



# Brutalist fundamentalism: radical and moderate

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## Abstract

In contemporary metaphysics, the doctrine that the fundamental facts are those which are wholly ungrounded is the received view or something near enough. Against this *radical brutalism*, several metaphysicians argued in favour of the existence of fundamental facts that are moderately brute or merely partially grounded. However, the arguments for moderately brute facts rely on controversial metaphysical scenarios. This paper aims to counteract the tendency in favour of radical brutalism on scientific grounds. It does so by showing that naturalistic metaphysicians can appeal to plausible considerations from physical theory to establish the existence of moderately brute facts. But should the naturalistic metaphysician embrace *moderate brutalism*, namely the view that the fundamental facts are those which are merely partially ungrounded? Here I argue for a negative answer, recommending a more inclusive pluralism about the kinds of brute facts we can expect to find in nature.

**Keywords** Grounding · Fundamentalism · Fundamental facts · Brute facts · Naturalistic metaphysics

## 1 Introduction

Metaphysicians and physicists are often portrayed as being like cats and dogs. The analogy is an exaggeration but is not unabashedly off the track. Typically, practitioners of both disciplines acknowledge substantive differences regarding the aims and the methodology of the two fields. Metaphysicians are not in the business of running large particle accelerators. Physicists are not primarily concerned with happenings in possible worlds where your exactly similar physical duplicate lacks consciousness. But as cats and dogs are sometimes in accord, so are metaphysicians and physicists. Both parties agree on the relevance of the concept of fundamentality in their respective theorising. Championing a popular view in contemporary analytic departments,

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Schaffer says that metaphysics ‘is about what is fundamental and what derives from it’ (2009, p. 379). Expressing a common sentiment in the physics community, Maudlin claims that ‘when choosing the fundamental posits of one’s ontology, one must look to scientific practice rather than to philosophical prejudice’ (2007, p. 1). Granted its importance, we face an immediate question: How should we articulate the notion of fundamentality?

This paper aims to advance the metaphysical discussion about the fundamental. It focuses on a well-received doctrine that defends an intimate tie between fundamentality and bruteness, namely that which lacks explanation. Call this view *brutalism*. As I will illustrate below, we can distinguish between two forms of brutalism: radical and moderate. The former holds that the fundamental facts are those that are wholly ungrounded; the latter takes them to be merely partially ungrounded. I will argue that the naturalistic metaphysician has compelling reasons to reject radical brutalism. Plausible considerations from physical theory undermine the truth of this view. However, I will also argue that the naturalistic metaphysician should not embrace the moderate counterpart. I will conclude by suggesting that the naturalistic metaphysician with brutalist inclinations ought to adopt a pluralistic view about fundamental facts: some are radically brute, and others are moderately so.

The game plan is as follows. In the remainder of this section, I motivate the adoption of a ground-theoretic approach to brutalism. Then, I clarify the target kind of naturalistic metaphysician I have in mind. In Sect. 2, I define the notion of a radically brute fact and illustrate the corresponding radical brutalism. In Sect. 3, I introduce the notion of a moderately brute fact. There, I will explain that the existence of moderately brute facts is typically justified via metaphysically controversial scenarios. I will contend that such cases are not particularly compelling for the naturalistic metaphysician. In Sect. 4, drawing from an argument against radical brutalism put forward by McKenzie (2017), I will argue that the naturalistic metaphysician has reasons for believing in the existence of moderately brute physical facts. I conclude in Sect. 5. There, I discuss how the argument defended in Sect. 4 does not warrant the adoption of moderate brutalism. As an alternative, I offer what I label *pluralistic brutalism*—the view that some fundamental facts are radically brute, and others are moderately so. I close by stressing that even proponents of moderately brute facts who are less naturalistically-inclined will benefit from the argument discussed in this paper.

I will frame the discussion of brutalism by adopting a ground-theoretic framework. This strategy brings us three merits. First, it allows us to precisify the idea of bruteness as that which is not metaphysically determined, either completely or merely partially. As it will become clear in due course, this precisification permits us to resist or at least mitigate the charge that invoking bruteness to talk about fundamentality is nothing but a terminological choice. Second, the notion of ground is exceptionally serviceable in articulating rigorous and insightful formulations of radical and moderate brutalism, respectively. Third, as I shall discuss in Sect. 4, the grounding toolkit allows us to resist three serious objections that De Rizzo (2019) raises against McKenzie’s original formulation of her argument. The proposed approach gives us a neat framework for turning McKenzie’s argument into one for the existence of moderately brute physical facts. These advantages should prompt us to explore this strategy further.

As I understand it, ground is a non-causal determinative relation with explanatory import among facts. However, nothing prevents the reader from reformulating the following arguments for a conception of ground as relating entities of other categories. Here we do not need to fix on a specific view of facts. But it might be useful to regard them in a ‘worldly’ fashion. On this view, for example, the fact that Glasgow is north of Birmingham and the fact that Birmingham is south of Glasgow are the same. Schematically, ground conveys the idea that whenever a fact  $f$  is a ground of some fact  $g$ , (1)  $f$  ‘metaphysically’ determines  $g$  and (2)  $f$  ‘metaphysically’ explains  $g$  (or  $f$  backs or supports a metaphysical explanation of  $g$ ). How to make sense of metaphysical explanation is complicated (Maurin, 2019). *Unionists* identify ground with metaphysical explanation. *Separatists* opt for a looser tie, choosing a backing model on which grounds support metaphysical explanations (the labels are from Raven, 2012). For illustrative purposes, I will operate under the assumption of unionism. This approach will facilitate the discussion. It will highlight the explanatory implications of the argument from physics in Sect. 4. However, the latter can be suitably reformulated in a separatist fashion if needed. In what follows, I also adopt the orthodox view that ground relationships are irreflexive, asymmetric, and transitive (for challenges against the orthodoxy, see Jenkins, 2011; Schaffer, 2012; Wilson, 2014).

