Esfeld on Causation and Structural Realism

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M. Esfeld has recently argued that ontic structural realism (OSR) may succeed only if it is based on causal structures. In order to meet this requirement, he offers a combination of dispositional/causal relations with moderate form of OSR. This paper, however, demonstrates that moderate OSR, in relation to causation, faces a dilemma: it either admits objects as mysterious unobservables, or voids them of their structural character. Esfeld's attempt to resolve the dilemma by making relations and their bearers inseparable is disputable as well. It leads to a monistic ontology that cannot cope with fundamental physical properties adequately, and creates a rather hostile environment for structural metaphysics.

Introduction

Independent physical structures and scientific realism are two fundamental items in the repertoire of ontic structural realism (OSR). One of the arguments against that repertoire is that it is not rich enough to accommodate causation.[1] Causation is considered as an indispensable constituent of scientific knowledge, and if OSR cannot come to terms with it, then its appeal to scientific realism must be a mistake. In response, M. Esfeld (Esfeld 2009) puts forward a proposal according to which causal powers, as dispositions, are built directly into relations. For instance, structures based on the spatio-temporal relations are regarded as the paradigmatic examples of non-causal entities, but Esfeld believes that his proposal succeeds even in their case: … *it seems possible to take the spatio-temporal, gravitational relations to be a causal structure like any other material entity: the spatio-temporal, gravitational relations are causal powers (dispositions) that bring about gravitational effects that are in principle observable* (Esfeld 2009, 12)[2]. In fact, Esfeld's position is even stronger: it is not just that OSR *can* introduce causality along with causal structures, it *must* do so. If not, then OSR, according to Esfeld, would oppose scientific realism because non-causal entities, including non-causal structures, are scientifically inaccessible and create a gap between scientific knowledge and reality.

This paper focuses on several aspects of Esfeld's exposition that make the alliance of structural metaphysics and causality problematic. Esfeld suggests moderate OSR as a suitable ontological setting for causal structures, but this is disputable. Moderate OSR, in addition to causal relations, includes objects with structural identity conditions (Esfeld 2009, 1; Esfeld and Lam 2008, 31-2) in order to eliminate some notorious problems of radical OSR (mainly the existence of relations without relata). However, the inclusion of such entities, in relation to causation, faces a dilemma: moderate OSR either admits objects as mysterious unobservables, or voids them of their structural character. Esfeld's attempt to resolve the dilemma by making relations and their bearers inseparable is disputable is well. It leads to a monistic ontology that cannot cope with fundamental physical properties adequately, and creates a rather hostile environment for structural metaphysics.

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[1] The deficit is seen in the absence of objects (e. g. Chakravartty 2003, 76 and Psillos 2006, 569).
[2] The page number refers to the reprint.

1. Moderate OSR

Structural realism endorses relational ontology, but it is not obvious how far it should go. There are three variants of structural realism, and the oldest one, defended by Poincaré and Russell (Chakravartty 2003, 868), is epistemic. Its defenders place a restriction on scientific knowledge in the sense that we can know structural aspects of reality, but nothing about the natures of unobservable things whose relations define structures (Chakravartty 2003, 867). However, unobservables (notably objects with intrinsic properties) open a gap between structural knowledge and metaphysics and thus block scientific realism. In order to close the gap, the second variant, radical OSR, claims that there are relations but no objects. Objects play only a heuristic role, allowing for the introduction of the structures which then carry the ontological weight (French 1999, 204). The third variant, moderate OSR, keeps the gap between structural knowledge and ontology closed by putting objects (both metaphysically and epistemologically) on par with relations (Esfeld and Lam 2008, 31). This, however, is not a return to traditional object ontology because moderate OSR views the identity of objects extrinsically, whereas object ontology does so intrinsically. Object ontology holds that objects enter relations with definite identities, whereas moderate OSR denies this: "*... structures are networks of concrete, qualitative physical relations among objects that are nothing but what stands in these relations, that is, do not possess an intrinsic identity over and above the relations in which they stand*" (Esfeld 2009, 1).[3]

