# Circular Paths and Infinite Descent
## A Guide

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The contributions to this special issue offer different perspectives on the question whether reality has foundation—whether metaphysical foundationalism is true. The purpose of this introduction is to provide some background. It starts by discussing how metaphysical foundationalism might be characterised—specifically, whether it is committed to the asymmetry, transitivity, or well-foundedness of reality-structuring relations such as parthood, causation, or ground. It then summarises how the articles in the special issue relate anti-foundationalism to the following topics: the history of analytic philosophy, modal epistemology, the relationship between ground and explanation, and between grounds and metagrounds.

## 1 Introduction to the Introduction

In contemporary metaphysics, it is widely though not uniformly taken for granted that reality has foundations—that there is a fundamental level that gives rise to everything else. A comprehensive world-view is then articulated by telling a story about what the fundamental level is like. A physicalist, for example, may describe the fundamental level as consisting of particles with no further parts, or perhaps of fields. But does such a foundationalist thesis withstand scrutiny? If not, what philosophical lessons could be drawn from the failure of foundationalism? What anti-foundationalist alternatives are there for thinking about the world? These are among the questions that this special issue aims to shed new light on. The papers herein deal, among other things, with the history of anti-foundationalist thinking, the epistemology of possible infinite regresses, the connection between ground and explanation, and potential infinite regresses arising from grounding relationships themselves being grounded.

The more specific aim of this introduction is to provide some background to foundationalism and anti-foundationalism, and to situate the various contributions in the recent literature. We shall be selective in doing so. The above questions have rich and pervasive connections to issues across metaphysics and beyond, and an exhaustive catalogue is beyond the scope of this introduction.

It is customary to understand the foundationalist thesis as concerned with formal features of certain relations. The relations in question are those that impose a hierarchy on their domain, which may contain facts, objects, or events. We shall use "reality-structuring relations" as an umbrella term, with proper parthood, ground, and causation among potential candidates.[1] For each of these relations, and each structural feature, there is an interesting debate about whether the relation has that feature. We shall not engage in such debates but merely survey theoretical options.[2]

After this introduction to the introduction, I shall suggest in section 2 that foundationalism characteristically takes reality-structuring relations to be transitive and irreflexive, and also to satisfy a condition we call "ancestry well-foundedness." In sections 3–4, we discuss anti-foundationalist views that reject respectively one of those three features. We then turn from a sketch of some formal background to introducing the specific themes developed by the contributions to this special issue: Janssen-Lauret's account of Stebbing's antifoundationalist views (section 5); O'Conaill and Pearson's epistemological question to anti-foundationalism (section 6); Billon's and Simsek's explorations of the connection between ground, explanation, and foundationalism (section 7); and Kappes' question whether metaground leads to infinite descent (section 8).

## 2  Reality-Structuring Relations

We shall not try to give a full account of what it takes for a relation to count as reality-structuring. We do, however, take it to be connected to notions of priority and explanation. If $R$ is a reality-structuring relation that relates $x$ and $y$, then $x$ is in some sense metaphysically prior to $y$, or metaphysically

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1  Some authors deny that there is a relation of grounding (Correia 2010) or of causation, preferring to express the relevant claims using sentential operators. With suitable higher-order expressive resources, we could recast our discussion in their favoured key.

2  See Dixon (2020) and Bliss and Priest (2018) for taxonomies of pertinent arguments.

explains *y*.[3] They also need to be fairly natural, as opposed to disjunctive or gerrymandered ones (Lewis 1983; Sider 2011)—a point to which we shall return.

Given a reality-structuring relation *R*, we can discuss whether foundationalism is true about *R*. Of course, it might turn out that foundationalism is true about one such relation but not another. Perhaps every object is composed of mereologically atomic parts, while every fact has further grounds.[4] We shall not discuss specific reality-structuring relations here; rather, we are asking what formal features of reality-structuring relations may be taken to capture the foundationalist thesis. Our discussion draws on previous attempts at mapping out this region of conceptual space, including Dixon (2016, 2020, 2023), Rabin and Rabern (2016), and Bliss and Priest (2018). Many of the observations that follow can be found in those authors, though sometimes couched in a different terminology.

The following three formal features are familiar and commonly assumed to hold of proper parthood, partial grounding, and causation:

IRREFLEXIVITY. Not $xRx$.

ASYMMETRY. If $xRy$, then not $yRx$.

TRANSITIVITY. If $xRy$ and $yRz$, then $xRz$.[5]

If a relation has all these features, it is a *strict partial order*. As a characterisation of strict partial orders, the list contains some redundancy: asymmetry entails irreflexivity, and irreflexivity and transitivity jointly entail asymmetry. However, we will later explore views that accept some but not all of these theses.

It is also widely held that suitable generalisations of these features hold for mereological composition, full grounding, and joint causation. These relations are not naturally regimented in the form $xRy$ but rather as $xxRy$, with $xx$ a plural variable. The relation *R* is then collective rather than distributive on

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3 It is tempting to add that $x$ will be more fundamental than $y$. However, it is not clear that this would fit every candidate we shall consider, such as causation. On such issues, see the discussion in Bennett (2017), where a class of "building relations" is characterised.

