What Are Tropes Fundamentally? A Formal Ontological Account

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Abstract

In this paper, I elaborate on the Strong Nuclear Theory of tropes and substances, which I have defended elsewhere, by my metatheory about formal ontology and especially fundamental ontological form. According to my metatheory, for an entity to have an ontological form is for it to be a relatum of a formal ontological relation or relations jointly in an order. The full fundamental ontological form is generically identical with a simple formal ontological relation or relations jointly in an order. Regarding generic identity, I follow Fabrice Correia and Alexander Skiles who consider it a form of generalized identity as distinguished from numerical identity. The SNT states that for any trope to have the full fundamental ontological form is for it to be strongly rigidly or generically (existentially) dependent individual simple part. Therefore the common dichotomous set-up of asking whether tropes are fundamentally rather properties than objects or *vice versa* is a non-starter to me in formal ontological terms. The elaboration of the SNT also supplies me with resources to answer the arguments against tropes by Douglas Ehring, Robert K. Garcia and Herbert Hochberg. Finally, I argue that non-fundamentally but necessarily, every trope is a proper part of a substance and concrete in the SNT.

Keywords: tropes, substances, formal ontology, internal relations, generic identity, fundamentality

Introduction

Consider the rest mass of an electron and the equal rest mass of another electron. According to a metaphysical theory called "trope theory", the rest mass of each electron is an entity numerically distinct from both the two electrons and the other rest mass. The rest masses are not numerically identical; they are tropes. Accordingly, tropes are routinely called "particular properties" or "particularized properties" in the metaphysical literature (e.g. Garcia 2016, 2). Especially introductions to metaphysics discuss tropes as such entities.[1] This is intimately connected to the dichotomous approach to tropes that they have to be seen as either properties, objects (i.e. bearers of properties) or more similar to either of them (Maurin 2018, sec. 2.1). For example, David M. Armstrong famously calls tropes "junior substances" – hence more akin to objects than properties (1989, 115).

In this paper, I argue that when one considers the basics of trope theory, one gets on the wrong track right from the start with this dichotomous set-up.[2] The set-up is deeply misleading when one tries to understand what tropes fundamentally are. Here I use "fundamentally" in formal ontological terms that means, to a first approximation, the fundamental *form of existence* of tropes. I shall present the fundamental form of existence of tropes as it is represented by the Strong Nuclear Theory ("SNT", for short) of tropes and substances by Markku Keinänen and me.[3] The SNT states that the full fundamental form of existence of each trope, that is, its full fundamental *ontological form* is to be strongly rigidly or generically dependent (mereologically) simple individual part. Neither propertyhood nor objecthood is mentioned here. The same result should concern any trope theory as a bundle construction of objects.

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[1] Cf. Allen 2016, 39-40; Edwards 2014, 49; Effingham, Beebee & Goff 2010, 255.
[2] By "trope theory", I refer to the trope-bundle theories of substances and objects, in contrast to their trope-substratum theories. "Trope nominalism" covers both of these.
[3] Keinänen 2011; Keinänen & Hakkarainen 2010; 2014; Hakkarainen & Keinänen 2017; cf. also Keinänen, Keskinen & Hakkarainen 2017.

The SNT distinguishes the ontological form of a trope from the ontological identification of the trope with a nature or character (Hakkarainen & Keinänen 2017). Each trope is an entity identified with a nature or character. Since the SNT involves the distinction between ontological form and ontology, it is construed in a specific metaphysical tradition I call "formal ontological". Formal ontological tradition stems from the *Logical Investigations* (1900-1) by Edmund Husserl but it was initiated in analytic metaphysics by Barry Smith and Kevin Mulligan (Smith 1978; 1981; Smith & Mulligan 1983). The basic idea of the formal ontological tradition is that the primary subject matter of metaphysics is ontological form, which includes the membership of ontological categories. Formal ontology studies both. Ontological form provides a unique point of view to the other main branch of metaphysics, ontology, that studies existence questions such as whether there are abstract entities or properties, that is, members of certain putative categories.

Nonetheless, no fully satisfying account of ontological form and its difference from being or existence has so far been put forward in the formal ontological literature. Therefore there is a dire need for a *metatheory of formal ontology* in which this deficiency is removed. Furthermore, the fully satisfactory account of ontological form has to include nowadays a sophisticated view of fundamentality and non-fundamentality, which are intensively discussed by metaphysicians and metametaphysicians (as is documented by Tahko 2018).

Accordingly, the SNT as a formal ontology needs to be elaborated upon by my metatheory. This elaboration concerns especially fundamental ontological form and the elaboration is what I do in this paper. Therefore, I can mostly just assume the SNT and not defend its central tenets here.

