Lowe's Eliminativism about Relations

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Abstract

Contrary to widely shared opinion in analytic metaphysics, E.J. Lowe argues against the existence of relations in his posthumously published paper *There are* (*probably*) *no relations* (2016). In this chapter, I assess Lowe's eliminativist strategy, which aims to show that all contingent "relational facts" have a monadic foundation in modes characterizing objects. Second, I present two difficult ontological problems supporting eliminativism about relations. Against eliminativism, metaphysicians of science have argued that relations might well be needed in the best a posteriori motivated account of the structure of reality. Finally, I argue that, by analyzing relational inherence, trope theory offers us a completely new approach to relational entities and avoids the hard problems motivating eliminativism.

Keywords

Relations; Relational Inherence; Modes; Tropes; Eliminativism about Relations

1 Introduction

It has been a widely shared view in analytic metaphysics that we need to postulate relations in order to provide an adequate account of reality. For instance, concrete objects are spatio-temporally related in various ways and the spatio-temporal arrangement of objects is contingent relative to their existence and monadic properties. Here the most straight forward conclusion is

that there are additional entities, spatio-temporal relations, which account for objects' being spatio-temporally related in different ways. Similarly, influential metaphysicians of science have maintained that relations figure among the fundamental constituents of reality according to reasonable interpretation of the best physical theories (Butterfield 2006; Teller 1986). In contradistinction with this widespread enthusiasm about relations, certain prominent metaphysicians have recently denied the existence of relations or similarly structured relational entities (Campbell 1990; Heil 2012; Simons 2016). In his posthumously published paper *There are* (*probably*) *no relations* (2016), E. J. Lowe joins the ranks of eliminativists about relations. According to Lowe, in addition to substances and kinds, there are only "monadic" modes and attributes. There are contingent relational truths, but they all have a non-relational truthmaker.

In this chapter, I will argue that the eliminativism about relations Lowe and these other metaphysicians advocate has a strong initial motivation. As does Lowe, I will assume that the proposed relations connecting distinct objects are *relational modes*, particular relations relating (i.e., relationally inhering in) certain specific objects.[1] Relational modes face two problems, which are hard to solve. The first main problem concerns the location of relations as parts of concrete reality. If relational modes are assumed to be parts of the realm of concreta, they are supposed have some spatial/spatio-temporal location. Nevertheless, the standard conception of relational modes does not give us any resources to determine their spatial, temporal or spatio-temporal location. The second problem is the non-modal version of Bradley's relation regress. Here, the

[1] Wieland and Betti (2008) and Maurin (2010, 2011) have also advocated relational modes, cf. Keinänen (2018), pp. 166–168. I do not consider Russellian relation universals directly instantiated by objects here. However, parallel problems can be addressed to them, cf. Keinänen, Hakkarainen, and Keskinen (2016).

main claim is constitutive: assume that relation *R* relates two or more entities. According to the main claim, *R*'s relating certain distinct entities is itself based on the fact that *R* is related to its relata by additional relations. A vicious infinite regress ensues. Although the friends of relations may claim that relations are primitively relating entities, the non-modal Bradley's relation regress puts the existence of all relating relations in jeopardy.

Moreover, I will assess Lowe's (Lowe 2016) own eliminativist strategy, which is based on the insight that all contingent "relational facts" have a monadic foundation in modes characterizing objects. Thus, Lowe attempts to avoid the postulation of relational modes. Nevertheless, Lowe's strategy is based on fairly strong general assumptions about the structure of space, for instance. As I will argue, it would be an additional strength of an ontological category system to be able to allow for the existence of relations or relation-like entities. I argue that one can deal with two major difficulties on relational modes without recourse to eliminativism, by analyzing relational inherence. Such analysis can be carried out in the context of trope theory SNT (Strong Nuclear Theory), as a generalization of the trope theoretical analysis of monadic inherence. This offers us an additional reason to adopt trope ontology instead a category system introducing primitive substances and the inherence relation.

Almost all metaphysicians admit that there are relational facts about entities, which need not be "grounded" by the inherence of relational entities.[2] For instance, *two* entities can be distinct without there being a *third* entity, the relation of distinctness that "makes" them distinct. In Section

[2] In this chapter, I will use the notion of grounding loosely for metaphysical determination. Instead of assuming that grounding is primitive, we may clarify it in terms of generic identity, for instance, cf. Jani Hakkarainen's chapter in this volume.

2, I will present a conception of different kinds of internal relations, which provides us with a principled account of relational facts that need not be "grounded" by the inherence of the corresponding relational entity. Section 3 illustrates how Lowe's eliminativist strategy can be construed by leaning on this general conception. Section 4 discusses the two difficulties that can be addressed to the ontological positions assuming relational modes. Finally, in Section 5, I show that the trope theoretical analysis of relational inherence offers us a new way out of these difficulties.

2 Basic and derived internal relations

There has been at least four different conceptions of internal relations present in the recent literature. I will not discuss these conceptions here because we have discussed most of them in detail elsewhere (Keinänen, Keskinen, and Hakkarainen 2019, sec. 2).[3] It is crucial to the view of internal relations presented in this chapter that internal relations are not any kind of relational entities, constituents of reality distinct from or additional to their relata. The corresponding relational predications indicate that entities are related in a certain way, but there is no relational entity that relates these beings.

According to *the existential conception of internal relations*, entities *e* and *f* are internally related by relation *R* if and only if the holding of *R* is necessitated by the existence *e* and *f*.[4] Our conception modifies the existential conception and might be therefore called "a *modified existential*

[3] Cf. also Yates (2016).