4 See Raven (2016) for relevant discussion. For the question of how we might read off an overall structure of the world from a multiplicity of reality-structuring relations, see Bennett (2017).

5 The theses are taken to be tacitly universally quantified.

the left (that $p$ and $q$ fully ground $r$ does not imply that $p$ fully grounds $r$).[6]
Apart from a few passing comments, we shall stick to the special case of the
non-collective relations, leaving it open what a generalisation might look like.

It is customary to divide anti-foundationalist views about a relation $R$ into
coherentist ones that allow loops, or cycles, and infinitist ones that allow
infinite descent or abysses.[7] Strict partial orders do not allow any loops and
are thus incompatible with coherentism. For *reductio*, suppose that there is a
chain $x_1Rx_2, \ldots, x_{n-1}Rx_n, x_nRx_1$. Then by transitivity, $x_1Rx_1$, in violation of
irreflexivity.

However, strict partial orders allow for infinite descent. A foundationalist
view that wishes to rule out that possibility will need a further principle. A
natural choice is the thesis that $R$ is *well-founded*. The set-theoretic notion of
wellfoundedness will need some introduction, though readers familiar with
it can skip ahead until the first candidate explication of foundationalism is
introduced.

> WELL-FOUNDEDNESS. Every non-empty set $S$ has a member that is
> $R$-minimal in $S$.

An element $x$ of $S$ is said to be *R-minimal* in $S$ just in case there is no $y$ in $S$
such that $yRx$.

WELL-FOUNDEDNESS entails asymmetry (and hence irreflexivity). For sup-
pose that $R$ is not asymmetric. Then there are $x$ and $y$ such that $xRy$ and $yRx$.
Then $\{x, y\}$ is a non-empty set without an $R$-minimal member.

For a paradigm of a well-founded strict partial order, consider the relation
$R_n$ that holds between $x$ and $y$ just in case they are both natural numbers, and
$x$ is smaller than $y$. Pick any non-empty set $S$. If the set contains any $x$ that is
not a natural number, then there is no $y$ such that $yR_nx$. Hence $x$ is minimal
in $S$. If $S$ is a set of natural numbers, then it clearly contains a smallest natural
number $x$. Then $x$ will be an $R_n$-minimal element. So every non-empty $S$ has
a member that is $R$-minimal in $S$.

For a paradigm of strict partial order that is not well-founded, consider the
relation $R_i$ that holds between $x$ and $y$ just in case they are both integers, and
$x$ is smaller than $y$. For every integer $x$, there is an integer $y$ such that $yR_ix$.

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6   For reasons to prefer the term "left-collective" to the perhaps more familiar "many-one" in this
    context, see Litland (2018).
7   The terminology of an "abyss" is due to Loss (2016).

Hence the set of all integers is a non-empty set without an element that is $R_i$-minimal in it.

The relation $R_i$ has an infinite domain—there are infinitely many $x$ such that for some $y$, either $xRy$ or $yRx$. Any example of a strict partial order that is not well-founded must share this feature. For suppose that $S$ is a non-empty set without an $R$-minimal member, with $x$ in $S$. Then for any $n$, there is a chain $x_nRx_{n-1}, \ldots, x_2Rx_1, x_1Rx$. Since $R$ is transitive and irreflexive, all elements of this chain must be distinct. For any natural number $n$, then, $S$ has more than $n$ members and thus needs to be infinite. On the other hand, the example of the natural numbers shows that having an infinite domain is only a sufficient and not a necessary condition for a relation being well-founded.

A first candidate explication of foundationalism about a reality-structuring relation $R$ takes it to be the thesis that $R$ is a well-founded partial order. We shall now discuss this candidate explication with regards to the relation of proper parthood and various hypotheses about the mereological structure of the world.

According to what we shall call a *finite particle theory*, there are finitely many particles in the universe, and everything is composed of them. The particles are mereologically atomic: they do not contain any proper parts. However, they are spatially extended. It follows from that theory that proper parthood has a finite domain.[8] So our finite particle theory entails that proper parthood is a well-founded partial order.

Now consider a *gunk theory*, according to which everything has proper parts. Matter is infinitely divisible. Let $x$ be any thing, and consider the set of its proper parts. Since everything has a proper part, that set has no minimal member with respect to proper parthood. So the gunk theory entails that proper parthood is not well-founded.

So far, so good for the provisional explication of foundationalism about $R$ as the thesis that $R$ is a well-founded strict partial order, or equivalently, a well-founded transitive relation. The finite particle theory should clearly count as foundationalist, and the gunk theory as anti-foundationalist, and the explication delivers those verdicts. However, while few have doubted that $R$'s being a well-founded strict partial order is sufficient for foundationalism about $R$, it has been argued that it is not necessary.

