**Structure**

Tuomas E. Tahko (University of Bristol) | www.ttahko.net | tuomas.tahko@bristol.ac.uk

Penultimate draft. Final version published as Chapter 27 of the *Routledge Handbook of Metaphysical Grounding* (2020), pp. 387–395, edited by Mike Raven.

## 1. What Is Structure?

The notion of *structure* is often invoked in connection to ground. By way of example, it is telling that the subtitle of Fabrice Correia's and Benjamin Schnieder's 2012 volume on *Metaphysical Grounding* is *Understanding the Structure of Reality* and the 2018 volume on fundamentality by Ricki Bliss and Graham Priest is called *Reality and Its Structure*. In general, grounding is often understood to impose constraints on the 'structure of reality'. Specifically, grounding is thought to impose an asymmetric, transitive, and irreflexive order on reality, giving rise to a hierarchical structure.[1]

However, structure, as it is used in the titles of the mentioned volumes and also more generally in the grounding literature, is not always intended as a technical notion. Rather, structure simply refers to the idea that reality has heterogenous content, which can be systematised in terms of grounding. There is another, technical sense of structure, which is known especially from Ted Sider's 2011 book *Writing the Book of The World*. Sider thinks that metaphysics is about the fundamental structure of reality and discerning that structure means discerning *patterns*. The idea is now very often captured with reference to the notion of *carving reality at its joints* or *joint-carving*, which originates in Plato. Following this line of though, we are looking for the most fundamental distinctions that we may use to categorise reality.[2]

In this Chapter, I will discuss both of these senses of structure as well as their potential connections. I will first briefly outline a potential connection between ground, structure, and fundamentality. Next we take up the idea that reality has a hierarchical structure and we will then examine whether there could be a systematic connection between ground and structure via the Lewisian notion of *naturalness*. This leads us to a question about the relationship between reality and representation, before concluding with a more detailed discussion about a famous principle regarding fundamentality, namely, the principle of *purity*.

## 2. Ground, Structure, and Fundamentality

It's clear that the notion of ground is somehow related to the idea of structure: the most fundamental facts in nature are presumably those that cannot be grounded in other, more fundamental facts.[3] On this view, structure is fundamental or describes what reality is fundamentally like; it concerns ungrounded facts about reality.[4] While the idea that structure is about what is *absolutely fundamental* or ungrounded is common, we should also note that the notion of *relative fundamentality* is of importance. If reality is hierarchically structured, it means that some things are less fundamental than others and it is often thought that grounding gives us an ordering of this hierarchical structure – an ordering of relative fundamentality. So, the notion of structure could also be used to refer to the idea that there are more and less fundamental facts in the world. Sometimes this is put in terms of *levels of reality*, whereby the ungrounded things are at the absolutely fundamental level and the less fundamental things are on higher levels and ultimately grounded in the absolutely fundamental.

There is an initial challenge that may be raised for the idea of joint-carving facts as the most fundamental ones (this is considered by Sider 2011: 3). Say that we have discovered that fermions and bosons are both fundamental objects. Assuming that facts constructed from

fundamental constituents are themselves fundamental, it follows that the fact that fermions exist and the fact that bosons exist both carve at the joints. But one might insist that there is nevertheless something that fermions and bosons share, namely, they both have the feature of *being either a fermion or a boson*. If this disjunctive property is a genuine feature of reality, then the facts about the existence of fermions and bosons are not, after all, fundamental ones, because there appears to be a more fundamental fact that they have in common: the fact that either fermions exist or bosons exist (or both). The worry is that it is not clear whether we should privilege the disjunctive property or the disjuncts. Indeed, by using logical operators such as disjunction, we can postulate many other combinations of properties and if we have no principled reason to favour one way of carving at the joints over another, then we will never find the joint-carving facts.

A possibly reply is that since the problematic feature in question, *being either a fermion or a boson,* is disjunctive, one might think that disjunction and other logical operators are just features of *language* and we are here bringing two fundamental features of reality together at the level of *representation* rather than at the 'worldly' level, the level of *reality*.[5] But what reasons do we have for thinking that the difference between *being a boson* and *being either a boson or a fermion* is objective in the sense that one describes reality's structure and the other one doesn't? The difficulty, then, is to pick out the genuinely fundamental features of reality, those that are genuinely part of the world's structure. There is a natural analogy here with grounding, since it is commonly thought that the disjuncts f and g are more fundamental than the disjunction (f ∨ g); in other words, disjunctions are grounded in their disjuncts. But what is the role of disjunction in this? Is it also part of what grounds the disjunction or not? We will return to this issue below in section 5, but let us first examine the underlying idea of a hierarchical structure of reality in more detail.