The paper has a six-part structure. To describe the fundamental ontological form of tropes in the SNT, first I have to go into a rather long discussion of my metatheory. That I will do in the first two sections of the paper. Then I shall apply my metatheory to the SNT in section 3, which leads me to argue in the subsequent section that the dichotomous set-up of properties, objects or more akin to either of them is a non-starter in the SNT when one is considering the fundamental

ontological form of tropes. In the fourth section, I also establish with the help of my metatheory that the arguments against tropes by Herbert Hochberg (2004), Douglas Ehring (2011) and Robert K. Garcia (2014b; 2015; 2016) fail. This section shows then the fecundity of the elaboration of the SNT by my metatheory. The fifth section discusses two non-fundamental ontological forms of tropes in the SNT: proper parthood of substances and concreteness. I wrap things up in the conclusion.

1.   Ontological Form as Distinguished from Being or Existence

To distinguish ontology from formal ontology in a determinate manner, I have to make a clear and precise distinction between being and ontological form. Regarding being, I do not have to go into the several questions of it, such as whether it is to be expressed by a quantifier or predicate. Suffice it that I simply make two assumptions about being in this paper leaving room for more than one view of it. (1) "Being" and "existence" are both univocal. (2) I follow the mainstream view in analytic metaphysics and metaontology that "existence" and its cognates are interchangeable with "being" and its cognates (van Inwagen 2009).

Let me introduce, for the theoretical purposes below, the technical primitive concept of *character* at this point: the character of an entity is *what the entity is like*. Paradigmatic examples of characters are qualities and quantities entities presumably are or have, such as shape and rest mass. So *character* covers both tropes, accidents, attributes or properties and is therefore a more general concept than all these.[4] In principle, a character may be essential, necessary or contingent to an entity. Therefore, the concept of character here also differs from the concept of essence—whether essence is understood modally or non-modally. Characters of entities belong to the extension of the concept of being or existence in the metaphysical theories that are committed to the existence of characters, for example realism about property universals, mereological nominalism, class or set

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[4] As a consequence, being a bare particular/substance or haecceity is not a character. Rather, it is an ontological form.

nominalism and trope nominalism. The upshot is that being consists of entities, including their character – given there are any characters or entities have any character.

The concept of *ontological form*, in turn, is a complex concept consisting of the concepts of *being* or *existence* and *form.* Of form, I have a relational account in terms of the concept of *character-neutral internal relation*. Character-neutral relations are internal because they are not entities numerically distinct from their relata ("additional entities" in this sense). The relational terms occurring in statements about internal relations do not designate (name) any relational entity (Keinänen, Keskinen & Hakkarainen 2017, ch. 2). They only *apply* to the relata of the internal relation: their reference is divided. To say that books are numerically distinct is not to name any entity additional to the books. Rather, it is to apply numerical distinctness to the books. Yet the holding of internal relations of their relata may be in principle asserted by relational statements expressing propositions true of the relata, such as "the books are numerically distinc". (Ibid.) So in this specific sense, the holding of internal relations is real: the books, for instance, really are numerically distinct.

Character-neutrality is independence from what an entity is like. Thus, a character-neutral internal relation holds independent from the character of its relata. When its holding is asserted, the statement as such, even if true, does not say anything whatsoever about the character of the relata. Therefore, character-neutral internal relations are such internal relations whose holding is expressible by true relational statements that do not describe the character of the relata without further assumptions. Hence, I may initially say that the ontological form of entities is determined by their standing in character-neutral internal relations.

To argue this, let us consider four examples that are typically discussed by contemporary metaphysicians: *being numerically distinct from*, *depending ontologically on*, *being a whole of* and *being a proper part of*. Each of these is *relational*: they are features that entities have in virtue of being related to something; for instance, *x* is a whole in virtue of being related to some entities,

that is, to its proper parts. These relational features of entities may also be tentatively characterized as *ways in which entities exist*: *x* exists *as* numerically distinct from *y*, *x* exists as ontologically dependent on *y*, *x* exists as a whole of *y* and *z* and *x* exists as a proper part of *y*. Thus, these four features may be said to be the *relational ways of existence* of entities – the existence of entities is their standing in a relation to something.

Here we have "way" in the sense of "form"; in these examples we are speaking about the specific *form* of the existence of *x*. Therefore I may say that the relational way of existence of *x* is its *relational form of existence*. For example, the numerical distinctness of a book from other books is its relational way of existence, rather than its character.