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8 If unrestricted mereological composition holds, and there are $n$ atomic particles, the domain of proper parthood will have size $2^n - 1$, which is of course finite if $n$ is.

Consider a *field theory*, which holds that everything is composed of extensionless points. (The familiar fields from physics—graviational, electromagnetic, etc.—are functions defined on such points.) These points do not have proper parts and are thus minimal with respect to proper parthood. But consider the set of objects of non-zero volume. That set is non-empty, and every such object has another one as a proper part. Hence the set has no minimal element with respect to proper parthood, such that proper parthood is not well-founded.

The first explication would thus classify the field theory as antifoundationalist. This may seem to be the wrong result: for all we have said, our field theory satisfies foundationalist strictures. It seems to capture the thought that everything is determined by the bottom level, consisting of mereological atoms.

For another illustration, consider an *infinite particle theory*. According to that theory, there are infinitely many spatially extended mereological atoms, such that space itself is infinitely extended. Moreover, any plurality of them composes something. Now consider the set of things composed by infinitely many mereological atoms. That set is non-empty, and every member has another one as a proper part. For suppose that $x$ is composed from an infinite plurality of mereological atoms. Then the same plurality minus one is also infinite, and its members will compose a distinct thing $y$, which is a proper part of $x$. So the set has no minimal element, and proper parthood fails to be well-founded.

Again, this seems to be the wrong result. Like field theory, infinite particle theory seems intuitively foundationalist. According to both theories, there is infinite descent of proper parthood. But the infinite descent is *bounded below*, in the apt terminology of Rabin and Rabern (2016).

So we may wish to replace well-foundedness with a weaker condition in the explication of foundationalism. (Philosophers who think that 'foundationalism' is merely a term of art, with a definition to be stipulated rather than discovered, may still find it worthwhile to distinguish stronger and weaker conditions on a reality-structuring relation.) A schematic version of a candidate mereological axiom (Simons 1987, 42; Varzi 2016) is a natural choice:

ATOMICITY. $x$ is $R$-minimal, or there is an $R$-minimal $y$ such that $yRx$.

Here, $R$-minimality is understood absolutely rather than relative to a given set, as in WELL-FOUNDEDNESS above: $x$ is $R$-minimal if there is no $y$ such that $yRx$.[9] If we call an $R$-minimal element an *atom*, ATOMICITY is equivalent to the claim that for every non-atom $x$, there is an atom $y$ that stands in $R$ to $x$.

ATOMICITY is entailed by WELL-FOUNDEDNESS.[10] As desired, the converse does not hold, such that ATOMICITY is strictly weaker. ATOMICITY is of course compatible with the finite particle theory. Unlike WELL-FOUNDEDNESS, it is compatible with the kind of infinite descent that is bounded from below, as exemplified by the field and infinite particle theories. In contrast, ATOMICITY does rule out the gunk theory, on which nothing is minimal with respect to proper parthood. An explication of foundationalism about $R$ by the conditions of IRREFLEXIVITY, TRANSITIVITY, and ATOMICITY thus seems to give the intuitively correct classification of each of our four theories.

ATOMICITY also fails to entail ASYMMETRY or IRREFLEXIVITY, again in contrast to WELL-FOUNDEDNESS. On its own, or supplemented with just transitivity, it is thus compatible with a different kind of scenario we have not yet considered: $R$-loops that are bounded below, i.e., do not involve things at the bottom of the hierarchy. It is doubtful whether loops of proper parthood that are bounded below are conceptually possible (Kearns 2011). Some theorists of causation, in contrast, have thought that local loops that can be causally accounted for by something outside the loop are less problematic than those that cannot (Lewis 1976, 74).

In the presence of TRANSITIVITY, we can replace ATOMICITY by a weaker condition in this explication, using a new technical term about to be introduced. Doing so will help us generate a more fine-grained taxonomy of anti-foundationalist options later. It will also further illuminate the relationship between WELL-FOUNDEDNESS and ATOMICITY.

For a given object $x$, let the *$R$-ancestry* of $x$ be the set of all $y$ such that $yRx$. So if $R$ is proper parthood, the $R$-ancestry of $x$ consists of the proper parts of $x$; if $R$ is partial grounding, the $R$-ancestry of $x$ consists of the partial

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9 ATOMICITY is the restriction to singular argument places on the left of a condition that has been proposed by Dixon (2016) and Rabin and Rabern (2016) to explicate foundationalism about the left-collective relation of full grounding.

10 Suppose that atomicity fails for $R$. Then there is an $x$ that is not $R$-minimal, and such that there is no $R$-minimal $y$ such that $yRx$. Pick such an $x$ and let $S$ be the set of $y$ such that $yRx$. Since $x$ is not $R$-minimal, $S$ is not empty, and since there is no $R$-minimal $y$ such that $yRx$, $S$ does not contain any $R$-minimal element. Hence $R$ is not well-founded.

grounds of $x$. A set $S$ is an $R$-ancestry just in case there is an $x$ such that $S$ is the $R$-ancestry of $x$. Then consider:

> ANCESTRY WELL-FOUNDEDNESS. Every non-empty $R$-ancestry set $S$ has a member that is $R$-minimal in $S$.

