Explaining Identity and Distinctness*

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Abstract

This paper offers a metaphysical explanation of the identity and distinctness of concrete objects. It is tempting to try to distinguish concrete objects on the basis of their possessing different qualitative features, where qualitative features are ones that do not involve identity. Yet, this criterion for object identity faces counterexamples: distinct objects can share all of their qualitative features. This paper suggests that in order to distinguish concrete objects we need to look not only at which properties and relations objects instantiate but also *how* they instantiate these properties and relations. I propose that objects are identical when they stand in certain qualitative relations in virtue of their existence. And concrete objects are distinct when they do not stand in the same kinds of relations to one another in virtue of their existence.

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1 Introduction

"The Rock of Gibraltar is identical to The Rock of Gibraltar" is an identity claim and "The Rock of Gibraltar is distinct from The Eiffel Tower" is a distinctness claim. While the truth of these kinds of identity and distinctness claims is uncontroversial, the following two problems impede our metaphysical accounts of identity and distinctness. I will call these "the identity problem" and "the distinctness problem."

The identity problem arises when we look to metaphysically explain identity facts involving concrete objects, facts like The Rock of Gibraltar = The Rock of Gibraltar, and The original McDonalds Big Mac = The original McDonalds Big Mac. At first glance, many such identity facts strike us as non-fundamental: they often involve non-fundamental objects like Big Macs and giant rocks, and it is doubtful that fundamental facts should involve non-fundamental objects. Furthermore, it is unclear what purpose identity facts involving physical objects would serve in our fundamental base. If we have a fundamental base consisting of the fundamental physical properties and relations holding between objects, do we need to include facts involving the identity of physical objects as well? Perhaps identity facts should come along "for free" once we specify the existence of fundamental objects and their fundamental physical properties.[1]

These two considerations should lead us to at least question the fundamentality of identity facts. If we wish to keep our fundamental base sparse, it is not clear we need identity facts in our base in the same way we may need facts involving fundamental physical objects, properties, and relations. Yet, while identity facts may strike us as metaphysically non-fundamental, we lack an explanation for why they obtain. But given that many contemporary metaphysicians take facts lacking explanations to be basic or fundamental, this pressures us to take identity facts to be fundamental—contrary to our initial assessment

[1] Employing a metaphor, Alexis Burgess (2012) puts the thought as follows: "Imagine God creating a field of poppies. Once the flowers exist, there's no need for Her to survey the field and stipulate that this poppy will be identical to itself, and distinct from that poppy, that poppy, etc. Intuitively, the identity...facts come along for free." (90) Although, Burgess himself raises problems for that idea, and we will discuss it further in section 7.

that identity facts are non-fundamental.[2]

The distinctness problem arises when we try to distinguish objects. Following Leibniz's Principle of the Identity of Indiscernibles, it is plausible to maintain that distinct objects are distinct in virtue of their possessing different properties. The Identity of Indiscernibles states that if objects share all of their properties then they are identical.[3] Yet, the Identity of Indiscernibles is notorious for the counterexamples it faces: there are metaphysically possible cases where distinct objects seem to share all their properties (all their properties not involving identity, anyway).[4] If we cannot distinguish objects by appealing to which properties they possess, then how can we account for the distinctness of objects?

The two problems are intimately related: Objects are taken to be numerically distinct when they are non-identical. So, if we could adequately account for object identity, we would likely be able to do so for distinctness as well. I maintain that we can solve the identity and distinctness problems by providing a metaphysical explanation of identity facts and distinctness facts. The structure of the paper is as follows: first, I specify what type of metaphysical explanation I have in mind. Next, I show how accounts that aim to identify objects merely on the basis of which properties they have and which relations they stand in are problematic. Instead, we should look not only at *which* properties and relations objects have but *how* they have them in order to identify and distinguish the objects in question. I then offer a metaphysical explanation that solves the identity and distinctness problems above.[5]

My proposal will attempt to explain the identity and distinctness of concrete objects by

[2]Some philosophers believe identity facts need no explanation.For example, see Lewis (1986, p.192-193), and also Williamson (1990, p.145), who maintains that for objects that are of a particular kind F, we should not try to explain why the Fs are self-identical. I will discuss this position further in section 2.2.

[3]Leibniz, *Discourse on Metaphysics*, Section 9. Although it is unclear whether Leibniz himself thought he was giving an *explanation* of object identity and distinctness as opposed to the necessary and sufficient conditions for object-identity.

[4]For discussion, see Ayer (1954), Black (1952), Cover and O'Leary-Hawthorne (1999), Hawley (2009), Hawthorne (2006), O'Leary-Hawthorne (1995), Saunders (2006a, 2006b), among others.

[5]In response to points raised by Della Rocca (2005), I aim to show that we can reject the Principle of the Identity of Indiscernibles, as commonly understood, and still provide an explanation of identity and distinctness that does not invoke non-qualitative properties and relations.

appealing to how such objects stand in quantitative relations to one another. Quantitative relations are ones like *more massive than*, *same electric charge as*, *five meters away from*, and so on. These are plausible candidates for fundamental relations, and facts involving microphysical objects instantiating such relations are good candidates for fundamental facts.[6] We typically appeal to facts involving microphysical objects instantiating quantitative features in order to to explain an array of non-fundamental facts, such as facts involving the weights of macrophysical objects like tables, the shapes of volleyballs, and so on. I will propose that in addition to being able to explain these kinds of non-fundamental facts, we can appeal to how microphysical objects stand in quantitative relations to explain identity and distinctness facts as well.

2 Preliminaries

2.1 What is a Metaphysical Explanation?

Metaphysical explanation is at work when we claim that some facts obtain in virtue of other facts. I will use *ground* to characterize metaphysical explanation, and my aim is to determine the grounds of identity and distinctness facts. For now, I take ground to be a relation of asymmetric dependence holding between facts or pluralities of facts, though we could rephrase the proposal in terms of sentential or object grounding.[7] For facts $[\phi]$ and $[\psi]$, if $[\phi]$ grounds $[\psi]$, $[\phi]$ metaphysically explains $[\psi]$. A fact $[\phi]$ is ungrounded if and only if it is metaphysically fundamental—there is nothing in virtue of which it obtains.[8] An object, property, or relation is fundamental if and only if it is featured in at least one fundamental fact. Where otherwise ambiguous, facts are offset with brackets [ ] while properties and relations are signaled in italics. Variables (written as x, y) range over concrete objects while constants (written as a, b...) pick out particular concrete objects.

[6] Quantitative relations will be further discussed in section 4.

[7] By taking ground as a relation holding among facts, I follow (Rosen 2010). For the sentential operator approach, see (Fine 2012), and see (Schaffer 2009) for the object approach.

[8] Fine (2001) is an exception: he draws a distinction between ungrounded facts and fundamental facts.

The metaphysically fundamental facts, objects, and properties/relations will plausibly include those captured by our ultimate physical theories. if our final physical theories make use of quantitative properties and relations, such as determinate mass relations, electric charge relations, spatiotemporal distance relations, and so on, then these will count as fundamental (there will be more discussion of quantitative properties and relations in section 4).[9] And if our ultimate physical account of the universe posits the distribution and features of photons, an example of a fundamental fact would be [photon a is massless] or [photon a has spin 1]. Although we do not know which objects and properties/relations our final physical theories will state, we take microphysical objects, physical quantitative features, and facts involving such objects and features as good working candidates for the metaphysically fundamental.