## 3. Hierarchically Structured Levels of Reality

The idea that reality is *layered* or has a hierarchical structure of *levels* predates the contemporary grounding literature. It was, until quite recently, common to conceive of this structure in terms of *supervenience* (see, e.g., Schaffer 2003, 2004), whereby psychological properties supervene on biological properties, which in turn supervene on chemical properties, and ultimately everything supervenes on physical properties.[6] The ultimate basis of all reality – *a supervenience base* – are the physical properties. The notion of a fundamental supervenience base was popularized by David Lewis (1986), but the idea of a hierarchical structure of levels is familiar already from the old ideal of a *Unity of Science* (Oppenheim and Putnam 1958).

In their famous paper, Oppenheim and Putnam suggested that by properly employing the notion of reduction, we can reach a *Unity of Science*. This was thought to be an empirical hypothesis, aiming for a full ontological reduction of all the laws of the special sciences into the most elementary elements. However, this ideal turned out to be too strong. It aimed for a transitive, irreflexive, and asymmetric *micro-reduction* from the higher levels to the lower levels, producing a system of reductive levels, which is finite and has a unique lowest level, a common denominator for each level.

More recent work on levels tends to eschew strong versions of reductionism, at least in the more extreme form that Oppenheim and Putnam recommended. But this means that the question about the relationship between the different levels as well as the status of the properties on those levels becomes acute. In particular, and related to the question that emerged in the previous section, do we draw the joint-carving properties from all the levels or just from the fundamental level? Jonathan Schaffer (2004: 92) distinguishes two ways to go here, the

*scientific* conception and the *fundamental* conception, where the first draws the properties from all 'scientific' levels and the second only from the fundamental level. On the latter view, *being a fermion* would likely qualify as a joint-carving property, but *being a proton* might not (since it supervenes on its composite parts).

Schaffer argues that we should draw the joint-carving properties from all scientific levels. He gives two primary reasons. First, the competing, fundamental conception would face insurmountable problems if it turned out that there is *no* fundamental level. On the Lewisian view of *naturalness*, the important criteria involve the ability to provide a basis for objective similarities and causal powers, which ultimately form a fundamental supervenience base. This fundamental supervenience base – the famous Humean mosaic – provides a minimal, non-redundant ontological basis for everything else. Second, Schaffer argues that the scientific conception is a better fit with Lewis's (1986) original theory of *natural* or *sparse* (vs. *abundant*) properties. This is relevant because the idea of a fundamental supervenience base was originally formulated by Lewis in terms of natural properties. We will discuss this theory and its link to structure in the following section.[7]

One of Schaffer's worries with the fundamental conception of naturalness, reflected in the idea of a fundamental supervenience base, is that the minimal basis needs to be found at the fundamental level. But what if there could be an *infinite descent* of the supervenience structure? In that case, there could be no such minimal basis.[8] So, if it is possible that there is an infinite descent of properties in such a way that they are 'endlessly supervenient upon lower-level properties' (Schaffer 2004: 99), then we need to revise the Lewisian requirement of minimality accordingly.

The main upshot of this section is that there seems to be a tension of some sort between the Lewisian project of providing a minimal, fundamental supervenience base consisting of joint-

carving natural properties and the idea that the world is hierarchically structured. The details depend at least partly on how we conceive of the idea of joint-carving and whether we think that infinite descent is possible. One possible way forward here is to introduce *degrees of naturalness*, as Lewis (1986: 61) himself does. The thought is that properties could then be ordered according to their relative degree of naturalness, with *perfectly* natural properties at the fundamental end.

**4. Ground, Structure, and Naturalness**

We have now seen that there is a close connection between the well-known Lewisian notion of naturalness and the notion of structure, so it could be helpful to approach structure via naturalness.[9] Naturalness is often thought to come in degrees and *perfectly natural properties* would seem to be good candidates for fundamental, ungrounded entities. The previous examples of *being a boson* and *being a fermion* are likely candidates for perfectly natural properties. Alternatively, we could put this in terms of ungrounded *facts* as we did in the beginning of this Chapter: the fact that electrons have unit negative charge might be fundamental in this sense. I will remain neutral about the issue regarding whether ground relates facts or any entities whatsoever, but for laying out a connection between grounding and naturalness, the latter approach, as used by Schaffer (2009) is somewhat more promising. This is because if grounding relates only facts and if naturalness applies only to properties, then they would clearly come apart. Indeed, to draw this connection, we will likely have to adopt a liberal understanding of grounding, whereby it can relate any entities whatsoever, and also a liberal understanding of naturalness or structure, so that it can apply also to other entities besides properties.[10]