Next, let us distinguish between *partial* and *full* grounds. Informally, a full ground is akin to a complete explanation of a target phenomenon. A partial ground is like a contributory part of such an explanation. On the orthodox view, partial grounds are completable in the sense of obeying the following principle (Audi, 2012, p. 698; Fine, 2012, p. 50; Raven, 2013, p. 194; Rosen, 2010, p. 115):

**Completeness:** if  $f$  is a partial ground of  $g$ , then there is a plurality of facts  $\Gamma$  such that (1)  $f$  belongs to  $\Gamma$  and (2)  $\Gamma$  is a full ground of  $g$ .

For example, we would typically say that each of the fact that  $p$  is true and the fact that  $q$  is true is a partial ground of the fact that  $p \& q$  is true. And these facts taken together fully ground the fact that  $p \& q$  is true. A few notable exceptions aside (e.g., Dixon, 2016; Leuenberger, 2020; Trogdon & Witmer, 2021), **Completeness** remains largely unchallenged. As I will explain in Sect. 3, the existence of moderately brute facts amounts to the falsity of this principle. One of the morals of this paper is that naturalistic metaphysicians should be more careful in undeservedly endorsing **Completeness**.

I now turn to clarify the target audience of this work. My aim is to give reasons to naturalistic metaphysicians with brutalist inclinations for accepting the existence of moderately brute facts on the grounds of physical considerations. I will use the label ‘naturalistic metaphysicians’ for indicating those who minimally believe that our best science should inform our metaphysical concepts. Unfortunately, I do not have a complete theory of what naturalistic metaphysics is. Nor shall I attempt to illuminate this issue since this would be the topic for a different paper. On this minimal interpretation, a naturalistic metaphysician is someone whose metaphysical theorising engages ‘conscientiously and painstakingly with the empirical data, theoretical insights, or practices of the current sciences’ (Bryant, 2018, p. 2).

There are different degrees of engagement between metaphysics and science (though I do not wish to imply that the notion I have in mind can be formally specified

in quantitative terms). On a very weak understanding, a naturalistic metaphysics is one whose theories, hypotheses, and claims ought to be compatible with current science. On a stronger understanding, metaphysics that is worth pursuing earns its value from its being dictated by and being at the service of fundamental physics (Ladyman & Ross, 2007, p. 37). Here I have in mind a position that falls between these two extremes. This stance lies in the vicinity of what Morganti and Tahko (2017) call ‘moderately naturalistic metaphysics’. On this view, the inputs of science (in terms of scientific practice, scientific evidence, and scientific theses) are crucial in informing our metaphysical theories. But they are also vital to formulate, revise, and assess metaphysical hypotheses. On a moderately naturalistic approach, the influence of science does not overtake an a priori, conceptual dimension of metaphysical theorising, which is independently valuable from empirical data. On such a view, if we have scientific reasons for thinking that fundamentality should not be understood *qua* radical bruteness of facts, these suffice for abandoning this view. I will return to this topic in the last section, discussing a pluralistic approach to brute facts.

The scene is set. I now turn to describe radical brutalism.

## 2 Radical brutalism

Let us define a *radically brute fact* as follows.

**Radically Brute:**  $f$  is a radically brute fact if and only if there is no fact  $g$  that is a partial ground of  $f$ .

Accordingly, radically brute facts are *wholly* ungrounded. They lack *any* metaphysical explanation. The corresponding brutalist view is this.

**Radical Brutalism:** fundamental facts are radically brute.

In contemporary metaphysics, radical brutalism is the received view or something near enough. For example, Leuenberger takes it as one of ‘two obvious strategies for defining the fundamental in terms of ground’ (2020, p. 2648; the other, according to which the fundamental grounds everything else, will not be discussed in this paper). Textual evidence supporting the acceptance of radical brutalism abounds. Here is an incomplete list of examples (borrowed from McKenzie, 2017):

- ‘Say that a fact is fundamental (or brute) iff it does not obtain in virtue of other facts’ (Rosen, 2010, p. 126).
- ‘A is ungrounded if and only if it is fundamental full stop—absolutely fundamental’ (Bennett 2011, p. 27).
- ‘To begin, the key notions of a fundamental entity (a prior, primary, independent, ground entity) and derivative entity (a posterior, secondary, dependent, grounded entity) can both be defined in terms of grounding (ontological dependence, priority in nature), as follows:

*Fundamental:*  $x$  is fundamental  $=_{df}$  nothing grounds  $x$

Further:

*Derivative*:  $x$  is derivative  $\equiv_{df}$  something grounds  $x'$  (Schaffer, 2009, p. 374).

- ‘If a fact has no ground, then it is fundamental in one perfectly good sense: there is no explanation of why it obtains’ (Audi, 2012, p. 710).
- ‘There are those facts that are apt for having a ground but lack one. These are the so-called ‘fundamental’ or ‘brute’ facts’ (Dasgupta, 2016, p. 387).

The popularity of radical brutalism is somewhat at odds with the lack of good arguments in its defence. This scarcity is problematic. For instance, it reinforces the potential objection that the appreciation of such a doctrine presupposes an independent grasp of either the fundamental or the brute.

Perhaps, as Bliss and Priest note (2018, pp. 19–20), the appeal of radical brutalism could be explained by the idea that derivative facts (or entities, more generally) are completely metaphysically explained. By contrast, no derivative fact can completely metaphysically explain its explainers. Therefore, if there are fundamental facts, these should be metaphysically unexplained. Another source of motivation could be the view that a theory accepting some unexplained facts doing all the metaphysical explaining of all the derivative facts is more theoretically virtuous than one in which metaphysical explanations never bottom out (Cameron, 2008). Whether these are good arguments for embracing radical brutalism is unclear. I leave the task of defending them to the radical brutalist. I flag these considerations because my strategy for arguing against radical brutalism is not to show that these arguments are unsound or unpersuasive (for a more extensive discussion and evaluation, see Bliss & Priest, 2018, pp. 17–27). Like the proponents of moderately brute facts, I will argue against radical brutalism on the grounds of the existence of fundamental facts that are merely partially ungrounded. However, unlike them, my considerations in favour of the existence of such facts are primarily based upon physical theory.

### 3 The metaphysical possibility of moderately brute facts

Several metaphysicians have recently defended the existence of what I shall label *moderately brute facts*, which we can define as follows.<sup>1</sup>

**Moderately Brute:**  $f$  is moderately brute if and only if (1) there is a fact  $g$  that is a partial ground of  $f$  and (2) there is no collection of facts  $\Gamma$  such that  $\Gamma$ ,  $g$  is a full ground of  $f$ .