However, the rejection of intrinsic identity only follows a strategy of moderate OSR to reject intrinsic properties as such. One of the slogans of object ontology – to know an object is to know its intrinsic properties – is denied by moderate OSR:

The argument is, in brief, that we gain knowledge of physical objects owing to the causal relations that obtain between the objects and our senses or our measuring instruments. […] *In other words, the fundamental intrinsic properties of the physical objects are beyond the scope of our knowledge, because we have access to these objects only in a relational way.* (Esfeld and Lam 2008, 28-9)

Epistemic inaccessibility does not necessarily mean nonexistence, but the situation differs within the context of OSR. If unobservables were admitted, they would block scientific realism, because the world would contain more elements than science can, in principle, discover. The harmony between science and reality can be restored only if the *existence* of inaccessible entities is refused.

In sum, moderate OSR suggests an ontology of objects devoid of intrinsic properties, whose identity conditions depend on the dispositional/causal relations in which they stand.

2. Causal powers

As has been indicated in the opening paragraph, one of the objections against OSR is its ontological deficit in dealing with causation. This deficit is seen in the absence of objects because events, as causal relata, depend on objects having properties and standing in relation to each other (Psillos 2006, 569). Radical OSR, for instance, offers a simple answer: causation disappears at the fundamental levels of physical reality, and OSR – as an ontological

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[3] Space-time points may serve as an illustration: *... the identity of space-time points is completely determined by the space-time (chronogeometrical, inertio-gravitational, causal) relations they exhibit, that is, their 'position' in the (generally covariant) network of space-time relations* (Esfeld and Lam 2008, 38).

framework of fundamental physics – only reflects this fact (Ladyman 2007, 259). Esfeld, however, disagrees because non-causal structures are bound up with ontological underdetermination, which hinders scientific realism (Esfeld 2009, 9). Esfeld defends this claim with the arguments of dispositionalists against the categorical view of properties. The categorical approach perceives properties as based on their non-causal intrinsic natures (*quiddities*) independently of causal or nomological relations. But this, according to dispositionalists, is a mistaken view. Consider the following *Reductio* argument proposed by J. Hawthorne:

Suppose a property is something over and above its causal profile. We then seem to have conceptual space for something like the following: there is negative charge 1 and negative charge 2 that have exactly the same causal powers. What we call an instance of negative charge is sometimes an instance of negative charge 1, sometimes an instance of negative charge 2. Since 1 and 2 have the same propensities to affect all possible detection mechanisms, there is no way of discriminating 1 and 2. We would now be unable to tell, it seems, whether two groups of particles that we call 'negatively charged' had the same property or else distinct but indistinguishable properties. But this is absurd: we can recognize property sharing. So we had better not allow properties to have an individual essence that transcends causal features (Hawthorne 2001, 215).

And Esfeld strictly follows this advice, because a switch from categorical properties to categorical relations/structures does not prevent Hawthorne's conclusions. Categorical relations allow for causally indiscernible worlds grounded in different fundamental structures as well. As a result, empirical data is anchored to several different ontological settings (different categorical structures), but science has no resources to identify the correct one, and scientific realism is lost. One of the main arguments in Esfeld 2009 is that scientific realism is preserved only if OSR eliminates mysterious *quiddities* and keeps its structures causal. So far so good, but this delineation of OSR will be spoiled by objects.[4]

3. Moderate OSR and causal powers

It looks, according to the previous paragraph, as if Esfeld was shifting causation from objects to relations and thus proposing a truly structural notion of causation. Unfortunately, this cannot be true, because a separation of objects from causation would turn objects into unacceptable unobservables.

3.1 What is then a source of causation? If relations, then, as has just been said, objects are in trouble because they would be causally idle and inaccessible. In order to evade this consequence, causal powers should be ascribed to objects as well, but then objects acquire properties "in isolation", that is, independently of relations. Such a non-structural explanation, which introduces causal properties as intrinsic to objects, must be avoided too. Thus moderate OSR faces the following dilemma:

(1)   If objects are causally passive, then they are beyond the scope of scientific knowledge and, therefore, incompatible with moderate OSR.