[4] The existential conception of internal relations is advocated by Campbell (1990) and Mulligan (1998), for instance.

conception". Assume that certain relation *R* holds of holds of entities a_1,..., a_n, these entities are related in an *R*-way. *R* is a *proto internal relation* if [PIR] holds.

> [PIR] Necessarily, entities a_1,…, a_n are related by proto internal relation *R* if and only if a_1,..., a_n exist.

On the plausible assumption that holding of a relation entails that its relata exist, all internal relations in the sense of the existential conception are proto internal, and vice versa. The simplest example is the proto internal relation of distinctness that holds between any two distinct entities. However, some internal relations hold due to entities being internally related to additional entities. For instance, according to Lowe's four-category ontology, an electron exemplifies the attribute of -e charge because that electron instantiates the kind electron and the kind electron is characterized the attribute of -e charge. In a different kind of case, a particular rose exemplifies the attribute of redness because it is characterized by a redness mode, which instantiates the attribute of redness. In both cases, the holding of the relation of exemplification is derivative from the holding of two more fundamental internal relations: characterization and instantiation. Moreover, an additional entity is involved in the "grounding" of the exemplification relation. The kind electron in the first case, a redness mode in the second. However, there is a difference in the modal status of the holding of exemplification. In the first case, it holds necessarily given the existence of its relata, in the second case, only contingently (Lowe 2012, pp. 242–244). We have introduced the notion of *derived internal relation* to deal with cases like Lowe's exemplification:

> [DIR] Necessarily, entities a_1,…, a_n are related by derived internal relation *R* if and only if the holding of *R* of a_1,…, a_n is derivative from proto internal relations holding between entities some of which are distinct from a_1,…, a_n.

Some derived internal relations are proto internal, but some are not as was seen in the case of Lowe's exemplification relation(s). Another kind of example of a derived internal relation drawn from trope ontology is the relation of having the same charge as between two electrons, which holds between two electrons because they possess charge tropes that are connected by the relation of 1:1 proportion (Keinänen, Keskinen, and Hakkarainen 2019, secs. 2–3). While this derived internal relation holds necessarily if it is relata exist, Campbell's (Campbell 1990, sec. 5.8) *founded external relations* are derived internal relations that are contingent given the existence of their relata.

Thus, derived internal relations may or may not be proto internal. The essential thing with derived internal relations is that they need some entities additional to their relata in order to hold. Yet, derived internal relations must not be reified as relational entities: their holding is derivative from the holding of some proto internal relations. Nevertheless, there are *basic internal relations*, which hold in virtue of the sole existence of their relata:

> [BIR] Necessarily, entities $a_1,\ldots, a_n$ are related by basic internal relation R if and only if R is a proto internal relation and the holding of R of $a_1,\ldots, a_n$ is not derivative from proto internal relations holding between entities some of which are distinct from $a_1,\ldots, a_n$.

All basic internal relations are also proto internal. All proto internal relations are either basic internal or derived internal, but they cannot be both. In addition to being proto internal, basic internal relations hold in virtue of the sole existence of their relata. This condition is expressed by the claim that the holding of basic internal relations is not derivative from the holding of proto internal relations holding between entities some of which are additional to the relata of the original relation.

Important examples of basic internal relations are *formal ontological relations* such as identity, distinctness and mereological relations (being part of, being disjoint of). In addition to identity, Lowe (2006), sec.3, takes instantiation, characterization, composition and constitution as fundamental formal ontological relations in his four-category ontology. According to Lowe (2006), p. 103, formal ontological truths are made true and necessitated by the existence of their relata.[5] In addition to formal ontological relations, the exact similarity between two distinct redness modes is considered a basic internal relation in a substance mode ontology. The same can be said about the relations of less than exact resemblance between two property universals in an ontological position assuming universals. Similarly, we have argued that, in trope ontology, quantity tropes falling under a determinable are mutually connected by the basic internal relations of proportion and order. For instance, an e charge trope is in the relation of 3:1 proportion to every *e*/3 trope (Keinänen, Keskinen, and Hakkarainen 2019, sec. 3). Tropes are related by the relation of proportion because of being the particular natures they are.

In the present chapter, I will not take up the challenge of spelling out the details of the relevant kind of *derivativeness* figuring in [DIR] and [BIR]. There are, however, two important constraints on any suitable conception of derivativeness: first, *derivativeness* is modally as strong as metaphysical necessitation – a set of basic internal relations necessitates the holding of a derived internal relation. Second, the notion of derivativeness must be *hyperintensional*. A merely intensional notion, whose fineness of grain only reaches the level of metaphysical necessity, would be incapable of distinguishing between two different kinds of cases: (1) those in which an internal

[5] In final analysis, Lowe assumes that fundamental general essences determine formal ontological truths. However, in this chapter, I will omit this feature of Lowe's views.

relation holds in virtue of some entities that are necessarily co-existent with but distinct from the relata (such as their necessary proper parts); and (2) those in which an internal relation holds in virtue of the mere existence of the relata. In (1), we are dealing with a derived internal relation, whereas in (2), we have a basic internal relation.