Accordingly, a moderately brute fact is *merely partially* grounded. That is, it has an *incomplete* partial metaphysical explanation. The corresponding brutalist view is this.

**Moderate Brutalism:** fundamental facts are moderately brute.

I shall defend the existence of moderately brute physical facts and discuss moderate brutalism later (Sects. 5 and 6, respectively). Here let us focus on the argument for

<sup>1</sup> I do not claim novelty in distinguishing between radically and moderately brute facts. The originality of the paper lies in exploring what to make of the distinction. The appearance in print of an explicit discussion of the distinction should be credited to Leuenberger (2020).

such brute facts. The existence of moderately brute facts is typically justified by the appeal to metaphysical scenarios that falsify the principle of **Completeness** (Sect. 1). Under the ground-theoretic framework, it should be evident that the very coherence of moderate bruteness requires us to show that **Completeness** occasionally fails. It is worth stressing how the existence of moderately brute facts threatens the tenability of radical brutalism. In schematic form, we can reconstruct the argument like this:

- (1) In scenario  $S$ , some facts are moderately brute.
- (2) Moderately brute facts are fundamental.
- (3)  $S$  is metaphysically possible.
- (4) If  $S$  is metaphysically possible, then radical brutalism is false.

Therefore:

- (5) Radical brutalism is false.

This argument has not been explicitly proposed by all supporters of moderately brute facts. However, the inference from the existence of moderately brute facts to the falsity of radical brutalism is straightforward. According to the brutalist doctrine, the mark of a fact's fundamentality is its lacking grounds. In this sense, moderately brute facts are fundamental. We could call them *weakly fundamental facts*, as Leuenberger does (2020, pp. 2653–2654), to distinguish them from *strongly fundamental facts*—namely, the radically brute ones. But weakly fundamental facts are nevertheless fundamental. Granted that, if it is possible for such facts to obtain, then not all fundamental facts are radically brute. To put it differently, we could say that the claim that there are moderately brute facts amounts to rejecting the view that all fundamental facts are strongly so.

Crucial to the argument against radical brutalism is the plausibility of the scenarios that yield the existence of moderately brute facts. The literature hosts many other coherent examples. Their existence is evidence supporting the recognition of this kind of facts. For reasons of space, I have to limit myself to a reconstruction of some of these in broad strokes.

### 3.1 Totality facts

On a well-developed conception articulated by Armstrong (2004), totality facts are higher-order “and that’s all” kind of facts, having certain first-order facts as constituents. On Armstrong’s view, totality facts involve a relation of *totalling* or *alling* connecting all the first-order facts that obtain or all the first-order facts of a certain kind that obtain. As Leuenberger (2020, pp. 2658–2660) discusses, totality facts are very plausible examples of moderately brute facts. Suppose that  $f$ ,  $g$ , and  $h$  are all the first-order facts that obtain. If so, a totality fact  $t$  would also obtain—namely, the fact that  $f$ ,  $g$ , and  $h$  are all the first-order facts that obtain. Now let us ask: What is the grounding relationship between  $t$  and the first-order facts  $f$ ,  $g$ , and  $h$ ? A natural and immediately available answer is that  $t$  is partially grounded in each of  $f$ ,  $g$ , and  $h$ . Each of these facts contributes to the obtaining of the (higher-order) fact that these are all the first-order facts that obtain. But  $f$ ,  $g$ , and  $h$ , even if taken together, do not fully ground that they are all the first-order facts that obtain. There is nothing in either

$f$  or  $g$  or  $h$  or all of them jointly considered that rules out the possibility that there may be other first-order facts. (Since ground is irreflexive,  $t$  cannot be one among  $f$ ,  $g$ , and  $h$ .) And since we suppose that  $f$ ,  $g$ , and  $h$  are all the first-order facts that obtain, there is something unexplained or brute about  $t$ . The totality fact that  $f$ ,  $g$ ,  $h$  are all the first-order facts that obtain appears to be moderately brute: it is partially grounded in  $f$ ,  $g$ , and  $h$  but lacks a full ground.

### 3.2 Schmerge's polarity

In addition to Armstrongian totality facts, Leuenberger (2020, pp. 2657–2658) discusses a scenario where the positive and negative polarity of the fictional property *schmerge* of a 'molecule' is merely partially grounded in the fact that it instantiates an even number of 'atoms' having a certain property F. In a possible world, say  $+$ , a molecule  $m$  has a positive schmerge. In another possible world, call it  $-$ ,  $m$  has a negative schmerge. Now assume that  $+$  and  $-$  are identical except for the polarity of  $m$ . In both possible worlds, the fact that  $m$  has a determinate schmerge is partially grounded in the fact that  $m$  has an even number of F-atoms. But nothing else in either  $+$  or  $-$  grounds the determinate polarity of  $m$ 's schmerge. The fact that  $m$  has positive polarity in  $+$  and the fact that it has opposite polarity in  $-$  are merely partially grounded.<sup>2</sup>

### 3.3 Strong emergence

Trogon and Witmer (2021, pp. 254–255), among other cases, suggest that one way to make sense of strongly emergent mental facts is to take them as merely partially grounded in physical facts. The strongly emergent mental facts escape any complete explanation in terms of physical facts. But they are still partially explained by them. It is unclear whether strong emergentists would be happy with this interpretation of their view. As such, I shall not ascribe to any specific strong emergentist. But if this interpretation is plausible, strongly emergent mental facts would be moderately brute.<sup>3</sup>

### 3.4 Existence

Trogon and Witmer, in the same work (2021, p. 255), discuss another case (which they credit to Kevin Mulligan). Consider the atomic fact that some object  $a$  has the property F. Suppose that this fact lacks full grounds. Yet it seems plausible that the

<sup>2</sup> Bader's notion of stochastic or indeterministic ground (2021) presumably implies the existence of moderately brute facts. However, Bader does not explicitly discuss the concept of stochastic grounding in connection with **Completeness**.