ANCESTRY WELL-FOUNDEDNESS has the same form as WELL-FOUNDEDNESS: it results from inserting "$R$-ancestry" before "set," which has the effect of restricting the domain of sets quantified over.[11]

While the field theory and the infinite particle theory are incompatible with proper parthood being well-founded, they are perfectly compatible with it being ancestry well-founded. On those theories, the ancestry of a thing, relative to proper parthood, is either empty (if the thing is an atom) or else it includes the atoms it is made up of. The sets that provided counterexamples to WELL-FOUNDEDNESS are not ancestry sets. One way to verify this is by observing that neither includes mereological atoms (points or particles, respectively), and that any ancestry will include mereological atoms if one of these theories is true.

To show that ANCESTRY WELL-FOUNDEDNESS is entailed by ATOMICITY, suppose that $S$ is a non-empty ancestry set. Then there is an $x$ such that $S$ is the ancestry of $x$. Since $S$ is non-empty, $x$ is not $R$-minimal. By ATOMICITY, there is an $R$-minimal $y$ such that $yRx$. Hence $y$ is in $S$, and since it is $R$-minimal, it is *a fortiori* $R$-minimal in $S$.

Conversely, we can show that together with TRANSITIVITY, ANCESTRY WELL-FOUNDEDNESS entails ATOMICITY, ensuring that the result of replacing ATOMICITY with ANCESTRY WELL-FOUNDEDNESS in the above explication of foundationalism is equivalent to the original. Suppose that ATOMICITY fails for $R$. Then there is an $x$ that is not minimal, and such that there is no $R$-minimal $y$ such that $yRx$. Consider the ancestry set $S$ of $x$. Since $x$ is not minimal, $S$ is non-empty. Consider any $y$ in $S$. Since $y$ is not $R$-minimal, there is a $z$ such that $zRy$. Hence $zRy$ and $yRx$, and by transitivity, $zRx$. So $z$ is in $S$ too, and it follows that $y$ is not $R$-minimal in $S$. Since $y$ was chosen

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11 In a generalisation of the concept that can apply to left-collective relations, an $R$-ancestry can be taken to be a set of pluralities. The key task would be to define a relation $R'$ among pluralities with reference to which minimality is defined. If $R$ is full grounding, $R'$ might hold between $X$ and $Y$ iff $X$ is a weak distributive ground of $Y$, but not vice versa. (See Fine 2012, 54 for the relevant notion of distributive ground.)

arbitrarily, it follows that $S$ is a non-empty ancestry set without a member that is $R$-minimal in $S$.

So on our second attempt, foundationalism about $R$ may be explicated as the conjunction of three claims:

- $R$ is irreflexive.
- $R$ is transitive.
- $R$ is ancestry well-founded.

(To recap: asymmetry is omitted because it is entailed by irreflexivity and transitivity; atomicity because it is entailed by ancestry well-foundedness and transitivity; and well-foundedness because it is arguably not required by foundationalism.)

In the following, we aim to highlight a number of ways in which foundationalism thus understood might fail to be true of a reality-structuring relation. We will discuss a strategy to deflate certain debates concerning formal features by taking them to be essentially verbal.

In so far as the project of explicating (rather than stipulatively defining) a technical term like "foundationalism" makes sense, one may take this proposal to do a reasonably good job. It reflects a typical conception of foundationalism that informs contemporary metaphysical work. As we will see, however, there are reasons to hold that it exaggerates the foundationalist's commitment.

When looking at varieties of metaphysical anti-foundationalism, a natural way to classify them is according to which conjunct they reject. In the following, the focus will be mostly on moderate versions of anti-foundationalism that leave much of the structure intact.

## 3 Rejecting Transitivity

Foundationalism about a relation $R$, as we have characterised it, holds that $R$ is transitive, irreflexive, and ancestry well-founded. We might think rejecting the transitivity of reality-structuring relations is a promising way to articulate an anti-foundationalist metaphysics. There are, after all, *prima facie* cases of transitivity failure for certain reality-structuring relations. Several such counterexamples have been proposed for causation (Hall 2000) and for partial grounding (Schaffer 2012). Other putative reality-structuring relations are non-transitive by design. There is increasing recognition of the theoretical need for a non-transitive notion of *immediate* ground (Fine 2012; deRosset 2017;

Werner 2021; Correia 2021). In her list of building relations, Karen Bennett
(2017) includes a number of non-transitive ones, notably set formation: *x*
forms the set {*x*}—it is its sole member—and {*x*} forms the set {{*x*}}, but *x* does
not form the set {{*x*}}, not being a member of it. Accordingly, Bennett rejects
the requirement that building relations need to be transitive, in contrast to
the conditions of asymmetry and irreflexivity, which she is happy to impose.