So, if structure is connected to naturalness and naturalness could be analysed in terms of grounding, then we would have a clear-cut connection between ground and structure. Sider's notion of structure is in fact 'a generalization and extension of Lewisian naturalness' (Sider 2011: vii). However, it should be noted that it is not Sider's intention to provide a definition of structure or naturalness in terms of grounding or fundamentality. Rather, for him, 'structure' is a primitive, theoretical term and its intended role is to capture the fundamental structure of reality.

There are some good reasons to think that structure/naturalness and ground must come apart even on a liberal conception of both notions, because the two notions may not be able to do all the same jobs (see Bennett 2017, Chs. 5.7, 5.8). There are two potential connecting principles to consider (cf. Bennett 2017: 127):

(1) All perfectly natural entities are ungrounded.

(2) All ungrounded entities are perfectly natural.

Our previous examples would seem to be compatible with (1). Fermions, such as electrons, are thought to have no internal structure, so the fact that electrons exist is a good candidate for being fundamental, ungrounded. What about things like a hydrogen atom? The fact that hydrogen atoms exist is presumably not fundamental, since hydrogen atoms are composed of electrons and protons, and protons as well have internal structure. But it is not entirely clear that *being a hydrogen atom* couldn't be understood as a perfectly natural property. Here we return to Schaffer's scientific conception of naturalness that we discussed in the previous section. Scientific properties like *being a hydrogen atom* or *being a proton* do appear to be objective in the required sense, but their ultimate status will depend on how we conceive of structure/naturalness. As we have already observed, on the traditional, Lewisian understanding of naturalness, *being a hydrogen atom* seems like a good candidate for a perfectly natural

property, as hydrogen atoms have distinctive causal powers and they may also feature in laws of nature. Yet, since naturalness comes in degrees and causal powers are features that help us distinguish natural properties from non-natural, abundant properties, it's not clear that *being a hydrogen atom* is indeed *perfectly* natural.

There are trickier cases though. Consider sets (as discussed by Bennett 2017: 128). For Lewis, sets can be perfectly natural; after all, according to Lewis's version of class nominalism, properties are just sets or classes (this is admittedly a rather controversial view). But are sets ungrounded? This doesn't seem to be the case, at least if we understand sets in terms of their members. The set that contains Socrates as its only member could not exist if Socrates did not exist, so a set is plausibly grounded in its members. The same will be true of all sets that have members: the members of the set are, in some sense, prior to the set itself. So, this might be one good reason to think that structure/naturalness and ground come apart, at least if one agrees with Lewis's conception of sets.

Regarding (2), one might point out (as Bennett 2017: 128 does) that the Lewisian notion of naturalness is clearly going to fail to respect the condition, insofar as entities other than properties, predicates, and sets can be ungrounded. For Lewis, the domain of naturalness only contains these types of entities, so entities such as electrons could not be natural (only properties such as *being an electron* are candidates).

However, this doesn't necessarily apply to Sider's notion of structure. Recall that Sider's notion of structure is a generalization of Lewisian naturalness, with the aim of capturing those *expressions* that carve at the joints (Sider 2011: vii). The question, then, is how we should understand this idea. Are the expressions themselves joint-carving or do they refer to something in reality – structure – that could contain things other than just properties, predicates, and sets? The answer may seem obvious: of course it's reality itself that we are interested in here rather

than just the expressions. But the issue may be more complicated than it first seems, as will become clear in the next section.

A related issue, as discussed in the previous section, is Schaffer's (2004: 100) proposal to replace the minimality qualification for naturalness with the primacy qualification, whereby we should only require that natural properties serve as the ontological basis for propositions. We must ask whether we wish to allow for redundant elements and infinite descent among the joint-carving structure of the world. To do so, we must be able to distinguish between *reality* and *representation*.

## 5. Reality and Representation

The question about the relationship between reality and expression or representation was a central topic in a book symposium on Sider's *Writing the Book of the World*. Kit Fine has made these two interpretations explicit. The issue can be illuminated via Fine's distinction between what he calls the *E-project* (for 'expression') and the *D-project* (for 'description'):

> The E-project is concerned with *saying* what can be said in the most fundamental terms, while the D-project is concerned with *describing* what can be described in the most fundamental terms. (Fine 2013: 730.)