One might ask whether [DIR] is conductive to making *all* true contingent descriptive predications to express a derived internal relation. For instance, a_1 and a_2 are related by the relation of 1 m distance if and only if the holding of 1 m distance is derivate from proto internal relations holding between third entity a_3 and a_1, on the one hand, and a_3 and a_2, on the other. If the third entity a_3 is a relational mode of 1 m distance, a_3 is assumed to stand in the internal relation of relational inherence to a_1 and a_2 (cf. Section 5). The objection is correct, but a true relational predication expressing inherence of a relation would express a limiting case of a derived internal relation. Here, it is not the relational predicate that refers to/corresponds to a relational entity but its function is syncategorematic: it applies to a relational mode and its relata, if the (alleged) formal ontological relation of relational inherence holds between them.[6] Nevertheless, the relational fact is assumed to hold in virtue of the existence of a relational entity and its relata.

3 Lowe's eliminativist strategy

There are two notable differences between how Lowe presents his eliminativist strategy and how the same strategy will be construed here. First, Lowe (2016), p. 101ff., talks about relational truths or predications and their truthmakers. Second, he distinguishes between formal and material

[6] Cf. Smith (2005), secs. 19–20.

predicates. The former do not denote to a corresponding entity (universal), whereas the latter do (ibid.). By contrast, I have kept the "material mode" by talking about internal relations and their relata. Moreover, as I indicated in the previous paragraph, *all* relational predications can be seen as syncategorematic, not just the formal ones.

These differences are fairly easy to overcome. One can say that corresponding to a formal ontological relation, we can construct a formal ontological relational predication, which is made true by the existence the relata of the formal ontological relation. By talking about "formal ontological relations", one avoids the semantic ascend. By the same token, one avoids the need to take stand on the difficult related issues like the nature of primary truth-bearers. Similarly, one can talk about basic internal relations instead of the corresponding relational truths.

Moreover, Lowe construes certain predicates as expressions denoting to universals. Drawing from the tradition of term logic, he takes predicates as expressions which are names of the corresponding universals. The names of objects and modes denote to objects and modes. In this approach, we need additional expressions like "instantiates", "is characterized by", "exemplifies" to construct complete sentences, which indicate the formal relations in which particulars and universals are (Lowe 2013, sec.4). By contrast, standard predicate logic treats predicates as "unsaturated" expressions, which can be made complete sentences by adding one or more singular terms. In the present chapter, I conceive all predicates in this standard way as unsaturated expressions. They can be used to describe the holding of internal relations between entities.

We can now apply Lowe's eliminativist strategy to formal ontological relations. Assuming that we can consider Lowe's instantiation and characterization fundamental formal ontological relations,

they hold in virtue of the existence of their relata (Lowe 2016, pp.102–103). By contrast, the holding of exemplification requires that certain entities additional to its relata exist, it is a derived internal relation in our terms (Lowe 2013, p. 104).

Derived internal relations expressed by material predications figure in a central place in Lowe's eliminativist strategy, which aims to show that all contingent relational facts have a monadic foundation. According to Lowe, all derived internal relations expressed by material predication hold in virtue of the existence of entities and their monadic modes. We need not postulate any relational modes. However, there are very different kinds of such relational facts. In some cases, it is fairly clear that a relational fact has a monadic foundation. Consider the relation of having the same height as between Tom and Sally (Lowe 2016, pp. 105–106). Assuming that there are monadic height modes, this relation holds because Tom is characterized by height mode m_1 and Sally is characterized by height mode m_2, and m_1 and m_2 are exactly similar height modes. Here, characterization is a basic internal relation between objects and modes and exact similarity is a basic internal relation between modes. One may also interpret Lowe to take exact similarity as a derived internal relation between modes, which holds because m_1 and m_2 are instances of the same height universal, the property universal of 179 cm length, for instance.[7] Whichever way we interpret Lowe here, being of the same height as is a derived internal relation between its relata.

[7] "And it can certainly be the case that these two height-modes are modes of the exactly the same universal (a certain *determinate* height universal, say *height of five foot six inches*), or that they are *exactly similar* height-modes. Whichever way one puts it, it will be an *essential* truth that *those* height-modes are modes of exactly the same universal, or are exactly similar to one another" (Lowe 2016, pp. 105–106). Here, Lowe seems to leave open which of these essential truths expresses the holding of a basic internal relation.

Nevertheless, Lowe applies the same eliminativist strategy to causal and spatial relations. It is certainly less clear that we need not introduce any relational modes to function as a (partial) foundation of these relations. Let us consider causal relations first. Here, Lowe (op. cit., pp. 107–108) adopts a causal powers-based account of causal relations. According to this view, the reciprocal power modes characterizing objects "ground" the causal relations between the corresponding objects. A causal relation holds between two objects because of the power modes of its relata and the essential rigid dependence of the additional manifestation modes of some of these substances on the power modes. For instance, assume that the water is causing some salt to dissolve in water. The holding of this causal relation between a sample of water and some salt is based on water's power mode (to dissolve salt) and salt's liability mode (to be dissolved in water). Moreover, the manifestation of these powers (the salt dissolving in water) is an additional mode of the salt, which is essentially rigidly dependent on the two power modes (ibid.).

According to Lowe's view, causal relations need no relational modes to act as their foundation. The holding of causal relation is based on the existence of these three modes of the related objects and the basic internal relation of rigid dependence between the modes. Thus, causal relation seems to be a derived internal relation between the objects. Although Lowe's account is interesting, it seems to leave the facts about spatial location and time largely implicit: for instance, one might claim that causes precede/are simultaneous to their effects in some spatial location. Modes and objects are concrete entities with some definite location, but no account of their relative locations is involved in the proposed view. This seems to leave question about whether there is a need to introduce some relational entities also in Lower's power-based account of causation an open issue.

