Properties]
5. (Being) crimson is more fundamental than (being) red. [3, 4]
6. It is essential to (being) crimson that it is a shade of (being) red. [Assumption]
7. (Being) crimson essentially depends on (being) red. [6, ETD]
8. (Being) red is more fundamental than being crimson. [7, DTF_s]
9. (Being) crimson is more fundamental than being red and (being) red is more fundamental than (being) crimson. \perp [5, 8]

We will discuss a number of possible objection to the argument—most notably, a form of pluralism about relative fundamentality à la Karen Bennett (2017). We argue against the idea that essential dependence has a related kind of relative fundamentality, for it is not a building relation.

Finally, we draw some of the consequences of rejecting DTF in some first-order debates in metaphysics (most notably, with regard to the metaphysics of properties and powers), as well as debates concerning the relation between essence and grounding (and their possible reduction), and advocate for a form of pluralism about metaphysical explanation.

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