The focus of the E-project is on sub-propositional constituents of propositions, whereas the D-project is concerned with propositions which we take to describe reality. Consider the disjunction (f ∨ g) of the facts f and g. Presumably, the *worldly constituents* of this fact will always be either f or g or both, but it will not involve the disjunction operator, ∨, itself. So, from the point of view of the D-project, the disjunction might very well be dispensable. We might compare this to a discussion familiar from the grounding literature, on so called 'worldly

facts'. This type of view is not uncommon among grounding theorists, here's Paul Audi's take on the view:

> [A] fact is something's or some things' having properties or standing in relations […] Facts are particulars, and are individuated by their worldly constituents (objects, properties, relations) and the manner of their combination. (Audi 2012, 686.)

The worldly constituents of (f ∨ g) could be things such as the object electron, the property of having a unit negative charge or relations like being more massive than or being two miles apart. But they do not obviously involve disjunction. Or do they? This is a question where the E-project and the D-project may get different results. Similarly, when the conjunction (f & g) is stripped down to its worldly constituents, we may just end up with the facts f and g, but not the conjunction operator, &. The underlying issue, once again, is how to interpret structure. It may be the case the disjunction operator is indispensable in the E-project, but does that make it part of reality's structure? As Fine himself puts it:

> The E-fundamentals are likely to include the logical constants, for how else is one to say something negative or disjunctive or existential? (Fine 2013: 730).

So, the question is whether the notion of structure is to be understood in terms of the E-project or the D-project, and Fine's main complaint is that it's not at all clear which project Sider is involved with. Fine even claims that Sider sometimes seems to take it for granted that logical constants such as ∨ or & are D-fundamental without giving any reasons to think that they are necessary in the relevant sense, i.e., for describing (rather than just expressing) the mind- and language-independent world (Fine 2013: 731).

Sider has provided a reply to Fine's concerns. Sider (2013: 739) explicitly states that his approach to fundamentality is sub-propositional (whereas Fine's is propositional). This would appear to put Sider's project within the remit of the E-project, but he doesn't seem to be entirely happy with this result. Regarding Fine's distinction between the E-project and the D-project, Sider acknowledges that it is illuminating, but considers one of his core assumptions to be the rejection of this distinction, or at least 'denying that it has the significance Fine thinks it has' (Sider 2013: 742). Sider attempts to put pressure on Fine's idea by insisting that, say, if disjunction is indeed E-fundamental, then 'a complete description of the world' must also include the true disjunctions.

To summarize, we are again faced with the same problem that we observed already in previous sections (compare with Schaffer 2004), namely, how do we decide what the minimal basis of reality is, what are the minimal elements required for 'a complete description of the world'? The debate between Sider and Fine, then, turns on how we should understand 'a complete description of the world'. Fine's idea seems to be that only the D-project is concerned with 'a complete description of the world'. It may be that there are things that we cannot express, say, without the use of disjunction, but this does not make disjunction D-fundamental.

Finally, we can introduce the question of *redundancy* at the fundamental level. Sider (2011: 259–260) discusses this condition. Relevant examples of redundant properties include relations and their converses, such as 'earlier' and 'later', as well as the fact that several subsets of the logical operators are functionally complete (e.g., conjunction and negation, or the Sheffer stroke). A potential motivation to avoid redundancy is the theoretical cost of redundant properties. However, Sider seems to think that redundancy may be acceptable at least in some cases. Explicit discussions of this issue in the literature are still scarce, but Michaela McSweeney (2019) puts forward a clear defence of non-redundancy. However, she weakens

the principle to what she calls *Weak Non-Redundancy*: 'There are no unexplained necessary connections between fundamental facts'.[11] So, one issue that may influence our interpretation of just what counts as 'a complete description of the world' is the question of which, if any, redundant elements we are prepared to accept.

Let us now move on to one final issue that may shed light on the relationship between ground and structure: the principle of purity.

## 6. Ground, Structure, and Purity

There is an important principle concerning structure, discussed in detail by Sider (2011: Ch. 7.2), that might give rise to reasons for distinguishing ground and structure:

PURITY: Fundamental facts involve only fundamental notions.

For Sider, 'fundamental' means 'joint-carving'. Sider thinks that on a Finean account of what is fundamental, we end up violating PURITY. That's because facts such as the following would seem to be perfectly acceptable for the Finean grounding theorist (where *C** is a predicate giving a complete microstructural account of the city of Hamburg, cf. Sider 2011: 108):

(C) The proposition that there is a *C** grounds the proposition that there is a city.