Lowe (2016), pp. 110–111, does offer us a non-relational account of the spatial location of objects preserving the intuitive basic idea that locations of objects are contingent relative to their existence and monadic properties. He regards space as an extended simple, an extended entity without proper parts, which is distinct from the objects occupying space. Thus, space is not divided into proper parts, regions with some definite boundaries. Rather, shapes are modes of objects, which are also their spatial boundaries. Objects do not stand in external occupation relations to the spatial regions they occupy (areas of space), but, rather, are characterized by certain modes, which are these regions and also constitute their boundaries (ibid.).

Hence, in order to avoid relational modes, Lowe introduces "*co-ordinate modes*", which are both shapes of objects *and* specify their locations in space. According to this view, spatial relations between objects are derived internal. For instance, objects *a* and *b* are in a 2 meter distance from each other because of *a* and *b* having their specific co-ordinate modes. The co-ordinate modes are locations of objects. Because of their nature, the co-ordinate modes are in certain spatial relations to all other co-ordinate modes. The relations of spatial distance between co-ordinate modes hold in virtue of the existence of their relata. In other words, they are basic internal relations between co-ordinate modes.

The type of account Lowe proposes to avoid spatial relations can probably be generalized to spatio-temporal relations. Nevertheless, many of its details remain unclear. According to Lowe, co-ordinate modes are shapes of objects. Their main function is, however, to act as locations of objects.

We may ask: what exactly is the co-ordinate nature of a certain mode? Any change in spatial relations between objects seems to entail that *all* co-ordinate modes of objects are replaced with new co-ordinate modes (cf. MacBride 2016, sec.3). Is it possible to build such dependence on the modes of all other objects into the single monadic modes of particular objects?

4 Difficulties with relations

Metaphysicians have provided some weighty reasons to reject relations and all relational entities. In this chapter, I consider two of them. The one is F. H. Bradley's (Bradley 1897) famous relation regress. Another is the general difficulty of determining the location of relations as parts of concrete reality. As does Lowe, I will assume that relations are *relational modes*. Like monadic modes (particular properties or the ways objects are), relational modes are particular relations or the ways objects are related. A relational mode of 1 m distance relating *a* and *b* is a way objects *a* and b are related. As I have argued elsewhere (Keinänen 2018, sec.2), certain metaphysicians have recently defended relational modes, although calling them "relational tropes" (Maurin 2010, 2011; Wieland and Betti 2008).[8]

Consider again relational mode *r* of 1 m distance relating objects *a* and *b*. Two clams hold true of these three entities (Keinänen 2018, p. 165):

[8] The main general difference between tropes and modes is the following: modes are assumed to stand in the fundamental formal ontological relation of inherence (characterization) to objects. By contrast trope theories attempt to analyze the inherence of tropes in objects by means of more fundamental relations (such as co-location, parthood and existential dependencies) (Keinänen (2018), sec.1).

1. Necessarily, if mode *r* exists, *r* relates (relationally inheres in) its specific relata, *a* and *b*.
2. Necessarily, if relational mode *r* exists, its relata, *a* and *b*, also exist. To put this in formal ontological terms, mode *r* is multiply rigidly dependent (only) on its relata, *a* and *b*.[9]

Claim 1 tells that relational modes are analogous to monadic modes. Necessarily, if a monadic mode exists, it characterizes a certain definite object. Similarly, necessarily, if a relational mode of 1 m distance exists, it relates certain objects *a* and *b* in a certain way. Plausibly, if a relation relates certain relata, the relata must exist. Therefore, claim 1 entails claim 2. By contrast, the converse does not hold: 2 does not entail 1 (Keinänen 2018, pp. 165–166).

The advocate of relational modes would consider relational inherence as a fundamental formal ontological relation holding between a relational mode and its relata. Thus, relational inherence would be a basic internal relation: necessarily, if relational mode *r* and its relata, *a* and *b* exist, *r* relationally inheres in its relata. In this respect, relational modes are completely analogous to monadic modes, which primitively characterize their bearers. Moreover, relational modes are considered to solve the modal version of Bradley's regress (the modal Bradley's regress). The modal Bradley's regress is premised on the claim that the existence of a relation and its relata does not entail that the relation holds between its relata. The modal Bradley's regress is blocked because the existence of a relational mode is assumed to entail that the mode relates its specific relata (ibid.).

[9] Let "≤" be a relation of improper parthood between entities and "E!" the predicate of (singular) existence. "SRD (*e*, *f*)" = *e* is strongly rigidly dependent on *f*. The multiple rigid dependence of *t* on *f* and *g*, "MRD (*t*, (*f*, *g*))", can be presented as follows: MRD (*t*, (*f*, *g*)) = (❑ (E!*t* → (E!*f* ∧ E!*g* ∧¬(*f* ≤ *t*)∧¬(*g* ≤ *t*) ∧¬(*f* ≤ *g*)∧¬(*g* ≤ *f*))) ∧¬(❑ (E!f)∧¬ (❑ (E!*g*)∧¬ (SRD(*f*, *g*)) ∧¬ (SRD (*g*, *f*)).