There are widely-accepted structural features of the grounding relation. First, grounding induces a strict partial order: it is taken to be a transitive, asymmetric, and (hence) irreflexive relation.[10] We can distinguish two kinds of ground: *full* and *partial* ground. $[\phi]$ fully grounds $[\psi]$ when $[\phi]$ is sufficient on its own to metaphysically explain $[\psi]$. $[\phi]$ partially grounds $[\psi]$ when $[\phi]$ either alone or together with other facts fully grounds $[\psi]$. The symbolization $[\psi] > [\phi]$ indicates that $[\phi]$ fully grounds $[\psi]$, and $[\psi] >_p [\phi]$ indicates that $[\phi]$ partially grounds $[\psi]$. In this sense, the plurality of facts $[Fx], [Px]$ fully grounds $[Fx \ \& \ Px]$. 'Grounds' indicates 'fully grounds' unless otherwise stated. I also take grounding to be factive in that if $[\phi]$ grounds $[\psi]$ then both $[\phi]$ and $[\psi]$ obtain. Conjunctive facts are fully grounded in both of their conjuncts taken together: The plurality of facts $[\phi]$, $[\psi]$ grounds $[\phi \ \& \ \psi]$. Disjunctive facts are fully grounded in each of their disjuncts individually. So $[\phi]$ fully grounds $[\phi \vee \psi]$ and $[\psi]$ fully grounds $[\phi \vee \psi]$. Existential generalizations are purportedly fully grounded in their instances; so $[Fa]$ grounds $[(\exists x)Fx]$, although we will

[9] See Lewis (1982) and Sider (2010) for accounts of fundamentality and naturalness which include these kinds of quantitative features.

[10] For detractors, see Jenkins (2011) and Schaffer (2012), who argue against the irreflexivity and transitivity of ground, respectively. In response, Raven 2013 defends taking ground as a strict partial order and Litland (2013) argues that Schaffer's counterexamples to the transitivity of ground are unsuccessful.

question this later. And universally generalized facts are grounded, at least partially, in their instances. $[Fa]$ partially grounds $[(\forall x)Fx]$. Although, this is controversial as well.[11]

A metaphysical explanation of identity facts and distinctness facts can solve the identity and distinctness problems above. Through grounding identity facts, we can show that identity facts are non-fundamental. And through grounding distinctness facts, we can see how the distinctness of objects is explained in terms of features not involving identity.[12]

2.2 Why think that Identity Facts are Non-fundamental?

At this point, you may wonder: Is the identity problem really such a problem–why not just treat identity facts as fundamental? Even if you concede that identity facts differ from other candidates for fundamental facts (like those involving the scientific properties found in our best physical theories), perhaps there is no *harm* in taking identity facts to be fundamental as well. If so, we do not need to seek out a metaphysical explanation for identity facts.[13]

David Lewis articulates a position in the vicinity. Lewis denies that there is anything that "makes it the case" that an object is identical to itself.[14] In Lewis's own words:

[11]The grounds for universal generalizations are difficult to fully account for, however, in that all of the instances together may not fully ground the generalization. We may need a totality fact, or a "that's all" fact in addition to the instances.

[12]There are different types of identity criteria we can formulate. We can also provide what Fine (2016) calls the "material" criterion for identity. These provide necessary and sufficient conditions for an object x to be identical to an object y. A grounding criterion for identity facts is stronger than a material one. Grounding criteria specify the facts *in virtue of* which identity facts obtain. The following proposals should be read as proposals for grounding criteria.

[13]Thanks to an anonymous reviewer for helpful feedback on these points.

[14]Lewis also believed that we can approach problems which traditionally concerned identity using other notions. For instance, we can frame questions of persistence without mention of identity (2001,188-189). Even if we agree with Lewis that identity is unproblematic (and we agree with Williamson that we do not need to explain certain identity facts), we may still wish to address questions raised in this paper. In particular, we may wonder whether the Max Black world contains two spheres or one bi-located sphere. If we think it contains two spheres, we may wish to investigate whether the two spheres differ in any qualitative respects. In section 3, I will maintain that while Castor and Pollux may have all the same physical properties (like mass, charge, shape etc.) and stand in the same physical relations to one another (same mass as, 5 meters apart from, etc.), they will differ in the ways in which they stand in those relations. One can conceive of this as a kind of qualitative difference between two spheres. Thus, this distinction between the different ways objects stand in relations to one another may still be of interest in describing what's going on in the

> "We should not suppose that we have here any problem about identity. We never have. Identity is utterly simple and unproblematic. Everything is identical to itself; nothing is ever identical to anything except itself. There is never any problem about what makes something identical to itself; nothing *can ever fail to be*. (Lewis 1986, 192-193) (emphasis mine)

Lewis's thought seems to be that if every object is *necessarily* self-identical then there is never an issue of what could make it the case that any specific object is self-identical. In the grounding context, denying that anything "makes it the case" that an object is identical to itself seems tantamount to taking identity facts to be ungrounded or fundamental.[15]

I believe we should resist taking identity facts to be fundamental. I deny that a tight connection obtains between fundamentality and an object's having a property/relation necessarily. Lewis maintains that objects cannot help but be identical to themselves. That is true. Objects are necessarily self-identical. But the fact that every object necessarily possesses a certain property or stands in a certain relation does not lend reason to take the fact that the object has that property/stands in that relation to be fundamental–at least not in a grounding context. Let me provide an unrelated example to show this: Every object necessarily has the disjunctive property of *being red or not red*. So, objects cannot help but have this disjunctive property. But the fact that an object has this disjunctive property is not fundamental. It is grounded in the object's having one of the disjunct properties. A Red Delicious apple has the disjunctive property in virtue of having the property of *being red*, for instance. Some facts involving necessarily-instantiated properties/relations are derivative upon facts involving more fundamental properties/relations. Thus, the fact

possibilities containing Max Black spheres, even if–like Lewis–one denies the core philosophical puzzles in question center around the notion of identity and distinctness. Thank you to an anonymous reviewer for helpful questions here.

[15]Saying that nothing makes it the case that an object stands in the identity relation to itself could also mean that identity facts are "zero-grounded" where zero-grounded truths or facts are not grounded by further truths or facts. Zero-grounded facts are not ungrounded. They have what Fine calls "the null ground". For more on zero-ground, see Fine (2012). For more on whether identity facts can be zero-grounded see Litland (2017), Donaldson (2016), Shumener (forthcoming).

that objects are necessarily self-identical should not lead us to believe that identity facts are fundamental.

I believe we also have a positive reason to take at least some identity and distinctness facts to be non-fundamental. In the previous section, we characterized an object as fundamental when it appears in at least one fundamental fact. If we take all identity facts to be fundamental, including ones like The Eiffel tower = The Eiffel tower, then every object will count as fundamental. This is because every object stands in the identity relation to itself; thus, every object is a constituent of an identity fact. This is problematic as we typically distinguish objects like protons and electrons from ones like appletinis and the Eiffel Tower on the basis of their relative fundamentality: the Eiffel Tower and appletinis should not belong in our stockpile of fundamental entities. This pressures us to take at least some identity and distinctness facts (the ones involving intuitively non-fundamental objects) to themselves be non-fundamental. If we are committed to taking at least some identity facts to be grounded, this provides *prima facie* motivation to seek out metaphysical explanations for identity facts in general.[16]

3 Unsuccessful Approaches to Object-Identity

The goals of this paper are relatively modest. I do not try to explain how objects persist over time or the identity and distinctness of abstracta.[17] Instead, the objective is only to provide a metaphysical explanation of identity and distinctness facts involving concrete objects *at a time*.[18]

It is tempting to appeal to the properties and relations concrete objects instantiate to

[16]For further discussion of how this characterization of fundamental objects should lead us to take identity facts to be non-fundamental, see Shumener [forthcoming)].