Since the notion of city is presumably not fundamental, PURITY dictates that (C) is not fundamental. The question here concerns whether something needs to ground things like (C) or whether they are themselves fundamental. There is a debate about this issue within the grounding literature. Since (C) is a further fact – part of reality – it must either be fundamental itself or something needs to ground it. If it is fundamental, it violates PURITY, so to maintain a connection between ground and structure, one should deny that (C) is fundamental. But what could possibly ground (C)? This is the problem of *Meta-Ground*, as discussed, e.g., by Shamik

Dasgupta (2014) and Jon Litland (2017, 2018).[12] Unless a satisfactory answer can be given, one must either abandon PURITY or admit that grounding and structure are competing notions, each with their own problems.

There is another related challenge, also put forward by Sider (2011: 145–7). This has to do with the idea of infinite descent, which we encountered above in section 3. This time, the question is whether there could be an infinite descent of grounds, such that the proposition $p_0$ is grounded in $p_1$, $p_1$ is grounded in and $p_2$, and so on, but with no proposition grounding the whole sequence.[13] It has been a relatively common idea in the grounding literature that such infinite chains of ground should be dismissed (see, e.g., Cameron 2008), even though this may no longer be the most popular view (consider Bliss 2013). Be that as it may, Sider (ibid.) argues that infinite descent of ground is commonplace, whereas we can satisfy the intuition that such descent should be denied if we adopt a *structure*-theoretic description of reality. One of his examples involves topological considerations:

> A friend of ground should describe a continuous curve as being continuous *because* its left and right halves are continuous (and continuously connected). Those halves are themselves continuous because their parts are continuous, and so on. […] [E]ven if space is atomic, provided it is not discrete there is no end to this descent of ground, because there are no "atoms of continuity"—there are no smallest continuous paths. (Sider 2011: 146.)

The thought here is that if we wish to take considerations like this seriously, they seem to require an unacceptable, infinite descent of grounds, whereas Sider thinks that a structure-theoretic account of such phenomena does *not* require this type of problematic infinite descent. This is because, for instance, topological facts may be represented quantificationally by using perfectly fundamental notions (ranging over an infinite collection of points).

It is, however, worth noting that the strength of these types of arguments involving infinite descent depends heavily on whether we consider infinite descent of grounds to be unacceptable in the first place – and even if we do this might not apply to *all* types of infinite descent. For one thing, if infinite *ascent* is not considered problematic, then it is clearly something about the *direction* of the chain that is problematic. Moreover, infinite chains that nevertheless *terminate* would not seem to be similarly problematic. There has been important progress on these questions in recent work on grounding and fundamentality (see, e.g., Dixon 2016, Rabin and Rabern 2016, and Tahko 2018).

## 7. Concluding Remarks

In conclusion, there are still several open questions about the connections between ground and structure, as well as the related issues of fundamentality, reality versus representation, infinite descent, and principles such as purity. Based on our survey, we can conclude that a straight-forward connection with the Lewis-inspired technical notion of structure as used by Sider faces some important challenges, although there clearly is a connection between ground and structure understood more loosely, in the sense of a hierarchical conception of reality.[14]

---

[1] This is known as a *strict partial order*, for discussion, see Naomi Thompson's entry in this volume.
[2] Sider also talks about the structure of 'the world', which we may take to be interchangeable with 'reality' in this context.
[3] See Ricki Bliss's and Scott Dixon's entries in this volume as well as Tahko 2018 for further discussion about fundamentality.
[4] I have put this in terms of 'facts' for convenience, but the idea of fundamentality itself does not imply a commitment to facts.
[5] See Fabrice Correia's entry in this volume for a discussion about the distinction between 'worldly' and 'representational' grounding. See also McSweeney 2019 for a discussion about logical constants and joint-carving.
[6] On the notion of supervenience, see David Mark Kovacs's entry in this volume. As outlined by Kovacs, supervenience may be understood as necessary co-variation: A-entities supervene on B-entities if and only if the A-entities cannot vary without some variation in the B-entities.
[7] Schaffer (2004: 92) pitches the distinction between sparse or natural and abundant properties as follows: 'The abundant properties provide the semantic values of meaningful predicates, while the sparse properties carve out the joints of nature on which the causal powers hinge.'