<sup>3</sup> Trogon and Witmer (2021) argues that the possibility of merely partially grounded facts should prompt us to define full ground in terms of partial ground. This original move represents a substantial difference with the standard view that partial grounds can be defined in terms of full ground by means of **Completeness**. However, my aim is not to explore whether can define the two varieties of ground in terms of each other. Given the different aims and focus, I will leave the discussion of Trogon's and Witmer's proposal to a separate paper.

fact that  $a$  exists is a partial ground of the fact that  $a$  is F. If so, the fact that  $a$  is F would be moderately brute.

### 3.5 Arbitrary grounding

Werner (2021 p. 19) considers the possibility that his notion of *arbitrary grounding* could be interpreted as implying that arbitrarily grounded facts are merely partially grounded (and thus moderately brute). An intuitive sketch of arbitrary grounding will suffice for this section (but note that Werner's account is more rigorous than what my gloss could imply). Let us say that some facts  $\Gamma$  arbitrarily ground a fact  $g$  belonging to a non-singular plurality of facts  $gg$  when  $\Gamma$  ground  $g$  but  $g$  is not necessitated by  $\Gamma$ . The fact  $g$  is arbitrary in the sense that  $\Gamma$  could have grounded some other facts of the  $gg$ . This toy example from Werner better conveys the idea (2021, p. 2). Suppose that God decides that one apple from the tree of knowledge has the fall-inducing property. Call this apple 'Anna'. God does not decide, however, which of the apples will be Anna (suppose that there are ten apples on the tree of knowledge). The fact that *this* apple is Anna, Werner would say, is arbitrarily grounded. The connection with moderate brutalism is as follows: there is something unexplained about why *this* apple, rather than another one, is Anna. The fact that God decided that some apple will be Anna is a partial ground of the fact that *this* apple is Anna. But supposing, as Werner does (2021, p. 2), that God does not fix any other facts, Anna could have been any other apples out of those hanging from the tree of knowledge. The fact that *this* apple is Anna appears to be merely partially grounded. Schematically, we could say that the fact that  $g$  of the  $gg$  rather than  $g^*$  of the  $gg$  is arbitrarily grounded in  $\Gamma$  is moderately brute.<sup>4</sup>

Each of the previous cases illustrates a superficially coherent failure of **Completeness**. However, I am confident that many readers will share the metaphysical intuition that the above scenarios are controversial. The radical brutalist has, therefore, various ways to defend their view. For example, someone will protest the Armstrongian conception (*totality facts*). Others will quibble about the setup of the schmerge

<sup>4</sup> Not all putative scenarios involving moderately brute facts that can be found in the literature are too remote from science. Such cases, if successful, would not represent a concern for the target naturalistic metaphysician. For instance, A. Wilson (forthcoming) hints at the possibility of moderately brute facts within the context of decoherence-based approaches to Everettian quantum mechanics (EQM). Wilson suggests that indexical facts about which worlds we occupy in the Everettian multiverse are plausibly merely partially grounded. An example of an indexical fact of this sort could be the fact that we observe a specific outcome of a quantum process, such as the observation of a particle's  $x$ -spin up after measurement. The fact that the multiverse exists is a partial ground of the fact that there are both  $x$ -spin up and  $x$ -spin down Everett worlds. However, there is nothing either in the fundamental physics of Everettian quantum mechanics (EQM) or in the multiverse that explains why we are located in the particular Everett world where we measure  $x$ -spin up. The self-locating element of this fact remains unexplained. It is worth noting, however, that even this case could be regarded as metaphysically controversial. While it is motivated by considerations from EQM, the target fact is about an observer's perspective. One could make the case that EQM is largely silent on how we should regard, metaphysically speaking, facts involving observers. Likewise, the metaphysics of EQM is underdetermined by physics. In my understanding, what motivates the adoption of a decoherence-based approach is a package deal of metaphysical and ontological considerations (for more on this, see Wilson, 2020). Lastly, as Wilson notes (forthcoming, p. 11), the possibility of offering an account of what fully grounds indexical facts in EQM remains open. What the full ground could include is something that I will not explore here.



case (*schmarge's polarity*). Strong emergentists might argue that strongly emergent mental facts are not suitably interpreted as merely partially grounded since this view fails to adequately capture what they have in mind (*strong emergence*). Further others will disagree on the plausibility of existence as a partial grounds for the fact that *a* is *F* (*existence*). Someone could attempt to argue that arbitrarily grounded facts are actually fully grounded (*arbitrary grounding*).

Crucially, the fact that the above scenarios are metaphysically controversial has an important implication for the naturalistic metaphysician with brutalist inclinations. These putative failures of **Completeness** do not give them strong or otherwise compelling reasons to abandon radical brutalism. But should the naturalistic metaphysician stick with this view? I do not think so. As I will explain in the next section, the naturalistic metaphysician does have other more forceful reasons to reject radical brutalism. I turn to argue that plausible considerations from physics yield the existence of moderately brute physical facts.

## 4 Physics and moderately brute facts

The case from physical theory I will employ concerns quantum field theory (QFT). To establish my conclusion, I will discuss and expand on an argument defended by McKenzie (2017), turning it into one for the existence of moderately brute physical facts. Along the way, I will address three serious objections against the original formulation raised by De Rizzo (2019). As it will become clear in due course, the proposed ground-theoretic interpretation of McKenzie's argument has the advantage of escaping the problems identified by De Rizzo. This represents a reason in favour of its adoption. If correct, this physical case increases the pressure against radical brutalism. Because it concerns physical theory and not an extravagant metaphysical scenario, the following argument has more traction against this view. It would be contentiously revisionary (or, worse yet, ideologically inconsistent) for the naturalistic metaphysician to defend radical brutalism in the face of compelling physical considerations against it.

### 4.1 The argument from fundamental kinds

In recent work, McKenzie (2017) argues that plausible considerations about the nature of quantum fields give us reason to think that what fundamental kinds of fields our world instantiates is a partially grounded fact. This upshot undermines the alleged fundamentality of this fact, which I justify in a moment. McKenzie offers an extensive and technically articulated defence of how QFT supports the assumptions the argument needs to go through. My aim is not to challenge McKenzie's interpretation of QFT. Nor do I have something insightful to add concerning its plausibility. To ease the discussion, I opt for a simplified presentation of McKenzie's argument. My goal is to show how this argument can be employed to support the existence of moderately brute physical facts.<sup>5</sup>

<sup>5</sup> Note that brutalist fundamentalism, as I understand it, is a claim about the fundamentality of facts; it is not a claim about the fundamentality of things that are not facts, such as quantum fields. How to think of

To begin with, we need to clarify three assumptions that McKenzie's argument adopts.