[17]See Donaldson (2016) for discussion of metaphysical explanations of abstracta.

[18]Providing the grounds for object identity and distinctness also does not address cognitive and epistemic issues concerning identity facts. For example, "Mark Twain = Samuel Clemens" is more cognitively significant than "Mark Twain = Mark Twain." For the purposes of this paper, we treat [Mark Twain = Mark Twain] as the same fact as [Mark Twain = Samuel Clemens].

provide the conditions for object-identity. In this section, I address property and relation-based approaches to object-identity and distinctness. The proponents of these views formulated them not in terms of ground but as necessary and/or sufficient conditions for object identity. Since the task is to find an adequate explanation for identity and distinctness, I depart from the original formulations and frame the views and criticisms of them in terms of ground. Nevertheless, the objections raised to the views can be (and some have been) raised to the original formulations of the views as well.

3.1 The Qualitative Properties Proposal

An appealingly straightforward approach distinguishes objects on the basis of which properties they have *full stop*. This view places no restrictions on the kinds of properties relevant for identifying and distinguishing objects. It takes an identity fact of the form $[x = y]$ to be grounded in the fact that x and y share all and only their properties, and distinctness facts of the form $[\neg\ x = y]$ to be grounded in x and y's possessing different properties.[19] This account creates problematic chains of ground because it allows us to use *identity-involving* properties to ground identity and distinctness facts. For instance, a fact like $[\neg\ a = b]$ will be grounded in the plurality of facts, $[Pa]$, $[\neg\ Pb]$. But if P is the property, *identical to a*, then this explanation is trivial. It just says that a is distinct from b because a has the property *identical to a* and b lacks the property *identical to a*. As one of Black's interlocutors in "The Identity of Indiscernibles" maintains, "this is a roundabout way of saying nothing." (1952, 11) The lesson we should draw here is that we need some restriction on the kinds of properties and relations involved in accounting for object identity and distinctness.

A more promising way to cash out the proposal that objects are distinct in virtue of which properties they have is to restrict the kind of properties involved to qualitative

[19] Stating the grounds of facts like $[x = y]$ and $[\neg\ x = y]$ is shorthand for speaking of the grounds of identity and distinctness facts involving particular objects (like $[a = b]$, $[c = c]$, $[\neg\ a = c]$, etc.). When I claim that a fact like $[x = y]$ is grounded in such-and-such way, what I mean is that the facts $[a = b]$, $[c = c]$...and so on, are grounded in that way.

ones.[20] It is hard to give a precise definition of "qualitative", but intuitively qualitative features are those that do not involve the identity relation or involve specific objects. So, for example, *5kg mass*, *adjacent to*, *same color as* are qualitative features, and *identical to a*, *Socratizing*, *distinct from* and *five meters from the Louvre* are non-qualitative features because they invoke the identity relation or the identities of particular objects. If we restrict the grounds to qualitative properties, we avoid triviality. We can now formulate this proposal:

Qualitative Properties Proposal: When x is identical to y, the fact that x and y are identical is grounded in the fact that x and y share all their qualitative features. And when x and y are distinct, the fact that x and y are distinct is grounded in x having some qualitative feature that y lacks.[21]

The fact that object(s) picked out by x and y share all their qualitative features grounds an identity fact of the form $[x = y]$, and if x and y pick out distinct objects, the distinctness fact is grounded in the fact that x has a qualitative feature that y lacks. This proposal is subject to the counterexamples that give rise to the distinctness problem. Qualitatively identical objects can be numerically distinct. Max Black (1952) popularized such a case; he imagines a possible world containing only two spatially separated spheres that have all the same physical characteristics: color, mass, size, density, and so on. The spheres are indistinguishable on the basis of these features. The Qualitative Properties Proposal cannot account for the distinctness of the spheres because there is no qualitative feature that one sphere has that the other lacks.

This proposal is formulated in terms of monadic properties, but we can extend the conditions to cover polyadic qualitative relations as well, and the criticism remains the same. In other words, there is no qualitative relation R such that sphere a stands in R and

[20] See Black (1952) and Della Rocca (2005) for discussion.

[21] We can rewrite the proposal more formally as follows: if x =y, x =y $>(\forall F_{qualitative})(Fx \equiv Fy)$. When $\neg$ x = y, $\neg$ x = y $>(\neg\ (\forall F_{qualitative})(Fx \equiv Fy)$.

sphere b does not stand in R. The spheres stand in all the same qualitative relations—they each stand in the *same mass as* relation, the *five meters from* relation, and so on. Thus, we cannot appeal to the spheres' standing in different relations to distinguish them.

There are ways to try to save the Qualitative Properties Proposal from Black-style counterexamples. One is to maintain that there is a single Max Black sphere that is located in two places, and a related way is to claim that there is a single object that has sphere-parts in two locations. We should consider adopting one of these views as a last resort.[22] The intuition we want to capture is that it is possible to have multiple qualitatively identical objects, and we should see if we can save this intuition before exploring alternatives.

3.2 The Weak Discernibility Proposal

Simon Saunders (2006a) attempts to provide identity conditions that can avoid the Max Black-style counterexamples above. He claims that objects are distinct when they stand in irreflexive relations to one another. This approach distinguishes the Max Black spheres because the spheres stand in irreflexive relations like *five meters away from* to one another. We can reformulate Saunders' view in terms of ground as follows:

> **Weak Discernibility Proposal:** When x is identical to y, the fact that x is identical to y is grounded in the fact that x and y only stand in reflexive relations to one another. And when x and y are distinct, the fact that x and y are distinct is grounded in the fact that x stands in an irreflexive relation to y.[23]

Here the fact that x is identical to y is grounded in the fact that there is no irreflexive relation that x and y stand in to one another. In other words, the identity fact is grounded in the fact that all qualitative relations x and y stand in to one another are reflexive. As Saunders maintains, distinct objects always stand in at least one irreflexive relation.

[22] See O'Leary Hawthorne (1995) and Hawley (2009) for versions of these approaches.

[23] We can rewrite the Weak Discernibility Proposal more formally: if x = y, x = y $>\neg$ ($\exists R_{qualitative}$) (Rxy & R is irreflexive). And if $\neg$ x = y, then $\neg$ x = y $>$($\exists R_{qualitative}$)(Rxy & R is irreflexive).

When objects x and y are distinct, the fact [¬ x = y] is grounded in the fact that there is a qualitative irreflexive relation x stands in to y. Following Quine (1976), Saunders calls this approach to accounting for distinctness "weak discernibility".

The Weak Discernibility approach faces two problems. First, French (2006) and Hawley (2009) argue that appealing to irreflexive relations in order to explain or ground the distinctness of entities is circular. French states:

> There is the worry that the appeal to irreflexive relations in order to ground the individuality of the objects which bear such relations involves a circularity: in order to appeal to such relations, one has to already individuate the particles which are so related and the numerical diversity of the particles has been presupposed by the relation which hence cannot account for it. (French 2006, p. 5)

We can spell out their concern in terms of ground. It is not just the fact $[Rab]$, where R is an irreflexive relation, that explains the distinctness of a and b, but the fact that a and b stand in a relation R *together with the fact* that R is irreflexive. In this case a harmful circularity may emerge depending on how we ground the fact that R is irreflexive. *R's* being irreflexive seems to amount to the fact that for any objects x and y such that Rxy, x and y must be distinct, or $(\forall x)(\forall y)(Rxy \supset \neg\, x = y)$. If we ground the irreflexivity of R in a fact of the form $(\forall x)(\forall y)(Rxy \supset \neg\, x = y)$, we are in trouble. Since universal generalizations are grounded in their instances, $[[Rab \supset \neg\, a = b]]$ will partially ground this universal generalization. Moreover, since $[Rab \supset \neg\, a = b]$ plausibly has the same grounds as $[\neg\, Rab \vee \neg\, a = b]$, and disjunctive facts are grounded in their disjuncts, $[\neg a = b]$ will partially ground $[(\forall x)(\forall y)(Rxy \rightarrow \neg\, x = y)]$. $[(\forall x)(\forall y)(Rxy \rightarrow \neg\, x = y)]$ along with [Rab] in turn partially grounds $[\neg\, a = b]$. Thus, by transitivity, $[\neg\, a = b]$ grounds itself, and irreflexivity is violated.