The non-modal Bradley's regress puts this very assumption in jeopardy. In other words, the possibility of there being any relational modes, that is, entities that stand in the basic internal relation of relational inherence to two or more entities, is contested. Here, I confine myself presenting the regress argument very briefly.[10] Assume (counterfactually) that relation *r* relates two entities *a* and *b* and unifies them all into a complex entity *rab*. Thus, relation *r* holds between its relata, *a* and *b*. Relation *r* can hold between its relata and unify itself and its relata into a complex entity only if *r* is related to its relata by additional relations r' and r''. In other words, $r'ra$ and $r''rb$ hold. Since the same reasoning can now be applied to these new entities, an infinite regress ensues. Hence, the main claim in the non-modal Bradley's regress is hypothetical and constitutive. If there are relational modes, each mode's relating its relata is constituted by the holding of additional relations. An infinite regress of relational modes results because every mode's relating must be based in the existence of additional modes (i.e., holding of additional relations). The regress is vicious because the existence of each relational mode and its relating some distinct entities presupposes the existence of some new relational modes. We never reach the bottom level, in which there would only be some modes relating their relata. Since the assumption that there are relational modes leads to a vicious infinite regress, there *cannot* be relational modes.

An advocate of relational modes might counter-assert the regress claim by maintaining that relational inherence is a fundamental formal ontological relation between a relational mode and its relata. Relational modes are basic entities of an ontological category system and it is their primitive formal ontological feature to relate their specific relata in a certain way. We need not introduce

[10] Bradley (1897), pp. 27–28. For a detailed account of non-modal Bradley's relation regress, see Hakkarainen and Keinänen (manuscript), cf. also Perovic (2017).

any additional entities. Nevertheless, nothing in this answer provides us with any independent reason to believe that there can be relational modes. In other words, that we are entitled to consider relational inherence a fundamental formal ontological relation between relational mode and its relata. As a consequence, we have not shown that particular relations connect their relata without themselves being involved in a vicious infinite regress (cf. MacBride 2011).

Another problem with relational modes concerns their location as parts of concrete reality. As Lowe (2016), pp. 111–112, puts it, a relational mode would be an entity rigidly dependent on two distinct and mutually independent objects. For the sake of argument, consider 1 m distance mode *r* relating John and Mary, which accounts for John being in a 1 m distance from Mary. 1 m distance mode *r* would be entirely distinct and mereologically disjoint from its bearers (John and Mary). John and Mary are distinct objects, but it seems that they do not themselves constitute a complex object. Consequently, unlike a monadic mode, the relational mode would not be an abstraction from any particular substance, it would not be "in" any substance. As Lowe (2016), p. 111, complains:

> A relation 'accident', if there could be such a thing, would not be 'in', or at least not wholly 'in', *any* of its two or more 'subjects', nor even wholly in the totality of them. I consequently find it hard to conceive what such an entity could really *be*.

Thus, distance mode *r* would not be "in" its relata, John and Mary. The postulation of entities like the relational distance modes would not fit with the Neo-Aristotelian conception of modes.

As an additional consequence of assuming relational modes, it would be hard to specify the spatial (or spatio-temporal) location of relational mode *r*. Unlike a monadic mode, relational mode *r* would not be co-located with any substance. Relational mode *r* would be a "weird" entity

somewhere close to two distinct substances (cf. Simons 2003). The standard category systems assuming relational modes do not give us any additional resources to determine the location of relational modes. This puts the claim that relational modes are parts of the system of concrete entities, even if determining their relative locations, in jeopardy. On the other hand, assuming that relational modes are non-spatio-temporal, that is, abstract, contradicts the reasonable claim that relational modes are concrete instances of relation universals. As a consequence, a category system introducing relational modes is seriously incomplete unless it can provide us with a more detailed account of the location of relational modes.

5 The third way: analysis of relational inherence

In addition to Lowe's co-ordinate quality view, there are other interesting forms of eliminativism about relations. For instance, Peter Simons (2016) has suggested a process ontology and a causal theory of time in order to avoid the need for introducing relations to ground the spatio-temporal locations of entities.[11] The assessment of different forms of eliminativism about relations is an interesting and unfinished project, but there are weighty reasons to keep the door open for relations or relation-like entities in an ontological category system. The first reason is that a relational theory of space or space-time is still an important option among the rival views. Since the relative locations of objects are contingent relative to their existence and monadic properties, one live option is to assume that space-time (or space) is constituted by relations or relation-like entities that connect the occupants of space.

[11] Cf. Keinänen (2018), sec.3, for a brief criticism of Simons' eliminativism about relations.

Second, recent metaphysicians of science have argued that the current physical theories provide us with independent reasons to postulate relations or relation-like entities. The current quantum physics introduces entangled states of two- or multi-particle systems, which are serious candidates for fundamental relations between particles (cf. Karakostas 2009; Teller 1986). For instance, Paul Teller (1986), sec.4, has argued that entangled spin-states of two superposed electrons are best considered relations, which do not supervene on the spatio-temporal arrangement and the monadic properties of these particles. Jeremy Butterfield (2006) argues that both classical and relativistic mechanics introduce fundamental quantities that should not be considered intrinsic properties of space-time points. We may need to introduce relations in order to account for some of such quantities. Finally, quantum field theories introduce interactions of particles mediated by virtual particles, which might also be considered relational entities.

There is perhaps no single reason which could show that the eliminativism about relations is false. Nevertheless, independent considerations suggest that it is a reasonable strategy to allow for the existence of relations or relation-like entities in an adequate ontological category system. By the same token, one should remain critical to the standard ways in which relations are introduced in analytic metaphysics. Relational modes already avoid some of the difficulties one can attribute to Russellian relation universals (Keinänen, Hakkarainen, and Keskinen 2016; Maurin 2010, 2011). As we saw above, however, the theories postulating relational modes have not provided any account of their location as parts of the realm of concreta. Second, the advocates of these views have not been able to show that relational modes are possible against the conclusion of the non-modal Bradley's regress.