First, it is assumed that the fact that our world instantiates a distinctive suite of fundamental physical kinds  $K_1, \dots, K_N$  is fundamental. Let us use  $K$  to collectively denote 'the fact that  $K_1$  is instantiated, the fact that  $\dots$ , and the fact that  $K_N$  is instantiated'. Echoing a widespread sentiment among metaphysicians, McKenzie motivates  $K$ 's fundamentality by arguing that the identification of the fundamental physical kinds 'just is to correctly specify a crucial aspect of the fundamental structure of the world' (2017, p. 236). On radical brutalism, if it is fundamental,  $K$  must be wholly ungrounded; it must be 'a fact for which no metaphysical explanation can be given' (McKenzie, 2017, p. 237). Here I suggest that we assume for a moment that  $K$  is neither conjunctive nor disjunctive. This assumption is needed to get the argument off the ground. If  $K$  were a conjunctive fact of the form 'the fact that  $K_1$  is instantiated &  $\dots$  & the fact that  $K_N$  is instantiated', it would be hard to concede the plausibility of its fundamentality. It is a standard principle of the logic of ground that conjunctions are grounded in their conjuncts. And if  $K$  is grounded in its conjuncts, then it would not be wholly ungrounded. Similar reasoning applies to an (admittedly less intuitive) interpretation of  $K$  as a disjunctive fact of the form 'the fact that  $K_1$  is instantiated  $\vee \dots \vee$  the fact that  $K_N$  is instantiated'. The same logic of ground dictates that disjunctions are grounded in their disjuncts. If so, it would be hard to grant  $K$  the status of fundamental fact. In due course, I will argue that  $K$  is moderately brute even if we discharge this assumption. For now, I ask the reader to bear with me.

Second, McKenzie takes the fundamental physical kinds to be quantum fields. Accordingly, each  $K_i \in K_1, \dots, K_N$  is a kind of quantum field. This assumption simply reflects McKenzie's focus on QFT. It should be evident, however, that the argument generalises: if we have a fundamental physical fact that is not wholly ungrounded, then radical brutalism is false.

Third, it is assumed that quantum fields evolve unitarily by virtue of their own nature. To put it differently, it lies in the essence of quantum fields that they undergo unitary evolution. McKenzie offers a rich and elaborated discussion in favour of the plausibility of this assumption drawing from the formalism of QFT (2017, pp. 240–243). Here I grant its tenability since I do not aim to undermine McKenzie's interpretation of QFT. However, it is worth noting that some interpretations of quantum mechanics, such as GRW collapse theory, do not secure the unitary evolutions of fields. McKenzie's argument might fail on such views. Whether possible amendments allow us to dispense with the requirement of unitary evolution will remain outside the scope of this paper.

In ground-theoretic terms, McKenzie's argument can be reconstructed as follows:

- (1)  $K$  is a fundamental fact.
- (2) If radical brutalism is true, then  $K$  is wholly ungrounded.
- (3) There is a further fact,  $GP$ , that is a partial ground of  $K$ .

Therefore:

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Footnote 5 continued

the fundamentality of quantum fields is unimportant for the purposes of discussing McKenzie's argument. The reader should bear in mind that the notion of ground is here understood as relating facts only. However, I believe that the present discussion can be suitably reframed for those who think that ground is a relation among other categories.

(4) Radical brutalism is false.

Before defending the advantages and the novelty of this grounding-based formulation of McKenzie's argument, I shall offer a brief commentary on premise (3).

Here I use *GP* to denote the fact that the fundamental kinds of quantum fields, collectively grouped under *K*, must obey what McKenzie calls a *Goldilocks principle*, where  $B_i$  and  $F_i$  are bosonic and fermionic kinds, respectively (2017, p. 249):

**Goldilocks principle for fundamental kinds:** 'Whatever the actual inventory of fundamental kind is, it will take the form of  $B_1, \dots, B_N; F_1, \dots, F_M$ , for some  $N > 0$  and with an upper bound on  $M$ , and with  $M$  and  $N$  related.'

The **Goldilocks principle** is a non-trivial non-causal constraint on the number of fundamental quantum field kinds that can be instantiated. They cannot be too many, nor can they be too few. Concede me an oversimplification for the sake of keeping the focus on the metaphysical consequences of the argument. McKenzie argues that whatever the actual fundamental quantum fields will be, these must be law-preserving at arbitrary high-energy levels. Under the assumption that quantum fields evolve unitarily, the satisfaction of such a requirement imposes a mathematical restriction on the number of quantum fields that the theory can admit. It has been shown—and, therefore, we already know—that the fundamental laws of QFT are unitary only if the theory contains  $N > 0$  non-Abelian gauge bosons, and fermion kinds do not exceed a number  $M$  which is related to  $N$  (for a technical and more detailed discussion, see Coleman & Gross, 1973; Gross & Wilczek, 1973; McKenzie, 2017, pp. 244–249). As I understand it, *GP* is then the fact that whatever fundamental kinds of quantum fields our world instantiates, these must abide by the **Goldilocks principle**.

If this reconstruction of McKenzie's argument is sound, then radical brutalism hits trouble: there is a fundamental fact, namely *K*, that is not wholly ungrounded.

#### 4.2 De Rizzo's objections resisted

Granted that *K* is a fundamental fact (as per premise 1), it appears that the crucial premise of McKenzie's argument is (3). As it happens, De Rizzo (2019) raises important objections against the original formulation. Coincidentally, one of these targets the explanatory character of *GP*. This is, therefore, a good place to pause and show how the proposed ground-theoretic formulation allows us to resist De Rizzo's (2019) charges. It will become clear that the proposed grounding interpretation is not a mere notational variant of McKenzie's argument.