Yet debates about foundationalism are not usually seen to hinge on the
status of Transitivity. What we take to be a typical attitude is expressed by
Gideon Rosen in his seminal paper on grounding:

> The grounding relation is not obviously transitive, but I shall
> assume transitivity in a strong form. [...] If the most fundamen-
> tal relation in the vicinity is not transitive, then [the symbol for
> grounding] picks out its transitive closure.

Whenever we are talking about a binary relation *R*, that relation will have
a transitive closure $R^*$—the smallest transitive relation that is implied by
*R*—and we are at liberty to announce that we are talking about $R^*$. (If *R* is
already transitive, $R^*$ will simply be *R* itself.)

One way of developing the thought here—perhaps going beyond what
Rosen intended—is to take Transitivity as partly helping us latch onto one
referent of "is a ground of" from a pool of potential ones. Other things said by
way of explicating the new predicate underdetermine its referent on that con-
ception. Perhaps one candidate is significantly more natural than the others
and is thus the referent. But if so, such naturalness comparisons are hardly
transparent to us. The satisfaction of Transitivity is then partly definitive
of the relation theorised about. But if so, then it cannot be a substantive claim
about a relation reference to which had been independently secured. It might
seem to follow that any dispute about the transitivity of grounding is merely
verbal.

On that picture, it is possible to proceed as Rosen does and make ground
transitive by stipulation. We may wonder, though, whether it is advisable.
Given that the predicate introduced is to pick out a reality-structuring relation,
would we not wish it to be the most natural one in the neighbourhood? We take
that to be an interesting question, but we shall not press it. Perhaps usefulness
in metaphysical theorising does not reliably correlate with naturalness. In
the realm of genealogy, there is some plausibility to the thought that the
parenthood relation is more natural but less theoretically useful than the
ancestry relation, which is its transitive closure.

However, there is reason to doubt that questions about the transitivity of reality-structuring relations are typically verbal. Consider David Lewis' first and most influential theory of causation, articulated in Lewis (1973). He first defined a relation of causal dependence between events and then claimed that causation is its transitive closure. Arguably, that move was not prompted by a need to resolve a problem of underdetermination in the expression "causally depends on": that expression had been defined, not just elucidated.[12] Rather, the move is recommended by the pre-theoretical plausibility of the claim that causation is transitive and since it enables Lewis' theory to match the intuitive verdicts in so-called "early preemption" cases. The claim looks as substantial as any in metaphysics, and disagreement about it has not been suspected of being verbal. When the theory was confronted with cases where causation is intuitively not transitive, nobody responded by saying that Lewis' theory is by definition about the transitive closure of the most natural relation in the vicinity. Moreover, whether something is a cause can sometimes make a practical difference that is not merely verbal. Assuming that I am only liable to pay compensation for damage I have caused, whether I am liable may in certain situations turn on whether causation is transitive or not.

The view that ground is transitive by stipulation does not make good sense of how debates about ground are conducted. Rosen's paper itself is a case in point. Before discussing transitivity, he tries to convince us that ground is irreflexive.

> The case for strong irreflexivity is clear enough. Just as no fact can make itself obtain, no fact can play a role along with other facts in making itself obtain.

However, it might happen that the most natural relation in the vicinity is irreflexive, but its transitive closure is not. So if grounding was by stipulation transitive, we would expect to be alerted to that, but we are not.

Lewis' theory of causation is an example of a conflict between irreflexivity and transitivity. By definition, causal dependence relates distinct events only and is thus irreflexive. As Lewis (1986b) notes, though, his theory allows for self-causation. They arise if there are loops of causal dependence, perhaps due to time travel.

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12 Maybe there is some underdetermination due to context, but that is presumably an orthogonal issue.

The more general point is that what may look like a stipulation—such as saying that relation $R$ is transitive—can turn out to have substantive implications, specifically for other formal features such as irreflexivity. For that reason, such formal features are best discussed in their interaction rather than one by one.

The question whether a certain reality-structuring relation is transitive is a substantive one and not a verbal one due to one party talking about one relation and the other about its transitive closure. Nonetheless, concerning the specific question whether foundationalism is true about $R$, it may well be that the transitive closure $R^*$ of $R$ is all we need to consider. The question whether foundationalism is true of a non-transitive relation such as immediate ground, say, is naturally understood as the question whether its transitive closure satisfies certain conditions.[13] So there is a case to modify the explication again. On the third attempt, foundationalism about $R$ is explicated as the conjunction of the following two claims:

- $R^*$ is irreflexive.
- $R^*$ is ancestry well-foundedness.

Clearly, any $R$ satisfying the previous explication also satisfies this one: if $R$ is transitive, then $R = R^*$, and so the irreflexivity of and ancestry well-foundedness of $R^*$ follows from that of $R$.

The converse does not hold, of course, since $R$ may be non-transitive even if $R^*$ is irreflexive and ancestry well-founded. So the third explication is strictly weaker than the second.