In what follows, I will argue that we can deal with both of these difficulties by analyzing relational inherence. The trope theoretical analysis of relational inherence aims to generalize the trope analysis of monadic inherence to "relational tropes". In the analysis of monadic inherence, the inherence of a trope in an object is identified with the holding of certain other relations (like parthood, co-location, existential dependencies) between these entities. Similarly, a trope theory analyzing relational inherence identifies the facts about two or more entities being connected by a relation with the facts about the entities of the trope theoretical category system. Since relational inherence is explained away, also relational modes (i.e., primitively relating entities) are eliminated from trope theory. However, certain tropes, which I call "*r-tropes*", will take the role of relational entities in the present account.

The different trope bundle theories analyze *monadic inherence* in different ways. Before going to relational inherence, it is instructive to consider two different trope theoretical analyses of monadic inherence. According to Keith Campbell's (1990) classical trope theory, objects are mereological sums of mutually co-located ("compresent") tropes. In this classical view, monadic inherence (a trope being a property of an object) can be analyzed in the following way: trope *t* inheres in object *i* if and if *t* is a part of *i* and *t* is co-located with *i*.[12] According to Campbell's trope theory, tropes are particular natures and mutually co-located parts of objects. A trope is, derivatively, a property of an object if it fulfills the just-mentioned condition relative to some object (a sum of co-located tropes).

[12] Since Campbell (1990), secs. 4.3–4.4, constructs complex quantity tropes as "conjunctive compresences" of simpler tropes falling under the same determinable, an additional maximality condition would be needed to be added to the analysis in order to deal with such mutually co-located tropes forming a complex trope.

In contradistinction with Campbell's trope theory, the trope theory SNT (Keinänen 2011; Keinänen and Hakkarainen 2010, 2014) claims that tropes are mutually existentially dependent entities. Objects are constituted as aggregates of tropes connected by the formal ontological relations of rigid and generic dependence.[13] In this chapter, I provide only a brief description of some features of the SNT directly relevant to the present discussion. According to the SNT, every object has either a single nuclear trope or, alternatively, two or more tropes rigidly dependent on each other, the nuclear tropes.[14] Nuclear tropes are necessary parts of an object *i* and, intuitively, constitute its "necessary properties". Trope *t* is a part of object *i* if and only if *t* is rigidly dependent only on the nuclear tropes of *i*. Object *i* is a *dependence closure* of tropes with respect to rigid dependence.[15] Because object *i* is a dependence closure of tropes, *i* is not rigidly dependent on any entity which not its proper part.[16]

There are two crucial differences between Campbell's classical trope theory and the SNT. First, the SNT constructs objects from tropes by means of the relations of existential dependence. Unlike Campbell's trope theory, the SNT does not rely on compresence. Second, the location of individual

[13] Let "≤" be a relation of improper parthood and "E!" the predicate of (singular) existence. Entity *e* is strongly rigidly dependent on entity *f*, if the following condition holds: $\neg(\Box\, E!f) \wedge \Box((E!e \rightarrow E!f) \wedge \neg(f \leq e))$, cf. Simons (1987), pp. 112 and 294ff.).

[14] According to the SNT, trope *t* is a nuclear trope if and only if 1) *t* is not rigidly dependent on any other trope (a single nuclear trope), or 2) *t* is rigidly dependent on certain trope(s) which are also rigidly dependent on *t* (two or more nuclear tropes).

[15] A dependence closure of tropes with respect to rigid dependence is a plurality of tropes in which all rigid dependencies of the tropes in the plurality are fulfilled. Moreover, we assume that necessarily, if these tropes exist, they form an individual. As a consequence, that individual is not rigidly dependent on any mereologically disjoint entity, cf. Keinänen (2011), pp. 446–447.

[16] The applicability of the notion of rigid dependence is restricted to contingent existents.

tropes is determined in radically different ways. In Campbell's trope theory, individual tropes are relata of the basic spatio-temporal relations. By contrast, according to the SNT, the certain kinds of aggregates of tropes (e.g., the nuclear tropes of a substance) form individuals, which are minimal relata of the basic spatio-temporal relations. The spatio-temporal locations of these complex entities determine the locations of their constituent tropes. In a simple case, object *i* is constituted solely by its nuclear tropes and the location of *i* determines the location of the tropes that are its proper parts. In this simple case, we can analyze monadic inherence as follows: trope *t* inheres in object *i* if and only if, necessarily, if *t* exists, *t* is a proper part of *i* and *t* is co-located with *i* (Keinänen 2011, pp. 438–440).

The purpose of this simplified presentation of the trope theory SNT was to show that the theory has enough resources to generalize the analysis of monadic inherence to relational inherence (a trope relating two or more entities). The next step is to introduce *r*-tropes, tropes which take the role of relational entities in the proposed account. Like relational modes, *r-tropes* are *multiply rigidly dependent* (MRD) on two or more entities. In order to rule out trivial cases, I assume that trope *r* and its dependees exist contingently.[17] Trope *r* is multiply rigidly dependent on entities *a* and *b* if and only if the following three conditions obtain. First, necessarily, if trope *r* exists, entities *a* and *b* (its "relata") also exist. Second, entities *a* and *b* are mereologically disjoint and mereologically disjoint from *r*. In other words, the dependees of a multiple rigidly dependent trope are mereologically disjoint ("wholly distinct") entities. Third, entity *a* is not rigidly dependent on

[17] The characterization of rigid dependence and multiple rigid dependence are thus restricted to contingent existents, cf. Simons (1987), pp. 294ff., for a similar restriction.

b, or vice versa. In the SNT, the third condition guarantees that the dependees of multiply rigidly dependent entities are parts of distinct objects.