As I understand it, De Rizzo (2019) makes three objections against the original formulation of McKenzie's argument. To understand the first one, we need to observe that McKenzie articulates her argument by employing the notion of a Hempelian partial explanation. Structurally speaking, the argument is overall the same. The reader could replace (3) with (3\*), where the subscript denotes that the partial explanation is Hempelian:

(3\*) There is a further fact, *GP*, that partially explains<sub>H</sub> *K*.

On the Hempelian view, explanations take the form of arguments having the *explanandum* as the conclusion. We could say that a Hempelian partial explanation

(Hempel, 1965, pp. 415–416) is an argument that does not entail the occurrence of a certain event to be explained. But it does entail that such an event ‘will fall within a wider class of events’ (De Rizzo, 2019, p. 400). The first objection is that Hempelian partial explanations are not explanatory. Since McKenzie’s original argument relies on this notion, it would fail to establish that *K* is partially explained by *GP*. The proposed ground-theoretic escapes this objection, and acceptance of this point should not demand an extensive commentary. First, the proposed reconstruction does not invoke the Hempelian notion. Second, ground is inherently explanatory, and De Rizzo believes this too (2019, p. 397).

The second objection targets the idea that McKenzie’s argument qualifies as an instance of metaphysical explanation (De Rizzo, 2019, pp. 402–404). According to De Rizzo, McKenzie takes her argument to be metaphysical because it makes an assumption about the nature or essence of quantum fields (namely, that they evolve unitarily). But the appeal to an essentialist claim, De Rizzo demurs, does not suffice to award the label ‘metaphysical’ to the explanation of *K* in terms of *GP*. (Or, if it does, it problematically overgenerates metaphysical explanations.) And, De Rizzo continues, if McKenzie’s argument fails to be a case of metaphysical explanation, it does not affect radical brutalism since the latter is a thesis about metaphysical explanation. If De Rizzo’s objection is sound, a rudimentary essentialist interpretation of the argument suffers a similar problem. For instance, the claim that the link between *GP* and *K* somehow involves the essence of either fact might give rise to a similar worry (for more on essentialist explanations, see Glazier, 2017). The proposed grounding-based interpretation avoids this objection. What ensures that the reconstruction of McKenzie’s argument is an instance of metaphysical explanation is its very ground-theoretic formulation. Where there is grounding, there is metaphysical explanation. This claim is certainly true within the unionist framework, which we assumed at the beginning. But the separatist could claim a similar advantage. Since grounding backs metaphysical explanation, the proposed reconstruction of the argument has a corresponding backing metaphysical explanation.

The third objection is the most important to address. De Rizzo argues that what I call *GP*—namely, the fact that the collection of fundamental kinds instantiated must obey the **Goldilocks Principle**—is not genuinely explanatory (2019, pp. 405–408). This objection amounts to the claim that *GP* is not a partial ground of *K*. According to De Rizzo, the appeal to *GP* does not yield a genuine explanation of *why K* obtains. To put it differently, the appeal to *GP* does not constitute a reason why *K* obtains (De Rizzo, 2019, p. 406). *GP* allows us to recognise *that K* is instantiated. But this feature, as I understand the objection, does not make it genuine explanatorily. My response to this critical point is threefold.

First, we should be given reasons for accepting that metaphysical explanation is confined to *why*-questions. De Rizzo may be right that *GP* does not explain *why K* obtains. But this limitation is insufficient to establish that *GP* fails to be metaphysically explanatorily *tout court*. For example, Litland (2013) and Richardson (2020) argue that the concept of grounding can be beneficially employed to cover cases of “metaphysical explanation how”—namely, cases where grounding explanations are answers to *how*-questions. These are cases where the claim that *f* grounds *g* is or backs an explanation of the way or manner in which *g* is the case by *f* being the case. One might ask:

How is it true that a certain suite of fundamental kinds is instantiated in our world? The answer ‘By its being true that they obey the **Goldilocks Principle**’ strikes me as perfectly acceptable.

Second, *GP* would be relevant in explaining the obtaining of *K* even if its grounding role is best understood as akin to that of a background condition or an enabler. For example, Cohen (2020) and Baron-Schmitt (2021) argue that some facts play an enabling grounding role rather than a generative one. The latter could be understood in terms of metaphysical causation (Wilson, 2018). Here my goal is not to make the case that *GP* is an enabling ground (though I would be happy to say so). Rather, I want to defend the claim even if *GP* were an enabling ground—and thus possibly unfit to offer a reason *why* *K* obtains—it could still be explanatory. *GP* would be a fact whose presence enables the obtaining of *K*.

Third, the interpretation of a *GP* as a partial ground is fruitful, and this is a reason in favour of its aptness. Its fruitfulness lies in revealing a better version of McKenzie’s argument. And as I will explain below, this approach paves the way to an effective strategy to establish that *K* is a moderately brute fact. This response is the same I would give to someone protesting that *GP* is metaphysically explanatory but not in a grounding fashion. For example, someone could argue that *GP* yields a explanation by constraint (for more on this topic, see Lange, 2015; Bertrand, 2019). However, it is unclear whether this approach can legitimately claim the same advantages as the proposed grounding formulation. For example, it is not immediately apparent that this view offers a rigorous notion of partial explanation. Similarly, it is not evident whether this approach escapes De Rizzo’s objections without invoking resources that the ground-theoretical framework has already built-in.<sup>6</sup>

### 4.3 The moderate bruteness of fundamental kinds

Thus far, I defended the claim that *GP* is a plausible partial ground of *K*. Now I turn to argue in favour of the moderate bruteness of *K*. More precisely, I set out to defend this conditional claim: *if* *K* is fundamental at all, as per McKenzie’s argument, *then* (1) *K* is moderately brute or (2) *K*’s constituent facts are moderately brute.

Let us begin with (1). Let us call a *K*-fact one having the form ‘the fact that  $K_i$  is instantiated’, where  $K_i$  is a fundamental kind of quantum field. My initial suggestion is that *K* is fundamental by virtue of being identical to a particular Armstrongian totality fact:

<sup>6</sup> Someone else might quibble that *GP* is a mathematical fact and not a ground since it constrains the number of instantiable kinds of quantum fields. I would not quiver if *GP* were indeed a mathematical fact. But I would protest the claim that *GP* thusly understood is *not* a ground. Mathematical facts *can be* grounds of other facts. Suppose that I have 23 coffee capsules, and I want to divide them evenly without cutting or buying any over 3 weeks. It seems to me that the fact that 23 cannot be divided evenly by 3 is very likely a partial ground of why I fail to arrange my weekly coffee intake in such a quirky fashion. The fact that 23 is not evenly divisible by 3 partially determines, in a non-causal sense, why I am bound to fail to evenly distribute the 23 coffee capsules over 3 weeks. The example is an adaption from Lange (2015, p. 6) and does not reflect my more generous weekly coffee intake. For more on ground and metaphysical explanation in mathematics, see Lange (2019).