While it may matter greatly whether a given relation is transitive, the truth of foundationalism about $R$ does not hinge on it, if this third explication is right. It appears that if foundationalism is our concern, transitivity is not where the action is, after all.

## 4 Rejecting Irreflexivity or Ancestry Well-Foundedness

We have noted that the question whether a certain reality-structuring relation is transitive has occasionally been taken to be verbal. The same applies to the question whether such a relation is irreflexive or not. If one philosopher insists that parthood is irreflexive, and another that it is reflexive, it is tempting to conclude that their disagreement is verbal—one using the term

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13  Dixon (2023) effectively makes that move.

"part" for what mereologists call "proper part." However, the possibility of verbal disagreement about an issue has no tendency to show that non-verbal disagreement is not also possible.

Again, like in the case of transitivity, we may think that we impose irreflexivity by *fiat*: stipulate that if $R$ is not itself irreflexive, one is referring to its *irreflexive restriction $R^-$*, which relates $x$ and $y$ iff $xRy$ and $x \neq y$.[14] But we have already seen that we cannot simultaneously ensure transitivity and irreflexivity by *fiat*: by taking the transitive closure of causal dependence, Lewis lost the irreflexivity of causation. Conversely, the irreflexive restriction of a transitive relation need not be transitive.[15]

Does $R^*$ need to be irreflexive for foundationalism about $R$ to be true? Perhaps not. Recall that, as originally conceived, foundationalism rules out both loops and infinite descent. We then weakened the foundationalist ban on infinite descent to allow for descent that is bounded below. This was motivated by considering two toy physical theories, a field theory and an infinite particle theory. We may analogously weaken the ban on loops, allowing them as long as they are bounded below.[16] Since loops of parthood are hard to get one's head around, mereology cannot be expected to supply motivating examples this time. Perhaps there are loops of ground among semantic facts due to self-referential devices in the language, and yet all semantic facts are ultimately grounded in non-semantic facts. If so, loops or cycles arise at the higher levels of reality but not at the bottom level.

In light of the preceding discussion, we arrive at a fourth and even weaker explication of foundationalism about $R$: as the thesis that $R^*$ is ancestry well-founded.

If $R^*$ is not ancestry well-founded, then either there are circles at the bottom level of reality or there is unbounded infinite descent.[17] The first option

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14 Proper parthood is often defined as the irreflexive restriction of parthood. (Alternatively, and equivalently given other assumptions, it is defined as the *asymmetric restriction* of parthood, where the asymmetric restriction $R'$ of $R$ relates $x$ and $y$ iff $xRy$ and not $yRx$.)

15 The asymmetric restriction of the transitive closure of $R$ is guaranteed to be both transitive and asymmetric (and thus irreflexive). However, it may lack other crucial features, such as non-triviality: if everything forms part of an $R$-cycle, then $R^{*'}$ will be the empty relation on $R$'s domain.

16 Again, Dixon (2023) deserves credit for articulating this move.

17 We may note that while $R^*$ being ancestry well-founded is necessary for foundationalism about $R$, $R$ being ancestry well-founded is not. Consider a structure where $xRy$, $yRy$, and $yRz$ holds. Then the ancestry of $z$ is the unit set of $y$, which has no $R$-minimal element. However, $x$ is the only element at the bottom level, and intuitively, foundationalism is true about $R$.

has received quite a bit of attention recently (Barnes 2018; McKenzie 2011; Thompson 2016; Calosi and Morganti 2021). Some authors take it to be anti-foundationalist, while others have suggested that it may be compatible with foundationalism (Bennett 2017; Giannotti 2021; Dixon 2023). After all, it does seem to make sense to identify a "bottom level" of reality, consisting of those $x$ such that nothing stands in the *asymmetric restriction* of $R$ to $x$ (i.e., no $y$ is such that $yRx$ but not $xRy$). In our view, foundationalism ceases to be a distinctive theoretical option if this move is made. However, this is not the place to argue for this.

Recapitulating the four candidate explications of foundationalism about $R$ in reverse order: The final explication requires that $R^*$—the transitive closure of $R$—is ancestry well-founded. The penultimate one adds that $R^*$ is irreflexive, ruling out loops bounded below. The antepenultimate explication adds that $R$ is transitive. The most demanding one, which we considered first, adds that $R$ is well-founded. If we wished to allow loops bounded below but not infinite descent bounded below, we could require instead that $R^*$ is ancestry well-founded and that $R^{*-}$—the irreflexive restriction of the transitive closure of $R$—is well-founded.

The remainder of the introduction offers summaries of the contributions to this special issue.