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[4] Esfeld's proposal is also entrenched in problems concerning the analysis of causation in terms of dispositions: Is the relation between causes and dispositions a supervenient relation? Is it an identity relation? If it is identity, is it contingent or necessary? Is the analysis of causes in terms of dispositions reductive or non-reductive? If it is reductive (and leads to something non-causal, e.g. regularities), then it faces ontological underdetermination; if the analysis is non-reductive, then it is circular.

(2)   If objects are causally active, then they acquire qualities independently of relations in which they stand and, therefore, are incompatible with moderate OSR as well.

This dilemma can be settled only if both objects and relations are causally active, and if the structural ontology is preserved. According to Esfeld, these requirements are met by an account of dispositional relations as inseparable modes of objects.[5] This idea is borrowed from J. Heil:

... property-bearers are objects considered as being particular ways, and properties are ways objects are. In considering an object as a property-bearer, we are considering it partially; in objects considering its properties, we are considering ways it is, another kind of partial consideration. Properties and property-bearers can be considered separately but they cannot be separated, even in thought (Heil 2003, 172-73).

This account avoids the dilemma because it rejects the ontological dualism of objects and the relations that powers it. An object and its modes are, according to Heil, two inseparable aspects because the identity of a property cannot be separated from the identity of its possessor, and *vice versa* (Heil 2003, 46). The resulting entity is a thick particular that contains its bearer and its inseparable attributes. If we apply this account to a relational setting and consider, for instance, a space-time point, then it represents a thick particular consisting of a manifold point (as a bearer) and inhering metric relations as its particular modes. This entity is causally active (because its modes are causal) and devoid of intrinsic properties (because its modes are only relational), and thus the introduction of causality to structures (in this case metric) seems to have been successfully accomplished. This conclusion, however, comes at a cost that structuralists, as I will try to show, are not likely pay.

3.2 Heil's views become more radical when applied to relations. Return to space-time points and their relational modes. Consider O1 and O2 as spatio-temporal points standing in a metric relation R. In Heil's vocabulary, R is a mode shared by both O1 and O2, and since modes are ontologically inseparable from their bearers, O1, O2 and R constitute a thick particular. Further assume that O2 stands in relation S to some third spatio-temporal point, point O3. O3, with its mode S, ontologically joins that thick particular and we get a more complex entity consisting of O1, O2, O3 and their relational modes R and S. Growing complexity is not a problem; the problem is that the entity's apparent constituents condition each other's identities. O2 contributes to the identity of O3 (by sharing mode S), and since O1 contributes to the identity of O2 (via mode R), then O1 also contributes to the identity of O3. Something similar holds for relations R and S, because they are both modes of O2. As the metric field spreads, you end up with space-time as *one indivisible thick particular* whose constituents are thoroughly dependant on each other: the identity of each constituent (be it object or a relation) depends on the identities of all the other ones. This scenario is repeated with any kind of objects and their appropriate relational modes, and it always ends up with a substance that monists call '*One*'.

3.3 However, such a framework is not friendly to structuralism. The fundamental building blocks of reality are, according to structuralists, relations, but we have learned in 3.1 that these are mere aspects of something more fundamental. Another important ingredient of OSR is extrinsicality, but this ingredient is lost because every mode is an *intrinsic* mode of the *One*.

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[5] Esfeld put forward this account as a response to the above dilemma in an e-mail exchange. His writings are not explicit about this aspect of moderate OSR. In addition, relations as modes of their relata prevent moderate OSR from becoming a mere version of the bundle theory, which is another objection raised against Esfeld.

3.4 Something similar holds for causation: dispositional relations produce only immanent effects because causal relata are numerically one and the same entity. Although immanent causation is admitted in some cases, rendering every causal effect immanent is rather unorthodox.