As I remarked above, multiple rigid dependence does not entail relational inherence. I suggest that we add three more conditions in order to obtain the conclusion that trope *r* relates, that is, relationally inheres in *a* and *b*. I will require that trope *r* together with its relata forms a complex individual, an *r-complex rab*, which is a spatio-temporally located entity.

The first two conditions concern the constitution of an *r*-complex. First, objects *a* and *b* are the only entities on which trope *r* is rigidly dependent, *r* is rigidly dependent only on *a* and *b*. Second, trope *r* together with its dependees, *a* and *b*, forms an individual, an *r-complex rab*.[18] R-complex *rab* is a dependence closure of its proper parts with respect to rigid dependence. As a dependence closure of its parts, *r*-complex *rab* is itself a strongly rigidly independent entity, it is not rigidly dependent on any entity that is mereologically disjoint from rab. Hence, *r*-complexes are substances in the weak sense of being *strongly independent particulars and individuals*.

The third condition is that *r*-complex *rab* is a spatio-temporally located entity: *r*-complex *rab* has a spatio-temporal location and its location determines the location of its constituent *r*-trope *r*. Like the objects constituted by their nuclear tropes, an *r*-complex is a strongly independent particular and has all of its proper parts necessarily. Moreover, the location of the *r*-complex determines the

[18] Note that every *r*-complex is an individual and a mereological sum of its parts (e.g., $r + a + b = s$).

location of its existentially dependent part, *r*-trope *r*. On the basis of these assumptions, I now propose the following analysis of the holding of relational inherence:

[RI] Trope *r* relationally inheres in *a* and *b* if and only if:

1. *r* is multiply rigidly dependent (MRD) on *a* and *b*, but not rigidly dependent on any entity that is not a part of *a* or a part of *b*.
2. *a* and *b* are not rigidly dependent on *r*.
3. *a* is not rigidly dependent on *b*, and *b* is not rigidly dependent on *a*.
4. *r*, *a* and *b* constitute an individual, *r*-complex *rab*.
5. Necessarily, if *r* exists, *r* is exactly co-located with *rab*.

Assume that *r* is a 1 m distance trope. Trope *r* relates (relationally inheres in) *a* and *b*, if *r* is both multiply rigidly dependent on *a* and *b* and necessarily exactly collocated with *r*-complex *rab*, which is a mereological sum of all these three entities (i.e., $r + a + b$).[19]

The purpose of [RI] is to generalize the analysis of monadic inherence of the trope theory SNT to *r*-tropes, which fulfill clauses 1–3 of [RI]. We can achieve this generalization by assuming that the corresponding *r*-complex, whose existence is entailed by the existence of *r*, is an individual having a specific spatio-temporal location. In the SNT, location of an individual determines the location of its existentially dependent trope parts. In this special case, the location of an *r*-complex determines the location of an *r*-trope (the existentially dependent part). Thus, necessarily, if *r*-trope *r* exists, it is co-located with *rab*. Consequently, trope *r* fulfills the conditions of monadic inherence in relation to complex *rab*: necessarily, if *r* exists, *r* is a (proper) part of *rab* and *r* is co-located

[19] In what follows, I leave out the qualification, although I refer to exact co-location when talking about "co-location".

with *rab*. Thus, *r* is a monadic property of complex *rab*. According to [RI], by being a monadic property of *r* complex *rab*, trope *r* also relationally inheres in *a* and *b*.

Tropes are particular natures (-*e* charges, 1 m lengths, etc.). One needs to provide an analysis of inherence in order to spell out the status of a trope as a property of some object. In the SNT, *r*-tropes, like 1 m distance trope *r*, are particular natures co-located with the corresponding *r*-complexes and monadic properties of these *r*-complexes. Moreover, necessarily, if trope *r* exists, *a* and *b* are parts of *r*-complex *rab*. Since *a* and *b* are proper parts of complex *rab*, their locations are parts of the location of *rab*. [20] Thus, *r*-trope *r* is a certain kind of entity that connects mutually distinct entities, *a* and *b*, into a certain kind of more inclusive whole, the *r*-complex. In our example, trope *r* (1m distance trope *r*) relates entities *a* and *b* in a certain way because *r* "makes" *a* and *b* as parts of a certain kind of complex individual, 1 m distance *r*-complex *rab*.

Finally, *r*-tropes avoid the above two difficulties addressed to relational modes. First, since the locations of *r*-complexes determine the locations of *r*-tropes, the latter have a determinate location as a part of the realm of concrete entities. It is obviously a further issue to provide an account of the determination of the location of different kinds of *r*-complexes. However, I have already outlined such an account in the difficult case in which an *r*-complex contributes to determining the spatial location of objects (Keinänen 2018, sec.6). What is essential to the present analysis is that the status of *r*-tropes as spatio-temporally located entities is a direct consequence of their relational inherence.

[20] As Parsons (2007), p. 213, argues, all concrete entities satisfy the following principle of Expansivity: the spatial location of a whole is as least as inclusive as the spatial location of its proper parts.