## 5 Anti-foundationalism in the History of Analytic Philosophy

Metaphysical foundationalism seems to have been a commitment of the three men who are often considered the founding fathers of analytic philosophy: Moore, Russell, and Wittgenstein. In "Susan Stebbing on Well-Foundedness," Frederique Janssen-Lauret draws attention to anti-foundationalist elements in the thought of Susan Stebbing, another early analytic philosopher whose work has been neglected until recently. Against some other interpreters, Janssen-Lauret argues that Stebbing did not abandon her method of metaphysical analysis in her mature work. Rather, she gave up the assumption that if there is such a thing as metaphysical analysis, then it must terminate in simples. Whether it does or not is a broadly scientific question, not to be answered a priori. Janssen-Lauret then warns us against understanding Stebbing's metaphysical analysis through the lens of contemporary theoretical posits such as truthmaking or grounding.

## 6 Anti-foundationalism and Modal Epistemology

Many contemporary philosophers would agree with Stebbing that it is an a posteriori question whether foundationalism is actually true. Much of the debate concerns the metaphysical possibility that the structure of reality might exhibit infinite descent or circularity. We might then take a step back and ask: How can we come to know that a structure is metaphysically possible, other than by inference from its actuality? This question belongs to modal epistemology, or perhaps more accurately the epistemology of possibility. A natural story is broadly recombinatorial: we know that a unicorn is possible because it is possible that a horse and a horn are arranged in a contiguous manner, and the existence of a contiguous arrangement of a horse and a horn grounds the existence of a unicorn.[18] More generally: we establish the metaphysical possibility of non-fundamental *p* by establishing the metaphysical possibility of a ground of *p*. Given such a principle, belief in the possibility of infinite regress seems to face the regress of justification familiar from discussion of skepticism. In "Infinite Regresses, Ground Conditions & Metaphysical Satisfaction," Donnchadh O'Conaill and Olley Pearson articulate a principle along these lines, which they call the "Principle of Satisfaction." They use it to argue that we currently lack reasons to think that infinite descent is metaphysically possible.

## 7 Grounding, Explanation, and Foundationalism

The literature on grounding typically has accepted a rather tight connection between ground and explanation. It is customary to distinguish between "unionist" views that take grounding to be metaphysical explanation and "separatist" views that take grounding to *back* metaphysical explanation.[19] Analogous views have been distinguished in the older debate about causation and causal explanation. However, it may not be plausible that all reality-structuring are explanatory or back explanations. As we have seen, Bennett (2017) does not claim that all building relations are.

How does foundationalism bear on that question? One tempting thought is that it is really the connection to explanation that drives foundationalist intuitions about a certain relation. Explanations cannot go on forever,

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18 The second step is controversial (Kripke 1980), but the issues it raises are orthogonal to those of present concern.
19 The labels are introduced in Raven (2015).

and there is no such thing as a circular explanation. This suggests that anti-foundationalists about a given reality-structuring relation need to convince us that widely held views of explanations are wrong, or else revise the connection between that relation and explanation. The relationship between reality-structuring relations and explanation is discussed by two papers in this volume.

In his recent book on infinitism, Ross Cameron (2022) pursues the second option: metaphysical determination relations—roughly what we have called "reality-structuring" relations—need not be explanatory. His argument turns on cases of infinite descent. "Determination Relations and Metaphysical Explanations" criticises Cameron's argument but nonetheless agrees with the conclusion. In the view of Maşuk Şimşek, it is loops, rather than infinite descent, that provide a strong case for divorcing metaphysical determination and explanation.

"A Recipe for Non-wellfounded but Complete Chains of Explanations (And Other Determination Relations)" casts doubt on the widely held view that foundationalism gives us superior explanations to anti-foundationalism. Alexandre Billon works with a conception of ground where grounds do not explain what they ground all by themselves, but in conjunction with certain laws of metaphysics (Schaffer 2017). Given such a conception, it is natural to ask what is explained by the fact that something is grounded according to a law?

Suppose that it is a law that only people without any non-inherited money can inherit, and that if someone inherits, they have one pound less than their testator, or zero, whichever is greater. Can you infer how much money you have from the assumption that you are at the end of the chain of $n$ inheritances, for finite $n$? No. For any $m$, your information is compatible with you having $m$ pound, since the starting capital may have been $m + n$. However, from the assumption that your money has been passed down to you through an infinite chain of inheritance, you can infer that you have zero pounds. Given a suitable connection between the ability to infer and explanation, it follows that the existence of an infinite chain is explanatory in a way that the existence of a finite chain is not. So there is a sense in which infinite chains make for superior explanations.

## 8 Metaground and Infinite Descent

Finally, "Grounding Ground and the (In-)Escapable Ill-Foundedness of the Inclusive 'Explains'" discusses whether there might be an infinitely descending chain of *metagrounds*: grounds of facts that themselves involve ground. The paper makes a number of moves in a short space, so it may not be remiss for my summary of it to be a bit more expansive than that of the other papers. I shall introduce the issue in a simplified form, abstracting away from some subtleties Yannic Kappes considers.

Where $f$ and $g$ are facts, let the fact that $g$ is a partial ground of $f$ be a *link* for $f$.[20] A sequence of facts is a *link sequence* just in case each successor in the sequence is a link for its predecessor.