However, The Weak Discernibility approach is not forced into this circularity.[24] One

[24] Thanks to Ted Sider and Cian Dorr for this point.

can ground the irreflexivity of a relation in other ways. For instance, one can ground the irreflexivity of R in a fact of the form $(\forall x)\neg Rxx$, in which case the fact that [a is distinct from b] is grounded in ([Rab], [$(\forall x)\neg Rxx$]). Nevertheless, even with the latter explanation of irreflexivity, the Weak Discernibility proposal's explanation of identity and distinctness may strike some as insufficient. Explaining why objects are distinct by appealing to irreflexive relations they stand in to one another still seems to presuppose the distinctness of the objects in the first place.

Saunders can maintain that it is just the fact [Rab], not [Rab] along with the fact [$R\ is\ irreflexive$], that fully grounds [$\neg\ a = b$]. While this explanation does not suffer from circularity, it is impoverished. Why does [Rab] ground the distinctness of a and b? Without being able to appeal to the fact that R is irreflexive in the explanation, there is not much to say.

Even if we can allay the above concerns, another problem arises for the Weak Discernibility approach; it cannot straightforwardly accommodate Deluxe Max Black cases. Deluxe Max Black cases are metaphysically possible scenarios in which there are co-located, qualitatively indiscernible objects. Unlike the original Max Black case, we cannot distinguish the objects in question on the basis of irreflexive spatiotemporal relations they stand in to one another. One Deluxe Max Black case may actually arise in cases of quantum particles. There are certain states, "symmetrized states", that purportedly contain multiple subatomic particles (in this case, bosons), which are not distinguished on the basis of their positions (See French (1989)). Unlike the original Max Black cases, the bosons in question here cannot be distinguished on the basis of their monadic features or relations holding between them.

Saunders (2006a) maintains that the bosons in the symmetrized state do not stand in any irreflexive relations, and on this basis, we should reject that bosons count as objects at all. Other responses on behalf of the Weak Discernibility approach have maintained that the bosons do in fact stand in certain irreflexive relations, but the existence of these relations

is controversial.[25] However, even if the Weak Discernibility approach can acknowledge distinct bosons in this particular scenario, it should cause us concern. One may worry that we were lucky to find a distinguishing property in the boson case. The boson case raises the spectre that there could be similar cases of distinct co-located objects standing only in reflexive relations to one another that the Weak Discernibility account cannot accommodate. Thus, we should see if we can find a type of metaphysical explanation of identity and distinctness that can handle both Max Black and Deluxe Max Black cases.

4 A New Approach to Object-Identity

4.1 The Ways in Which Concrete Objects Possess Properties

The grounding conditions we have considered all aim to account for identity in terms of which properties or relations objects instantiate. These approaches either fall victim to grounding circularity or face potential counterexamples. I explore a new type of proposal—one that takes not only *which* properties and relations objects instantiate to be relevant to the identity and distinctness of objects but also *how* objects instantiate those properties and relations. Objects can have properties and stand in relations in many different ways. They can have them necessarily or contingently, intrinsically or extrinsically, and here I maintain that objects have properties and relations in different ways depending on how facts involving the object(s) and properties (or relations) in question are grounded.

More specifically, we can distinguish how objects possess properties and relations on the basis of their patterns of ground: objects can have properties and relations *fundamentally* or *non-fundamentally*. Having properties fundamentally or non-fundamentally differs from a property's being fundamental or non-fundamental. As mentioned in section 2.1, A fundamental property/relation is a constituent of at least one fundamental (ungrounded) fact. Among the fundamental properties, we should draw a distinction between such properties

[25] See Muller and Saunders (2008), Muller and Seevinck (2009), French (2011) and Caulton (2013) for a discussion of alternative methods for distinguishing the bosons.

being instantiated fundamentally as opposed to non-fundamentally. The same goes for fundamental relations; objects can stand in relations fundamentally or non-fundamentally. Here is the distinction:

A property or relation is *fundamental* if and only if it appears in at least one ungrounded fact. Otherwise it is non-fundamental.

Since fundamental properties and relations can appear in grounded facts as well, we also need the following notion of possessing a property *fundamentally*.

An object x instantiates a property P *fundamentally* just in case the fact $[Px]$ is fundamental or ungrounded. x instantiates P *non-fundamentally* just in case the fact $[Px]$ is non-fundamental, or there is some fact $[\phi]$ that grounds $[Px]$.[26]

All properties and relations instantiated fundamentally count as fundamental, but fundamental properties can be instantiated non-fundamentally. We need the distinction between fundamental properties (relations) and possessing properties (relations) fundamentally because some fundamental properties and relations do not appear only in fundamental facts. Here is an example to clarify the distinction. Take the property of having -1 e electric charge. This is the electric charge of an electron, and it is a good candidate for a fundamental property: since electrons are elementary particles and electric charge appears in our physical theories, it is plausible to take the fact that an electron has this property as ungrounded. Yet -1 e is instantiated both by electrons as well as other objects. Certain ions, *anions*, have -1 e charge. The fact that a particular anion has -1 charge is grounded. It is grounded in facts concerning how many electrons and protons the anion has. We should claim that the electron has this property *fundamentally*, and the anion has this property *non-fundamentally*.

[26]Moreover, objects $x_1 \ldots x_n$ stand in relation R fundamentally just in case $[Rx_1 \ \ldots x_n]$ is fundamental (or ungrounded), and objects $x_1 \ldots x_n$ instantiate R non-fundamentally just in case there is some fact $[\phi]$ such that $[\phi]$ grounds $[Rx_1 \ldots x_n]$.

With this distinction in hand, the strategy is now as follows: I will try to show how we can appeal to the distinction between objects standing in certain types of relations fundamentally as opposed to non-fundamentally in order to explain their identity and distinctness. In particular, we will appeal to how objects stand in quantitative relations to one another in order to identify and distinguish objects. For ease of reading, I will develop the account in stages. First, I will explain in more detail what quantitative relations are. Second, I will argue that it is plausible to think that distinct objects stand in quantitative relations to each other fundamentally while objects stand in quantitative relations to themselves non-fundamentally. And then I will show how we can appeal to this fact in order to explain the identity and distinctness of concrete objects. Nevertheless, the account I will provide in section 5 is not suitably general: it can only explain the identity and distinctness of intuitively "fundamental" concrete objects, like microphysical particles. Third, I will show how to generalize this account so that it can accommodate the identity and distinctness of "non-fundamental" concrete objects (such as macrophysical objects like tables and chairs) as well.

4.2 What are Quantitative Relations?

For certain kinds of relations, we can distinguish between how objects bear them to themselves and how they bear those relations to distinct objects. In particular, we can distinguish or identify objects based on how they stand in *quantitative* relations. Distinct objects stand in quantitative relations to each other fundamentally and they stand in the same kinds of quantitative relations to themselves non-fundamentally.