The four relational forms of existence above are character-neutral, which can be seen by considering the statements that *x* is numerical distinct from *y*, that *x* ontologically depends upon *y*, that *x* is a whole of *y* and *z*, and that *x* is a proper part of *y*. None of them, *without further assumptions*, describe the character of *x*, *y* and *z* at all. As such it does not tell us anything about the character of *x*, *y* and *z* that *x* is numerically distinct from *y*, that *x* ontologically depends upon *y*, that *x* is a whole of *y* and *z* or that *x* is a proper part of *y*. Therefore these are *formal* statements: they concern the relational form of existence of their relata.

The etymological origin of "ontological" is in Greek *ontos*, which can be translated into the possessive form of "existence". So a general concept that covers all these four typical examples is *ontological form*: standing in certain character-neutral relations. *Being numerically distinct from*, *depending ontologically on*, *being a whole of* and *being a proper part of* are ontological forms. Other plausible candidates for typical examples of ontological forms in different metaphysical theories are *being numerically identical with, being a part of, being a member of, being an element of, instantiating, exemplifying, participating, modifying, characterizing* and different *types* of *depending ontologically on* such as *depending for its existence rigidly or non-rigidly on* (cf. Tahko & Lowe 2015).

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Let us follow the clue of these four typical, that is, paradigmatic examples. Since they are paradigmatic, they generalize: true relational statements about ontological forms do not say anything about the character of entities without further assumptions. Ontological forms of entities consist of or may be construed as their standing in character-neutral relations. Since the order of character-neutral relations might make a difference, the order is to be considered. Proper parthood, for instance, is asymmetric (and standardly dyadic). Furthermore, it is Lowe's insight that ontological forms are better be considered internal rather than external relations on pain of a vicious infinite regress (2006, 80, 92, 111, 167). Therefore I can conclude that *for an entity to have an ontological form is for it to be a relatum of a character-neutral internal relation or relations jointly in an order.*[5]

The "is" in the previous statement is neither predication nor numerical identity. It is "the is of generic identity": (for an entity) to have an ontological form *is generically identical with* (for it) to be a relatum of a character-neutral internal relations or relations jointly in an order. So I need to introduce the notion of generic identity next. This notion will turn out to be crucial also for my account of formal ontological fundamentality and non-fundamentality, including the fundamental and non-fundamental ontological forms of tropes below. Therefore, generic identity needs to be elucidated although I assume it as a primitive notion.

Generic identity is a form of *generalized identity* that is a newcomer notion in philosophy, although its plausible examples are familiar: for instance, "for an entity to be a bachelor is for it to be an unmarried adult male" and "for an entity to be a water molecule is for it to be an H_2O molecule". Groundbreaking work on generalized identity has been done by Augustin Rayo (2013),

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[5] As such, ontological form differs from the possible logical form; to a first approximation, ontological form concerns entities, whereas logical form concerns truths or truth-bearers *qua* true or false (cf. Smith & Mulligan 1983, 73). Thus, logical connectives such as negation and disjunction are not formal ontological although they might be character-neutral. It is a different metaphysical question whether there are corresponding formal ontological concepts.

Øystein Linnebo (2014), who coined the term, Cian Dorr (2016), Fabrice Correia (2017) and Correia & Alexander Skiles (2017).

I follow Correia and Skiles and consider generalized identity analogous to the familiar numerical or *objectual identity* (e.g. "Hesperus is Phosphorous"). Correia & Skiles (2017, 3) express generalized identity with an operator, ≡, indexed by one or more variables, which takes two open or closed sentences. *Generic identity* is generalized identity of the form "for an entity to be F is for it to be G" in the monadic case ($Fx \equiv_x Gx$), which can be generalized into polyadic cases that involve relational predicates such as character-neutral internally relational terms. Generic identity, just like objectual identity, is reflexive, symmetric and transitive. (Correia & Skiles 2017, 4, 8). It has transparent linguistic contexts concerning only metaphysical matters rather than their mode of presentation (Dorr 2016, 44; Correia & Skiles 2017, 4).

The expressions flanking ≡ can be conjunctive (Correia & Skiles 2017, 2). Still Correia & Skiles (2017, 3) emphasize that a generic-identity statement as such does not commit us to the existence of conjunctive properties or facts, which someone might find metaphysically problematic. Unlike objectual identity, the terms of generic identity do not have to be entities or its sign's flanking expressions designating, true or satisfied (Ibid.). For example, it may hold of "for an entity to be a bachelor" and "for it to be an unmarried adult male" even if there were no bachelors, that is, unmarried adult males.

Generic identity allows for *representational* differences between the left-hand side and the right-hand side of ≡, as well as in the objectual identity "Virginia Woolf is Virginia Stephen" (arguably these names differ in meanings). So representational asymmetry is possible and the right-hand side may be informative about the left-hand side. Thus, the generic identity of the ontological form of an entity with its standing in a character-neutral internal relation or relations jointly in an order may very well be symmetric *and* informative.