[8] The problem of infinite descent is further discussed in Ricki Bliss's and Scott Dixon's entries in this volume, as well as in Tahko 2014 and Raven 2016.
[9] As we saw in the previous section, the notion of *sparseness* is sometimes used synonymously with *naturalness*; see for instance Schaffer 2004.
[10] It should be noted though that there may be ways to find a connection also under a fact-based conception of ground, e.g., by taking the fundamental entities to be those that appear in some fundamental fact.
[11] For cases in favour of some forms of redundancy, see also Sider 1996, Eddon 2013, Raven 2016, and Wang 2016.
[12] See also Jon Litland's entry in this volume.
[13] Again, for further discussion on infinite descent, see Ricki Bliss's and Scott Dixon's entries in this volume, as well as Tahko 2014 and Raven 2016.
[14] Thanks to Kit Fine and Mike Raven for comments on earlier drafts of this entry.

**References**


Audi, P. 2012. ‘Grounding: Toward a Theory of the In-Virtue-Of Relation.’ *Journal of Philosophy* 109 (12): 685–711.

Bennett, K. 2017. *Making Things Up*. Oxford University Press.

Bliss, R. 2013. ‘Viciousness and the Structure of Reality.’ *Philosophical Studies* 166: 399–418.

Bliss, R. and Priest, G. 2018. *Reality and Its Structure: Essays in Fundamentality*. Oxford University Press.

Cameron, R. 2008. ‘Turtles All the Way Down: Regress, Priority and Fundamentality.’ *Philosophical Quarterly* 58: 1–14.

Correia, F. and Schnieder, B. 2012. *Metaphysical Grounding: Understanding the Structure of Reality*. Cambridge University Press.

Dasgupta, S. 2014. ‘The Possibility of Physicalism.’ *Journal of Philosophy* 111: 557–92.

Dixon, T.S. 2016. ‘What Is the Well-Foundedness of Grounding?’ *Mind* 125 (498): 439–468.

Eddon, M. 2013. ‘Fundamental Properties of Fundamental Properties.’ *Oxford Studies in Metaphysics* 8: 78–104.

Fine, K. 2013. ‘Fundamental Truth and Fundamental Terms.’ *Philosophy and Phenomenological Research* 87 (3): 725–732.

Lewis, D. 1986. *On the Plurality of Worlds*. Oxford: Basil Blackwell.

Litland, J.E. 2017. ‘Grounding Ground.’ *Oxford Studies in Metaphysics* 10: 279–316.

Litland, J.E. 2018. ‘Could the Grounds’s Grounding the Grounded Ground the Grounded?’ *Analysis* 78 (1): 56–65.

McSweeney, M.M. 2019. ‘Following Logical Realism Where It Leads.’ *Philosophical Studies* 176 (1): 117–139.

Oppenheim, P. and Putnam, P. 1958. ‘Unity of Science as a Working Hypothesis.’ *Minnesota Studies in the Philosophy of Science* 2: 3–36.

Rabin, G.O. and Rabern, B. 2016. ‘Well Founding Grounding Grounding’, *Journal of Philosophical Logic* 45 (4): 349–379.

Raven, M.J. 2016. ‘Fundamentality without Foundations.’ *Philosophy and Phenomenological Research* 93 (3): 607–626.

Schaffer, J. 2003. ‘Is There a Fundamental Level?’ *Noûs* 37: 498–517.

Schaffer, J. 2004. ‘Two Conceptions of Sparse Properties.’ *Pacific Philosophical Quarterly* 85: 92–102.

Schaffer, J. 2009. ‘On What Grounds What.’ In David Manley, David J. Chalmers & Ryan Wasserman (eds.), *Metametaphysics: New Essays on the Foundations of Ontology*. Oxford University Press, pp. 347–383.

Sider, T. 1996. ‘Intrinsic Properties.’ *Philosophical Studies* 83 (1): 1–27.

Sider, T. 2011. *Writing the Book of The World*. Oxford University Press.

Sider, T. 2013. ‘Replies to Dorr, Fine, and Hirsch.’ *Philosophy and Phenomenological Research* 87 (3): 733–754.

Tahko, T.E. 2014. ‘Boring Infinite Descent.’ *Metaphilosophy* 45 (2): 257–269.

Tahko, T.E. 2015. *An Introduction to Metametaphysics*. Cambridge University Press.

Tahko, T.E. 2018. ‘Fundamentality.’ In Edward N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy* (Fall 2018 Edition), URL = <https://plato.stanford.edu/archives/fall2018/entries/fundamentality/>.

Wang, J. 2016. ‘Fundamentality and Modal Freedom.’ *Philosophical Perspectives* 30 (1): 397–418.