Quantitative relations involve physical features like mass, electric charge, acceleration, and spatiotemporal separation. Examples of determinate quantitative relations include: *five meters away from*, *twice as massive as*, *opposite charge as* and the like. While I cannot provide a proper definition of what makes a relation quantitative, we can get a handle on some of the distinctive characteristics of quantitative relations. These relations

are taken from our physical theories, they have a determinable-determinate structure, and they admit of degrees.[27]

Quantitative properties and relations are much discussed because some of them seem like good candidates for fundamental properties and relations. For example, David Lewis (1983, p.355-6), takes physics to "aspire to provide a [partial] inventory" of natural or fundamental properties and relations. If we look to our current physics, these properties and relations include quantitative ones like mass, electric charge, and spatiotemporal relations.[28] In providing identity criteria below, I will follow them in taking quantitative relations, such as spatiotemporal distance relations or mass relations between objects as fundamental.

Before explaining what quantitative relations have to do with identity and distinctness, we should note that there are different views in the metaphysics of quantitative relations. Theories of quantities fall into two camps: relationism and absolutism. Relationism treats polyadic quantitative relations, instead of monadic quantitative properties, as fundamental. Relationists take facts involving objects standing in quantitative relations to distinct objects (facts such as [a is as massive as b]) to either be fundamental or grounded in other relational quantitative facts. Relationism is the view I assume in presenting the identity conditions below. Absolutism, on the other hand, treats monadic, determinate quantitative properties, like *9.1 x 10-31 kg*, *-1 e*, and so on, as fundamental. Absolutists take many quantitative relational facts to be grounded in facts involving objects' possessing monadic quantitative properties. For instance, the absolutist will ground the fact that [a is as massive as b] in a plurality of facts of the form [a is 9.1 x 10-31], [b is 9.1 x 10-31] when a and b are distinct objects (that each have 9.1 x 10-31 mass).[29]

[27] For a discussion of the features of quantities, see Field (1980), Mundy (1987), Bigelow and Pargetter (1988), Armstrong (1988), Hawthorne (2006), Eddon (2013a)(2013b), Dasgupta (2013), and Perry (2015)

[28] Also see Sider (2011), Chapter 13.

[29] There is an exception for spatiotemporal relations: absolutists can either take the facts that objects stand in spatiotemporal relations to one another to be fundamental (as the relationist would do as well) or grounded in locational facts—facts maintaining that the objects in question occupy specific spatiotemporal locations.

While I will assume relationism in order to present identity and distinctness criteria in the next section, this assumption can be discarded. When I generalize the account in section 8, I will show how we can develop a proposal in a similar spirit which is friendly to absolutism. But first, we will follow relationists in assuming that certain quantitative relations, not monadic properties, are fundamental.

Throughout the rest of this paper, we will focus on a special subset of quantitative relations. We will focus on the quantitative relations that the relationist takes to be the most fundamental. In what follows, these are ones like *as massive as*, *less massive than*, *more massive than*, *same charge as*, *opposite charge as*, and relations of spatiotemporal separation.[30] To indicate that I only have these kinds of quantitative relations in mind, I will subscript 'Quantitative' with $_{rmf}$ in later sections of the paper.

The qualification "most fundamental" is intended to exclude gerrymandered relations which may nevertheless count as quantitative because they exhibit determinable-determinate structure and admit of degrees. For instance, relations like *being as knowledgeable of the first season of Breaking Bad as* and *being as massive as or less dense than* will not count as quantitative relations for our purposes. "Most fundamental" is also meant to exclude relations like *sharing 1kg of mass with* and *having the same negative 1 e electric charge as*. These relations are not gerrymandered like the ones mentioned above, but they are not the most fundamental quantitative relations the relationist posits. While relationists may make sense of such relations, they will not count them as fundamental given that these relations involve monadic quantitative properties (1kg mass and -1 e electric charge), and monadic quantitative properties are not fundamental according to the relationist.[31]

[30] We should note that it is somewhat controversial exactly what form the most fundamental relations should take. For instance, some relationists, like Field (1980) speak in terms mass congruence (CONG) and less than (LESS) relations. Where x LESS y whenever the mass of x is less than or equal to the mass of y. And xy CONG wz when the mass difference between x and y is the same as that between w and z. See Eddon (2013b) for a nice discussion of this. For ease of reading, I will stick with relations like *as massive as same electric charge as* and so on, but it should not impact my proposal if CONG and LESS than turn out to be more fundamental than the relations I pick out here. We could reframe the proposal using those relations instead.

[31] When we move to the generalized proposal in section 8, which is intended to be absolutist-friendly, we

4.3 How can we use Quantitative Relations to Explain Identity and Distinctness?

When a and b are distinct objects, they stand in certain quantitative$_{rmf}$ relations to one another fundamentally. For distinct microphysical objects, quantitative facts of the form [a is five meters from b] or [a is as massive as b] are good candidates for fundamental facts extracted from our physical accounts. This differs from how objects stand in quantitative$_{rmf}$ relations to themselves; Objects stand in physical quantitative$_{rmf}$ relations to themselves non-fundamentally. For instance, the facts [a is the same mass as a], [a is co-located with a] are non-fundamental. This is because such facts are not scientifically informative. These types of facts do not belong in our ultimate physical accounts of the world as they hold "no matter what" or regardless of which specific features the object in question has. a will be the same mass as itself if a has one gram of mass, 1000 kg of mass, or (trivially) if a has no mass at all.[32] I take it that these facts are cheap: just in virtue of an object's existing, it stands in these quantitative relations to itself.

There is a parallel between how objects stand in quantitative relations to themselves and how they stand in the identity relation. An object is identical to itself "no matter what" as well. In the case of both the identity and quantitative$_{rmf}$ relations an object stands in to itself, it does not matter what specific characteristics the object has in order for it to stand in these relations to itself. This surprisingly contrasts with how distinct objects stand in quantitative$_{rmf}$ relations to one another. The existence of a and b is insufficient to determine what kinds of mass relations, charge relations, spatiotemporal relations, and so on, a and b stand in to one another—a and b could have existed and borne different quantitative$_{rmf}$ relations to one another. For instance, when a is five meters from b, the

will still cash out the proposal in terms of the quantitative relations stipulated here (*as massive as*, *more massive than*, *same charge as*, *opposite charge as*, and so on.) even though these relations are not perfectly fundamental according to the absolutist due to the fact that she posits fundamental determinate monadic properties of mass and charge instead of fundamental mass and charge relations holding among concrete objects.

[32] Although, this last case is tricky. See footnote 35 for discussion.

existence of a and b is insufficient to ground this fact. a and b could exist and stand in different spatiotemporal relations.

5 The Quantitative Proposal

The asymmetry between how objects stand in quantitative$_{rmf}$ relations to themselves as opposed to distinct objects gives way to new grounding conditions for object-identity and distinctness. Furthermore, it allows us to appeal to the nature of how objects stand in fundamental physical relations in order to identify and distinguish objects. We can now formulate the proposal as follows:

> The Quantitative Proposal: when x is identical to y, then for any quantitative$_{rmf}$ relation R that x and y stand in, the fact that x is identical to y is grounded in the fact that x and y stand in R to one another non-fundamentally. And when x and y are distinct, The fact that x and y are distinct is grounded in x's standing in at least one quantitative$_{rmf}$ relation, Q, to y fundamentally.[33]

When $x = y$, x and y stand in quantitative$_{rmf}$ relations non-fundamentally, and if they are distinct then they stand in quantitative relations$_{rmf}$ to another fundamentally. The proposal states that distinct objects stand in *at least one* quantitative$_{rmf}$ relation fundamentally because distinct objects may stand in some quantitative$_{rmf}$ relations to one another fundamentally and others non-fundamentally. For example, we want to leave the option open that perhaps the fact that [a is more massive than b] is grounded in the fact that [a is twice as massive as b]. Here, distinct objects a and b stand in the *more massive than* relation non-fundamentally and the *twice as massive as* relation fundamentally.