$K_{\text{tot}}$ : the fact that  $K_1$  is instantiated obtains, ..., the fact that  $K_N$  is instantiated obtains, and these are all the obtaining K-facts.

To put it differently,  $K_{\text{tot}}$  expresses that the fundamental kinds instantiated are all the fundamental kinds there are. If  $K$  were identical to  $K_{\text{tot}}$ , it would be moderately brute. As I explained in Sect. 3, Armstrongian totality facts are eminently plausible examples of moderately brute facts (for the sake of brevity, I shall not repeat the entire discussion). Each of the constituent K-facts is a partial ground of  $K_{\text{tot}}$ . Each of them partially explains why these are all the K-facts that obtain. Yet there is something inescapably brute about  $K_{\text{tot}}$ : nothing in its constituent K-facts seems to determine or otherwise accounts for the “and that’s all” component of  $K_{\text{tot}}$ .

A radical brutalist could reject the claim that  $K_{\text{tot}}$  is moderately brute in various ways. There are two straightforward options: one is to deny that  $K$  is a totality fact, the other is to argue that  $K_{\text{tot}}$  is fully grounded in some K-facts plus some extra facts. I will discuss the first manoeuvre by considering (2), namely the second disjunct of the conditional claim. Here let us focus on the second proposal.

Someone could accept that the K-facts are partial grounds of  $K_{\text{tot}}$ . Yet they could argue that some other facts complete the ground of  $K_{\text{tot}}$ . These could be facts about the patterns of instantiation of fundamental kinds that we extrapolate from observation. For example, what could fully ground the “and that’s all” component of  $K_{\text{tot}}$  is the fact that the fundamental kinds that are instantiated are all the fundamental kinds we observed. This deflationary strategy would be appealing to those who regard totality facts with suspicion. However, it introduces a controversial perspectival element that potentially conflates the epistemic and the ontic. As I understand McKenzie’s argument (2017, p. 236), the claim that  $K$  is fundamental—namely, that fact a certain suite of fundamental kinds of quantum fields is instantiated—is an ontic affair; it is a matter of how the world is like. By contrast, the discovery and the observation of fundamental kinds is an epistemic business. Whether  $K$  either has or lacks or partially lacks a full ground should be independent of our knowledge of  $K$ .

There is a related way of eliciting the partial bruteness of  $K_{\text{tot}}$ . On a necessitarian conception, if  $g$  is grounded in a plurality of facts  $\Gamma$ , then, necessarily, if all members of  $\Gamma$  obtain,  $g$  obtains (e.g., Rosen, 2010). This entailment principle fails for totality facts (for a more extensive discussion of failures of entailment, see Leuenberger, 2014). The constituent K-facts of  $K_{\text{tot}}$  can obtain, and yet  $K_{\text{tot}}$  may fail to obtain. The obtaining of a collection of K-facts does not rule out that other K-facts could obtain. As I explained above, one could add some extra facts to the relevant K-facts, hoping to ensure that  $K_{\text{tot}}$  is entailed by the expanded grounding base. However, it is unclear what facts could guarantee that the “and that’s all” component of  $K_{\text{tot}}$  is fully metaphysically explained except for the totality fact itself. But we cannot allow for  $K_{\text{tot}}$  to ground itself, for this would be an inadmissible violation of the irreflexivity of ground.

Now let us turn our attention to (2). Someone could argue that there are other ways of conceiving  $K$ . On these views, we can accept that the constituents of  $K$  are the K-facts. But, as the objection goes,  $K$  thusly understood is a complex fact fully grounded in its constituent K-facts. I will argue that this approach does not remove the moderate bruteness of the K-facts.

Contrary to the assumption I made to discuss McKenzie's argument, one might think, quite naturally, that  $K$  is a conjunction of K-facts. (Along these lines, someone might regard  $K$  as a disjunction of K-facts of which every disjunct obtains. But this reading of  $K$  strikes me as initially less intuitive than the conjunctive interpretation. Be that as it may, we could suitably extend the following discussion to the disjunctive interpretation.) On this approach, it could be argued that  $K$  is wholly grounded in its constituent K-facts. It is part of the standard logic of ground that whenever  $f$ ,  $g$  obtain, they fully ground  $f \& g$ . Thus,  $K$  would be fully grounded if it were understood as a conjunctive fact,  $K_{\&}$ , having the form 'the fact that  $K_1$  is instantiated obtains & ... & the fact that  $K_N$  is instantiated obtains'. The conjuncts of  $K_{\&}$  would fully ground it. Accordingly, someone might be inclined to believe that this strategy blocks  $K$ 's fundamentality (since it will be neither radically nor moderately brute). However, I want to suggest that moderate bruteness is still lurking beneath the appearances. There is something about the constituents of  $K_{\&}$  that has a partial but not complete grounding explanation.

Suppose that  $K$  is  $K_{\&}$ . It seems that we can still ask why the constituent K-facts of  $K_{\&}$  obtain. Currently, we can offer just a partial explanation to answer this question. The K-facts of  $K_{\&}$  collectively taken have  $GP$  as a plausible partial ground. A particular conjunction of K-facts obtains because the kinds involved in its K-facts collectively obey the **Goldilocks Principle**. The latter partly explains why  $K_1$  is instantiated & ... &  $K_N$  is instantiated. The reasons I offered above for taking  $GP$  as a partial ground of  $K$  apply to the claim that  $GP$  is a partial ground of the constituents of  $K_{\&}$  collectively considered. Present-day physics suggests that there is nothing else that, together with  $GP$ , fully explains the obtaining of a certain collection of K-facts. Therefore, we have compelling evidence for holding that something about the constituents of  $K_{\&}$  is moderately brute. (The response generalises to other interpretations of  $K$  as being somehow fully grounded in its constituent K-facts. I focused on  $K_{\&}$  as this is the more commonsensical option.)