Second, *r*-tropes avoid the non-modal Bradley's regress. Relational inherence is analyzed away (in terms of parthood, multiple rigid dependence and necessary co-location). Therefore, there is no room for speculative claims about the constitution of relational inherence as expressed in the non-modal Bradley's regress. The remaining formal ontological relations in the analysans (multiple rigid dependence, rigid dependence and parthood) are basic internal. Since "they" are not relational entities, no relation regress can be generated.

6 Conclusion

In this chapter, I have argued that the eliminativism about relations E. J. Lowe advocates is an appealing ontological position in the view of the serious general difficulties one can address to relations. However, relations might well be needed in the best a posteriori motivated account of the structure of reality. In Section 5, I proposed a trope theoretical analysis of relational inherence as a way out of this dilemma. Although more work is required in this direction, the proposed analysis already shows the fruitfulness of the trope theoretical approach in solving the perennial metaphysical problems.

Bibliography

Bradley, F. H. (1897), *Appearance and Reality*, 2. edition, London: Allen and Unwin.

Butterfield, J. (2006), 'Against Pointillisme About Mechanics', *British Journal for the Philosophy of Science* 57(4): 709–754.

Campbell, K. (1990), *Abstract Particulars*, Oxford: Basill Blackwell.

Hakkarainen, J. and Keinänen, M. (manuscript), 'Bradley's Relation Regress and the Incompleteness of the Relata-Specific Answer'.

Heil, J. (2012), *The Universe As We Find It*, Oxford: Oxford University Press.

Karakostas V. (2009), 'Humean Supervenience in the Light of Contemporary Science', *Metaphysica* 10(1): 1–26.

Keinänen, M. (2011), ‘Tropes – the Basic Constituents of Powerful Particulars?’, *Dialectica* 65(3): 419–450.

Keinänen, M. (2018), ‘A Trope Theoretical Analysis of Relational Inherence’, in J. Kuorikoski and T. Toppinen (eds), *Action, Value, and Metaphysics, Acta Philosophica Fennica* 94: 161–189, Helsinki: Societas Philosophica Fennica.

Keinänen, M. and Hakkarainen J. (2010), ‘The Persistence of Simple Substances’, *Metaphysica* 11(2): 119–135.

Keinänen, M. and Hakkarainen J. (2014), ‘The Problem of Trope Individuation – A Reply to Lowe’, *Erkenntnis* 79(1): 65–79.

Keinänen, M., Hakkarainen J. and Keskinen, A. (2016), ‘Why Realists Need Tropes?’, *Metaphysica* 17(1): 69–85.

Keinänen, M., Keskinen, A. and Hakkarainen J. (2019), ‘Quantity Tropes and Internal Relations’, *Erkenntnis* 84(3): 519–534.

Lowe, E. J. (2006), *The Four-Category Ontology*, Oxford: Oxford University Press.

Lowe, E. J. (2012), ‘A neo-Aristotelian Substance Ontology: Neither Relational nor Constituent’, in T. E. Tahko (ed.), *Contemporary Aristotelian Metaphysics*, Oxford: Oxford University Press, 229–248.

Lowe, E. J. (2013), *Forms of Thought*: *A Study in Philosophical Logic*, Cambridge: Cambridge University Press.

Lowe, E. J. (2016), ‘There Are (Probably) no Relations’, in A. Marmodoro and D. Yates (eds), *The Metaphysics of Relations*, Oxford: Oxford University Press, 100–112.

MacBride, F. (2011), ‘Relations and Truth-Making’, *Proceedings of the Aristotelian Society* 111: 159–176.

MacBride, F. (2016), ‘Relations’, in E. N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy* (Winter 2016 Edition), Available online: https://plato.stanford.edu/archives/win2016/entries/relations/

Maurin, A.-S. (2010), ‘Trope Theory and the Bradley’s Regress’, *Synthese* 175(3): 311–326.

Maurin, A.-S. (2011), ‘An Argument for the Existence of Tropes’, *Erkenntnis* 74(1): 69–79.

Mulligan, K. (1998), ‘Relations through Thick and Thin’, *Erkenntnis* 48(2/3): 325–353.

Parsons, J. (2007), ‘Theories of Location’, in D. W. Zimmerman (ed.), *Oxford Studies in Metaphysics* 3: 201–232.

Perovic, K. (2017), 'Bradley's Regress', in E. N. Zalta (ed.), *The Stanford Encyclopedia of Philosophy* (Winter 2017 Edition), Available online: https://plato.stanford.edu/archives/win2017/entries/bradleyregres

Simons, P. (1987), *Parts*: *A Study in Ontology*, Oxford: Clarendon Press.

Simons, P. (2003), 'Tropes, Relational', *Conceptus* 35: 53–73.

Simons, P. (2016), 'External Relations, Causal Coincidence, and Contingency', in A. Marmodoro and D. Yates (eds), *The Metaphysics of Relations*, Oxford: Oxford University Press, 113– 126.

Smith, B. (2005), 'Against Fantology', in J. Marek and E. M. Reicher (eds), *Experience and Analysis*, Vienna: öbv & hpt, 153–170.

Teller, P. (1986), 'Relational Holism and Quantum Mechanics', *British Journal for the Philosophy of Science* 43: 201–218.

Wieland, J. W. and Betti, A. (2008), 'Relata-specific Relations: A Response to Vallicella', *Dialectica* 62(4): 509–524.

Yates, D. (2016), 'Introduction: Metaphysics of Relations: Internal and External Relations', in A. Marmodoro and D. Yates (eds), *The Metaphysics of Relations*, Oxford: Oxford University Press, 7–14.