This proposal has two major advantages: First, it offers a metaphysical explanation of identity and distinctness that avoids the problems Max Black cases and Deluxe Max Black cases caused above. For example, consider the case where there are two spatially separated

[33] More formally as follows: If x = y then $x = y >$ ($\forall R$)((R is quantitative$_{rmf}$ & Rxy) $\supset$ Rxy non-fundamentally). If $\neg$ x = y then $\neg\, x = y >$ ($\exists R$)((R is quantitative$_{rmf}$ & Rxy) & Rxy fundamentally)

electrons. The electrons stand in quantitative$_{rmf}$ relations to one another, like *same mass as*, *same electric charge as*, *five meters away from*, and so on, fundamentally. Were we to look at the physical account of this universe, it would contain a fundamental fact of the form [electron a is the same mass as electron b]. We can distinguish the electrons by maintaining that they stand in those relations fundamentally. Were there only a single electron, then it would stand in relations like *same mass as*, and *co-located with*, to itself trivially, just in virtue of the fact that it exists. If $a = b$, there would be no fundamental fact of the form [electron a is the same mass as electron b].

Similarly, in the Deluxe Max Black case above, we can distinguish the co-located bosons by appealing to the fact that the bosons stand in *same mass as* and *co-located with* relations to one another fundamentally. Even though the objects stand in only reflexive relations in the case of the qualitatively-identical co-located objects, the fact that the objects stand in them is not settled merely on the basis of the objects' existence. The ultimate physical account of the Deluxe Max Black world would contain a fundamental fact of the form [boson a is colocated with boson b].

The Quantitative Proposal also has the advantage of fitting identity and distinctness facts into a greater pattern of explaining non-fundamental phenomena in terms of fundamental quantitative features. The Quantitative Proposal explains identity and distinctness in terms of how objects stand in physical, quantitative$_{rmf}$ relations. These are the relations which many metaphysicians already take to be metaphysically significant; they seem to be good candidates for metaphysically fundamental relations holding between concrete objects. We typically attempt to explain other non-fundamental phenomena, the densities and shapes of macrophysical objects for example, in terms of the quantitative properties and relations instantiated at the microphysical level. So if we can explain identity and distinctness facts in terms of quantitative$_{rmf}$ relations, we can subsume identity and distinctness facts into a greater pattern of explanation: we would have another successful explanation of non-fundamental phenomena by appeal to fundamental quantitative fea-

tures. The major difference here is that, in order to explain identity and distinctness facts (as opposed to many other kinds of non-fundamental facts), we must appeal not just to which quantitative$_{rmf}$ relations objects stand in but how they stand in them.

5.1 How Objects Stand in Relations to Themselves

So the Quantitative Proposal, if successful, has advantages as a view for explaining concrete object identity and distinctness. Now the question arises: if objects stand in quantitative$_{rmf}$ relations to themselves non-fundamentally, what grounds the fact that they stand in such relations to themselves? I suggest that objects stand in quantitative$_{rmf}$ relations in virtue of their existence. Facts like [a is as massive as a], [a is colocated with a], [a has the same charge as a] are fully grounded in the existence of a.[34]

Above, I claimed that objects stand in quantitative$_{rmf}$ relations to themselves "no matter what" or regardless of which particular characteristics the object has. Objects stand in these relations to themselves whenever they exist.[35] If the existence of an object b fully grounds the fact that b has feature F, then b has F in virtue of b's existence. Likewise, objects stand in a relation R in virtue of their existence when the fact that the objects

[34]This may not be the only way to develop the Quantitative Proposal. I suggest that objects stand in quantitative$_{rmf}$ relations to themselves in virtue of their existence–and I develop this line of thought below–but the main insight of the Quantitative Proposal is that objects stand in quantitative$_{rmf}$ relations to themselves *non-fundamentally* and to distinct objects *fundamentally*. One avenue to explore is whether there are alternatives to existence facts which could ground facts involving objects standing in quantitative$_{rmf}$ relations to themselves. For instance, if our ontology of fundamental facts included essence facts, perhaps facts involving the essences of an object a could ground [a is as massive as a]. Thanks to Kelly Trogdon for raising this possibility.

[35]I take it to be true, yet infelicitous, to maintain that objects lacking features like mass or charge still stand in the *same charge as* and *same mass as* relations to themselves. It is just that they trivially stand in these relations to themselves in virtue of having no mass or charge at all. But one could insist that objects do not stand in any quantitative relations to themselves in such scenarios. Additionally, one could claim that objects do not have the same mass or charge as themselves in possible worlds where there is no mass or charge. If this is the case, the existence of the object will not suffice to ground facts like [a is as massive as a]. In this case, such facts should be taken to be grounded in the fact [a exists] as well as further facts like the fact that mass exists or the fact that a is the kind of object capable of possessing mass, such as [a is mass-apt]. Augmenting the grounding base with these extra facts still allows us to distinguish and identify objects. Facts like [a is as massive as b] will still hold non-existentially when a and b are distinct such facts will be grounded in a plurality of existence facts when a is identical to b.Thanks to Jill North for pressure here.

stand in R is fully grounded in the fact(s) that the objects in question exist.[36]

6 Responding to two Circularity Charges

6.1 The Structure of Existence Facts

In this section, I will respond to two charges of circularity against my proposal. The first concerns the structure of the existence facts I appealed to in the previous section. What is the structure of the existence fact that supposedly grounds the fact that objects stand in quantitative$_{rmf}$ relations to themselves? The most natural way to formulate the claim that an object a exists is as an existentially quantified fact as follows $[(\exists x)(x = a)]$. I call existentially-quantified facts "∃-facts". A fact of this form cannot ground a fact involving an object standing in a relation to itself if the latter fact in turn is supposed to partially ground the fact that the object in question is self-identical. Taking ∃-facts to ground facts like $[Paa]$, where P is a physical quantitative relation, is problematic because ∃-facts are grounded in their instances, so $[a = a]$ should ground $[(\exists x)(x = a)]$. Since $[Paa]$ partially grounds the fact that $[(\forall R_{qualitative})\ (Rxy\ \supset\ [Rxy]$ is non-fundamental)] which in turn grounds the fact $[a = a]$, $[Paa]$ partially grounds $[a = a]$ by transitivity. So if ∃-facts are grounded in their instances, they will both partially ground and be partially grounded in identity facts, which leads to circularity.

What I take this example to show is that existence facts do not always take the form of quantified identity facts. Intuitively, we can claim that Aretha Franklin exists without having to invoke the identity relation. There is another candidate for the kind of existence facts that can capture this intuition and ground objects standing in quantitative relations to themselves. We can ground facts such facts in *existential-property* facts or "E-facts". E-facts take existence to be a first-order property instantiated by objects. We now represent

[36] This proposal is less radical than it may initially seem: taking the existence of an object to ground its standing in quantitative$_{rmf}$ relations to itself does not preclude quantitative$_{rmf}$ relational facts from having other grounds as well. Facts often have multiple full grounds.

the fact that a exists as $[Ea]$, where E picks out the property of existence. Taking E-facts to ground objects standing in quantitative relations to themselves does not lead to circularity because E-facts are not grounded in identity facts as ∃-facts are.