3.5 More importantly, monistic ontology is disqualified by its inadequate approach to fundamental physical properties. Fundamental properties are local in the sense that, for instance, a charge of *this* particular electron repels or attracts a charge of *that* particular electron. Their causal influence is based on strictly singular facts – it is an *intrinsic* relation between the properties. Differently put, causal interactions between fundamental particles cannot be global and, therefore, monists are wrong when they say that every fundamental fact is a global fact of the world (Sider 2007, 5-6). The monistic framework includes a disputable picture of fundamental properties and this, I think, is the price that structuralists, in regard to scientific realism, are not likely to pay.

3.6 Fundamental physical properties are a threat to moderate OSR in yet another sense. They undermine the structuralist argument against intrinsic properties (discussed in the first paragraph). Let us return to electrons. An electron is charged intrinsically (independently of its environment), and yet this power is detectable due its manifestations in causal interactions. For this reason, some intrinsic properties *can* and *must* be accepted by scientific realists, but this is what the argument against intrinsic properties was supposed to block. To follow M. Dorato's example (Dorato 2006, 143), dispositional/categorical distinction differs from relational/intrinsic distinction: relational does not mean dispositional and intrinsic does not mean categorical. If he is right, and I believe he is, then Esfeld's appeal to relational ontology does not automatically guarantee the existence of causal/dispositional structures, nor *vice versa*.

Meanwhile, Esfeld has changed his opinion about fundamental properties and now admits that they are indeed intrinsic.[6] Surprisingly, he does not consider this concession dramatic and believes that OSR can survive it almost intact. He claims that fundamental properties would undermine moderate OSR only if they contribute, as intrinsic properties, to the identities of their bearers. In that case, structural identity conditions would be thrown away and moderate OSR would accept object ontology because the knowledge of objects would require the knowledge of intrinsic properties. But this does not happen, and Esfeld is right, because objects are indiscernible from fundamental properties. For instance, positively charged electrons are indiscernible from positive charge because, loosely speaking, they all share the same positive charge. Although this partial tolerance to intrinsic properties may become a strong weapon in the hands of Esfeld's opponents, there is another reason why moderate OSR (with dispositional relations) should accept it.

3.7 Dispositions may not be manifested, and the same holds for dispositional relations. It is then conceptually possible to have an object whose extrinsic properties are not, currently, manifested because it is not under a relevant stimulus. As a result, a given object does not manifest its modes, does exist outside relations, and thus becomes a mysterious unobservable.[7] In order to avoid this, moderate OSR should stipulate that *some* dispositional relations are necessarily manifested, but this would be a rather controversial proposition. A partial fix comes from fundamental physical properties because they manifest their powers spontaneously, outside relations, as they do not need triggering conditions (Dorato and Esfeld 2010, 8-9)[8]. If isolated entities exemplify such properties, then they are indeed observable. On the other hand, since fundamental physical properties are not relational, they do not prevent their isolated bearers from losing structural identity conditions, and this is in sharp contrast to

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[6] This shift has been indicated in an e-mail exchange.
[7] I owe this point to F. Huoranszky and H. Ben-Yami.
[8] The page number refers to the reprint.

moderate OSR's view of objects. Its defenders can only respond by either saying that isolated entities are *empirically* impossible, or by limiting the scope of their theory. The truth is that the impossibility of isolated objects is already contained within the monistic aspect of moderate OSR, and so its scope does not have to be limited. Once again, a problematic monism proves to be useful.

Conclusion

We have started with the rather sketchy claim that the repertoire of OSR requires physical structures and scientific realism. Then we have moved on to moderate OSR and come up with a more specific list. Moderate OSR required objects with structural identity conditions, and it also required causal relations as modes of their bearers and denied intrinsic properties (with the exception of fundamental physical properties). This repertoire, however, uncovered several tensions and problems in moderate OSR. Their main source is the ontological inseparability of relations from their bearers because it implied radical monism. But inseparability cannot be avoided because it prevents objects from becoming mysterious unobservables, and so the problematic monism can be consistently rejected only if objects are denied. Then, however, we confront objectless structures and this is what Esfeld rejects. An ideal solution would consist of keeping objects tied to dispositional relations, but preventing ontological dependence from spreading throughout the entire structure.[9] In this sense, moderate OSR requires further refinements.

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[9] For instance, replacing monism with an acceptable holistic framework.

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