I envisage two further complaints at this stage: one is that this approach forces us to acknowledge that  $K$  is not fundamental after all, the other is that future physics will identify the full grounds of the K-facts. I will discuss the second point in the conclusive section since it touches on a more general issue. Here I address the first point instead. Let me stress again, however, that the moderate bruteness of the obtaining K-facts suffices for establishing the conditional claim I made at the beginning of this subsection.

One way to secure  $K$ 's moderate bruteness would be to identify  $K$  with the obtaining K-facts. For example, one could regard  $K$  as an ontologically lightweight device that collectively denotes the K-facts. Alternatively, someone could argue that  $K$  just is the obtaining K-facts. If  $K$  is identical with the collection of obtaining K-facts, and if the latter is moderately brute, then  $K$  is also moderately brute. This strategy remains available.

Having proposed two ways of regarding  $K$  as fundamental, we face an immediate question: Which one should we favour? It seems to me that the identification of  $K$  with  $K_{\text{tot}}$  (and thus the first approach) is preferable. This interpretation seems more appropriate. It better captures that 'which fundamental kinds the world does instantiate should be taken as a fundamental fact about it' (McKenzie, 2017, p. 236; the emphasis

is mine). There is also a more metaphysically substantial reason for favouring the  $K_{\text{tot}}$  approach. This strategy evades potential complaints about the identity claim between  $K$  and its many constituent  $K$ -facts. To repeat, however, both strategies are viable. Each recovers the moderate bruteness of  $K$ . This is all we need for defending the claim that some physical facts are moderately brute.

In this lengthy section, I discussed how to turn McKenzie's argument into one for the existence of moderately brute physical facts. I also defended the merits of this approach by showing how it permits us to resist De Rizzo's objections. Now I turn to discuss some relevant implications, going back to the theme of naturalistic metaphysics. In closing, I offer my favourite version of brutalism.

## 5 Pluralistic brutalism

To recap, I argued that we could draw from physical theory to establish the existence of some moderately brute physical facts. If sound, my argument has two general implications. First, the radical brutalist has a harder time defending their view. They need to fend off metaphysical as well as physical considerations against their doctrine. Second, metaphysicians who believe that **Completeness** sometimes fails have a new argument in their arsenal. They could appeal to the discussed case from QFT to bolster their opposition against this principle.

One might wonder, however, whether naturalistic metaphysicians should endorse the view that all fundamental facts are moderately brute. Call it **Moderate Brutalism**. In this conclusive section, I argue that they should not.

If one were to embrace **Moderate Brutalism**, the moderate bruteness of  $K$ —namely, the fact that a certain suite of fundamental kinds is instantiated—would be unproblematic. However, in the absence of extra considerations, we are not justified in believing that *all* physical facts are moderately brute. This is not to say that such considerations *cannot* be offered. Rather, the claim is that the empirical considerations supporting  $K$ 's moderate bruteness are insufficient to warrant the moderate bruteness of all physical facts. The proposed grounding formulation of McKenzie's argument does not rule out the existence of radically brute facts. This much should be uncontroversial.

Returning to an objection I mentioned in 4.3, someone could argue that future physics will give us reasons to believe that all fundamental physical facts are moderately brute. (By parity of reasoning, one could also claim that future physics will support the view that all fundamental physical facts are radically brute.) But which version of brutalism we should favour is, for the naturalistic metaphysician, an affair that must be settled by the light of present-day physics. And it is unclear what the supporting empirical evidence for **Moderate Brutalism** could be. It is up to moderate brutalists to shoulder the burden of showing that this claim is wrong. For example, they could demand examples of physical radically brute facts and then falsify them on empirical grounds. This strategy amounts to dialectical trench warfare over specific examples, which does not strike me as a desirable philosophical upshot. There may be more promising approaches. But I leave the task of articulating them to the defenders of this view.



I conclude by recommending a more inclusive alternative, one which is driven by the recognition that current scientific evidence leaves open the possibility of radically brute physical facts. The empirical considerations against **Radical Brutalism** support the suitability of **Moderate Brutalism** as a more befitting option. However, the very naturalistic spirit motivating the rejection of **Radical Brutalism** should lead us to a more open-minded approach to the kinds of fundamental physical facts we might find in nature. We currently lack empirical evidence for establishing that all fundamental physical facts are moderately brute. In the absence of defeating evidence, I suggest that we should be prepared to accept a pluralistic form of brutalism about fundamental facts. We can label this view *pluralistic brutalism*: some fundamental facts are moderately brute, others are radically so.

The argument for pluralistic brutalism is one by elimination. If radical brutalism is false and moderate brutalism is empirically unwarranted, then the naturalistic metaphysician ought to endorse pluralistic brutalism. This approach is not just more scientifically responsible (as some physical facts such as *K* are eligible candidates for being moderately brute). But it is also metaphysically more permissive. It does not banish wholly ungrounded physical facts from the inventory of what there is. What these facts are, if they obtain at all, is an unsettled business susceptible to scientific consideration, empirical discoveries, and—of course—philosophical debate. Setting aside its naturalistic motivations, the merit of the pluralist approach is that it is more flexible than a more conservative view that countenances *either* radically brute facts *or* moderately brute facts but not both.

Putting the pieces together, I suggest that we welcome this take-home message. There are scientific considerations in favour of the existence of moderately brute facts. Thus, the case against the completability of partial grounds is fortified. The metaphysical scenarios against this principle may be easier to counteract. By contrast, the physical case about the fundamental kinds instantiated in our world is harder to dismiss. For the naturalistic metaphysicians, who are the target audience of this paper, the soundness of the argument from physical theory should be a strong or even decisive point against **Completability**. As a concluding remark, it is worth punctuating that the suggested pluralistic brutalism does not demand another concept in addition to ground. Both radically and moderately brute facts are ground-theoretic characterisations of fundamental facts. Once ground is accepted in our theorising, we can enjoy both. Such an upshot vindicates the serviceability of ground as a tool for investigating the fundamental structure of reality.

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