It has been widely accepted that links are not fundamental. So they are grounded ($\prec$ expresses partial ground):

LINK-GROUNDED. Any link is grounded.
$$g \prec f \rightarrow \exists h(h \prec (g \prec f))$$

Suppose that $f_2$ is a ground of $f_1$. Then given LINK-GROUNDED, there are facts that form an infinite linking sequence with $f_1$ as the first element:

$$f_1, f_2 \prec f_1, f_3 \prec (f_2 \prec f_1), f_4 \prec (f_3 \prec (f_2 \prec f_1)), \dots$$

If we define $F_1$ as $f_1$ and $F_{i+1}$ as $f_{i+1} \prec F_i$ for $i > 1$, this sequence can be rewritten as:

$$F_1, F_2, F_3, \dots$$

LINK-GROUNDED thus entails that if there is an instance of ground at all, there is an infinite linking sequence.

Let a *ground sequence* be a sequence in which each member is grounded by the subsequent one. As a number of authors have pointed out in the literature, none of the generally accepted principles guarantee that the above link sequence is a ground sequence: $F_2 = f_2 \prec f_1$ may not ground $F_1 = f_1$, for example. However, there does seem to be a whiff of infinite descent about that sequence. It is natural to wonder whether its existence guarantees that

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20 We could call links "grounding facts." But that term is best avoided due to an ambiguity pointed out by Katherine Hawley (2019): a grounding fact could be a fact is a ground of another fact (as $g$ is, given that $g$ grounds $f$) or a fact that has the relation of ground as a constituent, i.e., a link such as the fact that $g$ grounds $f$.

of a closely related infinite grounding sequence. As we are about to see, the following will do the job:

LINK-GROUND. Any link for $f$ is a ground of $f$.
$$g \prec f \rightarrow (g \prec f) \prec f$$

Consider the element $F_{i+1}$. It is of the form $f_{i+1} \prec F_i$, where $F_i$ is the predecessor of $F_{i+1}$ in the sequence. Then since $f_{i+1} \prec F_i$ is true, an instance of LINK-GROUND together with modus ponens yields:

$$(f_{i+1} \prec F_i) \prec F_i$$

Or, in rewritten form:

$$F_{i+1} \prec F_i$$

So LINK-GROUND guarantees that every linking sequence is a ground sequence. Together, LINK-GROUNDED and LINK-GROUND entail that grounding is either an empty relation—nothing grounds anything—or else there is an infinitely descending grounding sequence. Have we found a new example of an infinitely descending grounding sequence?

After criticising a pioneering recent discussion of these issues by Frugé (2023), Kappes resourcefully motivates LINK-GROUND—a principle which may not be *prima facie* compelling. This is one of the key contributions of his paper. The other key contribution is his argument that despite being well-motivated, LINK-GROUND ought to be rejected. (We slightly simplify the argument again.) Kappes makes a strong case for the plausibility of the following ($<$ is full ground):

FULL-LINK. If $f$ is partially grounded in $\Gamma$ being a partial ground of $f$, then $\Gamma$ is not a full ground of $f$.
$$(\Gamma \prec f) \prec f, \text{ then not } \Gamma < f.$$

The idea is that if links are grounds, then full grounds need to include these links. But FULL-LINK is not compatible with LINK-GROUND. Assume that LINK-GROUND holds also when the singular variable $g$ is replaced by a plural variable $\Gamma$, and assume further that ground is non-trivial in the sense that there are $\Gamma$ and $f$ such that $\Gamma < f$. Then, since full grounds are partial grounds, $\Gamma \prec f$. By the generalised form of LINK-GROUND, $(\Gamma \prec f) \prec f$. With FULL-LINK, it follows that not $\Gamma < f$, contradicting our assumption.

Full-Link raises interesting questions for further research. It is of the general form of an *exclusion principle* for ground, analogous to exclusion principles that have received a great deal of discussion in connection with mental causation. Such principles are of the form: if Γ is a ground of $f$, then nothing can be a ground of $f$ unless it is suitably related to Γ. Of course, the suitable relation needs to be spelled out. It is well known that since disjunctive facts may have independent full grounds, formulating tenable exclusion principles for ground is not straightforward.

The completion of this special issue marks the end of the Swiss National Science Foundation research project "Being without Foundations." One of the project aims had been to offer a taxonomy of different varieties of foundationalism and anti-foundationalism. The first part of this introduction has presented relevant building blocks. The summaries of the five articles in the second part of the introduction point towards a reason why an exhaustive taxonomy is not yet to be had at this stage of the debate. As we have seen, the relevant theoretical options depend on a range of background assumptions: about how metaphysical analysis is to be understood (Janssen-Lauret), how possibility facts are established (O'Conaill and Pearson), whether ground is linked to explanation (Şimşek), whether metaphysical laws are among grounds or separate from them (Billon), and whether grounds exclude each other (Kappes). The project question has turned out to be more open-ended than anticipated. If this special issue has pointed towards new ways of tackling it, it will have achieved its aim.*

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