Treating existence as a first-order property of objects is independently attractive as it recovers an understanding of existence that does not involve the identity relation.[37] Accepting existential-property facts also does not require that we reject ∃-facts. We can adopt both kinds of existence facts. Additionally, acknowledging both E-facts and ∃-facts also allows us to solve a puzzle Fine (2012) raises as Fine suggests. Taking existentially quantified facts to be fully grounded in their instances leads to "the problem of necessary existents." Consider the fact $[(\exists x)(Fx \vee \neg Fx)]$. This fact is supposedly grounded in $[Fa \vee \neg Fa]$ but the latter fact holds necessarily. From grounding necessitation, it should follow that $[(\exists x)(Fx \vee \neg Fx)]$ necessarily obtains, but this implies that necessarily something exists, and that presumably is not a commitment that should be forced upon us. If we accept existential-property facts in addition to ∃-facts, and maintain that ∃-facts are partially grounded in their instances as well as partially grounded in existential-property facts, then we can avoid this problem. On this picture, while ∃-facts are still partially grounded in their instances, facts like $[(\exists x)\ Fx]$ are fully grounded in each instance and an existential property fact, in this case: $[Fa]$, $[Ea]$. Here, the fact $[(\exists x)(Fx \vee \neg Fx)]$ is fully grounded in the plurality of facts, $[Fa \vee \neg Fa]$, $[Ea]$. So if only $[Fa \vee \neg Fa]$ obtains, but a does not exist, it is not the case that $[(\exists x)(Fx \vee \neg Fx)]$ holds. Accepting E-facts allows us to avoid a commitment to necessary existents.

We have other compelling positive reasons to accept existential property facts. Fine (2009), McDaniel (2013b), McGinn (2000) among others argue for the viability of taking existence to be a property (or the viability of an existence predicate) and against the idea that we can only capture existence quantificationally. For one, it is plausible to take certain

[37] See Salmon (1987a) and McDaniel (2013b) for discussion of the relation of existence properties to the ontological argument.

objects to exist fundamentally and others to exist non-fundamentally.[38] In other words, the existence of some objects (perhaps some subatomic particles) is fundamental, but the existence of others (ice cream cones, Google, picket fences, etc.) is non-fundamental. This is hard to capture without existential property facts since existentially quantified facts are never fundamental; they are always grounded in their instances. But with existential property facts, it is open that facts like $[Ea]$ (where a picks out a particular electron) are fundamental or ungrounded and facts like $[Eb]$ (where b picks out a particular ice cream cone] are grounded or non-fundamental.[39]

With this picture of existence facts, we can fully clarify the Quantitative Proposal. Objects are distinct when they stand in quantitative$_{rmf}$ relations fundamentally and objects are identical when they stand in the same kinds of quantitative$_{rmf}$ relations merely in virtue of their existence. Objects stand in a relation in virtue of their existence if the fact that the object(s) bears the existence property fully grounds the relational fact in question.

6.2 Reversing the Order of Explanation

We have seen how the first threat of circularity is avoided by appealing to existential property facts instead of existentially-quantified facts. Nevertheless, you may worry that circularity is still looming. Perhaps you have the suspicion that objects stand in quantitative$_{rmf}$ relations to themselves non-fundamentally *because* they are identical. If so, then we cannot appeal to objects' standing in quantitative$_{rmf}$ relations non-fundamentally in order to ground or explain object identity. The explanatory arrow is already pointing in the opposite direction. I see the appeal of this line of thought; however, here I will argue that we can explain why facts like [a is as massive as a] are non-fundamental without appealing to identity or distinctness facts involving a.

[38] See McDaniel (2013a) and Markosian (2014) on fundamental existence facts.

[39] Questions still arise here. Namely, what (if anything) grounds the E-facts? If one takes some objects to exist fundamentally, it may be compelling to consider some E-facts to be fundamental. If one denies that existence facts belong in the base of fundamental facts, then perhaps existence facts will be further grounded.

While we may not know the entire inventory of fundamental facts, we think at least some quantitative facts are good candidates for belonging to the fundamental stockpile. But not every quantitative fact should count as fundamental. How do we distinguish *which* quantitative facts are the good candidates? The good candidates for fundamental quantitative facts are the ones encapsulated in our best scientific theories. These fundamental quantitative facts will presumably include those quantitative facts that are useful and are not easily explained in terms of other facts.[40] Quantitative facts are useful when they serve as the basis for explaining other, non-fundamental facts. And while every fact is useful in that sense (for instance, every fact will ground, or explain, a disjunctive fact that has it as a disjunct), we can be more specific about the type of usefulness we have in mind: fundamental quantitative facts help explain quantitative facts in other domains.

There are multiple ways for fundamental quantitative facts to help explain quantitative facts in other domains. First, fundamental quantitative facts at least partially ground many non-fundamental quantitative facts, facts involving other objects (plausibly, macrophysical ones). For example, the table stands in the *same electric charge as* relation to other macrophysical objects because its parts stand in various electric charge relations. Fundamental quantitative facts can also help explain quantitative facts in other domains when they explain non-fundamental quantitative facts involving different quantitative relations. Certain facts involving the mass relations objects stand in partially explain non-fundamental facts involving volume relations, for example. But facts like [a is as massive as a] or [b has the same charge as b] are not useful in these ways.

Additionally, the quantitative facts we should take to be fundamental are those that are not easily explained in terms of other facts. Facts like [a is as massive as a] do not seem to be like this. As discussed above, existence facts seem like plausible grounds for these facts. On the other hand, facts like [electron a is less massive than proton b] are not so

[40] When discussing quantitative facts in this section, I have mostly dropped the subscript to fundamental quantitative relations, $_{rmf}$, because I am concerned with quantitative facts involving both fundamental and non-fundamental quantitative relations.

easily grounded or explained. Thus, if we want to keep the fundamental base minimal[41], then we should exclude facts like [a is as massive as a] or [b has the same electric charge as b] from the class of fundamental facts.

To distinguish whether objects stand in quantitative$_{rmf}$ relations fundamentally as opposed to non-fundamentally, I have appealed to three criteria:

1. Whether they help explain quantitative facts in other domains.

2. Whether they are difficult to ground in other facts.

3. Whether they appear in a minimal fundamental base.

Since facts like [a is as massive as a] do not have significant explanatory power, they are not difficult to ground, and would not plausibly appear in a minimal base, they are good candidates for being non-fundamental. The three criteria above do not appeal to identity or distinctness. As we have these criteria for distinguishing between an object's standing in relations fundamentally or opposed to non-fundamentally, we need not appeal to the identity and distinctness of objects in order to ground the fact that objects stand in quantitative$_{rmf}$ relations fundamentally or non-fundamentally. I have not provided an argument that we *cannot* ground facts like [a is as massive as a] in [$a = a$]. But given that we have not seen a positive reason to ground such facts in identity facts, we have not undercut the proposal on the table.

7 A Simpler Proposal?

One may oppose The Quantitative Proposal on the grounds that there is a simpler alternative in the vicinity. Perhaps we should bypass discussion of quantitative$_{rmf}$ relations altogether and ground identity facts directly in existence facts.[42] For example, [Ea] would

[41] This is controversial, but look at Schaffer [2010] for someone who thinks that basic or fundamental entities should be minimally complete. Although, Schaffer there is concerned with objects instead of facts.

[42] Lewis (1986), Salmon (1987b), Burgess (2012), and Fine (2012) discuss the viability of taking existence facts to explain identity and distinctness facts.

ground the fact $[a = a]$. If we were to directly ground identity facts in existence facts, it would be plausible to take distinctness facts to be grounded in existence facts as well; in this case, *two* existence facts. For instance, $[\neg a = b]$ would be grounded in the plurality of facts, $[Ea]$, $[Eb]$. If existence settles which objects are self-identical, why can't it settle which objects are distinct as well?

This proposal is not satisfactory because it only displaces the problem of explaining distinctness. Explaining the distinctness of objects a and b on the obtaining of $[Ea]$ and $[Eb]$ does not achieve very much. We are left with the problem of distinguishing two facts, $[Ea]$ and $[Eb]$, and facts are usually distinguished or identified on the basis of their constituents (*i.e.* by the objects, properties, and relations they involve). Since these two facts involve the same existence property, we should distinguish the facts by appealing to the different objects they have as constituents. This does not generate grounding circularity, but it is still unsettling because our explanation of the distinctness of the facts rests upon the distinctness of the objects, while our explanation of the distinctness of the objects is supposed to be settled by appealing to the two facts.[43] The Quantitative Proposal sidesteps this issue as it grounds distinctness facts in facts involving objects standing in quantitative$_{rmf}$ relations fundamentally. There is no reference to the number of facts that ground distinctness facts as opposed to the number of facts grounding identity facts.

8 Generalizing the Proposal

The Quantitative Proposal is not suitably general as it stands. The Quantitative Proposal only accommodates the identity and distinctness of intuitively "fundamental" objects: the identity and distinctness of objects lacking proper parts. This is because we may deny that objects like tables and chairs stand in any quantitative$_{rmf}$ relations to one another fun-

[43] The problem is more pronounced if we think the distinctness of the facts $[Ea]$ and $[Eb]$ explains the fact that the existence facts ground the distinctness of the objects. In this case, since the distinctness of a and b grounds the fact that $[Ea]$ and $[Eb]$ are distinct, then [¬ a = b] would ground the fact that the plurality of existence facts grounds the distinctness of the objects themselves. A fact should not explain an explanation of itself. Thanks to Tobias Wilsch for pressing this point.

damentally. Non-fundamental or complex objects presumably stand in many if not all of their quantitative$_{rmf}$ relations in virtue of their parts. For instance, the fact that the table is five meters from the chair is presumably not a fundamental fact; it is plausibly grounded in the spatiotemporal relations holding between the table's microphysical parts and the chair's microphysical parts. This is problematic for the proposal as it stands because the Quantitative Proposal states that to explain the distinctness of non-fundamental objects like the table and chair, they must stand in quantitative$_{rmf}$ relations to one another fundamentally. Yet, the table and chair are distinct and may not stand in any quantitative$_{rmf}$ relations to one another fundamentally; only their microphysical parts do.

We can still distinguish how tables and chairs stand in relations to one another from how they stand in quantitative$_{rmf}$ relations to themselves. Even though non-fundamental objects may not stand in quantitative$_{rmf}$ relations to one another fundamentally, they do not stand in them wholly in virtue of their existence either. Their parts must stand in quantitative$_{rmf}$ relations to one another fundamentally. We can contrast this with how non-fundamental objects stand in quantitative$_{rmf}$ relations to themselves. They stand in such relations to themselves in virtue of their existence.

Given that we can still distinguish between how non-fundamental objects stand in quantitative$_{rmf}$ relations to themselves from how they stand in them to distinct objects, we can generalize the Quantitative Proposal in order to accommodate this:

> The Generalized Quantitative Proposal: When x is identical to y, the fact that x is identical to y is grounded in the fact that x and y stand in every quantitative$_{rmf}$ relation to one another in virtue of x's and y's existence. And when x and y are distinct, the fact that x and y are distinct is grounded in x's standing in some quantitative$_{rmf}$ relation to y not in virtue of x and y's existence.[44]

These grounding conditions state that when objects x and y are identical they stand

[44]More formally as follows: If x = y then $x = y >$ $(\forall R)$((R is quantitative$_{rmf}$ & Rxy) $\supset$ (Rxy > Ex, Ey)). If $\neg$ x = y then $\neg$ $x = y >$ $(\exists R)$((R is quantitative$_{rmf}$ & Rxy) & $\neg$(Rxy > Ex, Ey))

in physical quantitative relations, relations such as *same mass as*, *same electric charge as*, *co-located with*, and so on, in virtue of their existence. In other words, if the facts involving x and y standing in quantitative relations are all grounded in the fact that x exists, then this in turn grounds the fact that x and y are identical. And if objects stand in quantitative relations to one another non-existentially, this grounds their distinctness. Objects stand in relations non-existentially when the fact that they stand in that relation is not fully grounded in the fact that the object(s) exist. This can mean either that the fact that the objects stand in that relation is ungrounded or at least partially grounded in a different plurality of facts. This holds even for intuitively non-fundamental objects like tables and chairs.[45]

The generalized proposal not only can accommodate the identity and distinctness of non-fundamental objects, it is also compatible with absolutism about quantities. Recall in section 4.2, I remarked that some theorists about quantities will deny that objects stand in quantitative$_{rmf}$ relations like mass and charge relations to one another fundamentally. They instead believe that objects stand in such quantitative relations to one another in virtue of the object's possessing monadic quantitative properties. For example, the absolutist will claim that the fact that an electron is less massive than a neutron is grounded a plurality of facts, [the electron has mass 9.1 x 10 -31 kg], [the neutron has mass 1.7 x 10-27 kg]. In appealing to the Generalized Quantitative Proposal, the absolutist can explain object identity and distinctness without having to claim that distinct objects stand in quantitative$_{rmf}$ relations fundamentally. For instance, the absolutist will maintain that

[45]Do the same explanatory worries arise here as in the previous section? In particular, perhaps objects stand in quantitative relations to themselves existentially *because* they are identical instead of the other way around? I think we can appeal to some of the criteria from the previous section to mitigate this concern. For example, I maintain that we can determine whether objects stand in quantitative relations to each other existentially/non-existentially by considering how useful these facts are in grounding other quantitative facts. For example, it is a sign that x stands in R to y in virtue of x's existence when Rxy is not useful in grounding other quantitative facts. But if Rxy does ground quantitative facts, that is a sign that x stands in R to y non-existentially. This criterion for determining whether Rxy holds in virtue of x's existence does not invoke identity or distinctness facts involving x. Thanks to Nina Emery for pressing this issue.

the electron stands in the *same mass as* relation to itself in virtue of its existence, but it will stand in the *same mass as* relation to distinct electrons in virtue of the electrons' monadic mass properties.

In other words, absolutists and relationists will agree that distinct objects stand in quantitative$_{rmf}$ relations to one another non-existentially though they will disagree as to what fact(s) grounds their standing in quantitative$_{rmf}$ relations to one another. The relationist will maintain that, when x and y are distinct, they stand in quantitative$_{rmf}$ relations fundamentally or in virtue of other quantitative$_{rmf}$ relational facts. Absolutists will maintain that distinct concrete objects x and y stand in quantitative$_{rmf}$ relations to one another in virtue of their monadic quantitative properties or facts about their locations. This still contrasts with how concrete objects stand in quantitative$_{rmf}$ relations to themselves: objects stand in quantitative$_{rmf}$ relations to themselves in virtue of their existence. So the Generalized Quantitative Proposal provides an explanation for identity and distinctness that is compatible with both relationism and absolutism about quantities.

9 Conclusion

In summary, we can solve the identity and distinctness problems by providing a metaphysical explanation of identity and distinctness facts. Identity facts involving concrete objects are grounded in concrete objects' standing in quantitative$_{rmf}$ relations to themselves in virtue of their existence. This captures the sentiment that certain identity facts are non-fundamental: concrete objects are identical when the fact that they stand in quantitative$_{rmf}$ relations to themselves holds merely in virtue of their existence. Furthermore, we can distinguish concrete objects on the basis of their fundamental (quantitative) features; we just need to appeal to how objects stand in quantitative$_{rmf}$ relations to one another.

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