Since for an entity to have an ontological form is for it to be a relatum of a character-neutral type of internal relation or relations jointly in an order, the suitable term for these ontological forms is "formal ontological relation" ("FOR", for short; cf. Smith & Grenon 2004, Lowe 2006, ch. 3).[6] Accordingly, true formal ontological relational statements do not tell us anything about the character of their relata without further assumptions. Rather, they describe the character-neutral relational way in which the relata exist. Hence, for an entity to have an ontological form is for it to be a relatum of a FOR or FORs jointly in an order. In Aristotelian realism, for instance, for an entity to have the ontological form of being a universal is for it to be a terminus of the FOR of instantiation.

By contrast, neither indistinguishability, exact resemblance/similarity, (inexact) resemblance/similarity nor any of their opposites is a FOR. They are character-*dependent* internal relations. Their statements even without further assumptions tell us something about the character of their relata. Let us assume it is true that *x* exactly resembles *y* and we know it. This true statement as such says something about the character of *x* and *y*, namely, that they are exactly resembling; the statement could not be true without something being true of the character of *x* and *y*.

On this basis, I am also able to draw a clear-cut distinction between formal ontological and other internally relational *terms*. Formal ontological terms are character-neutral internally relational terms, whereas other internally relational terms are character-dependent: they appear in statements that in themselves say at least something about the character of the entities to which they apply. Moreover, formal ontological terms are *primitive* if they cannot be non-circularly defined. *Derivative* formal ontological terms, in turn, may be non-circularly defined. It depends on the metaphysical theory, which formal ontological terms are primitive and which derivative. For

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[6] Therefore, generic identity is not a FOR since the terms of generic identity do not have to be entities, in contrast to internal relations such as FORs.

instance, "is a part of" is considered primitive and "is a proper part of" derivative (and dyadic) in the metaphysical theories following the standard axiomatization of classical mereology.

2.   Formal Ontological Relations and Formal Ontological Fundamentality

The Types and Ground of Formal Ontological Relations

If FORs are character-neutral internal relations, why do they hold of their relata if they do? Why do entities have ontological forms they have? To answer this question, I need to elaborate on the sense in which FORs are internal first. This involves drawing important distinctions between different types of FORs.

Due to their character-neutrality, FORs cannot be internal in the "property conception of internal relations", held by Armstrong (1989, 43), for instance, that grounds the holding of any internal relation in the character of its relata. FORs are internal by the "modified existential conception" of internal relations, for which I have argued elsewhere (Hakkarainen, Keinänen & Keskinen 2018, 93-102; cf. Keinänen, Keskinen & Hakkarainen 2017, ch. 2).

This modified existential conception elaborates upon Mulligan's existential account, according to which the mere joint existence of the relata of an internal relation is sufficient and exhaustively necessary for its holding (1998, 344). Mulligan's existential conception needs to be modified to cover a plausible key *type* of internal relations in metaphysical literature. Here we are speaking about the situation where the mere existence of the relata is jointly sufficient for the holding of a relation, but the existence of entities distinct from the relata of the relation is also necessary for its holding. Indeed, it is better to consider this kind of case an internal rather than an external relation in order to avoid worries about Bradley's relation regress threatening the latter but not the former (Lowe 2006, 111; Hakkarainen & Keinänen 2016).

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This type of case may be illustrated by qualitative and quantitative relations among objects in views that are committed to properties. Let us take exact resemblance of objects as an example. Assume for the sake of the argument that electrons are objects and the electron charge (-e) is *their* essential or *de re* necessary (particular or universal) property numerically distinct from the electrons. Independent of the details of the metaphysical description of this circumstance, the sole existence of two electrons is jointly sufficient and individually necessary for the holding of the internal relation of having the same charge as between the two electrons. Necessarily, if these electrons exist, then they have the property of –e charge and the same charge. Due to this sufficiency, there is no ontological need to reify the relation of having the same charge as into an external relation. However, the existence of entities numerically distinct from the relata, that is, the two electrons is also necessary for the holding of the relation. The existence of the property of -e is necessary for the holding of the relation of having the same charge as. The necessity basis for this holding includes the property in addition to the two electrons (other examples are provided by proper parthood (given certain assumptions) and Lowe's FOR of exemplification below).

To cover these important cases, the modified existential conception makes a tripartite distinction among internal relations. When this distinction is elaborated on by the concept of generic identity and applied to FORs for the present purposes, it reads as follows. In the first place, for the holding of *proto* FORs, the mere existence of their relata is jointly sufficient and individually necessary. Secondly, a distinction between *derived* FORs and *basic* FORs is partly put in terms of proto FORs:

> [DFOR]: Necessarily, entities a_1, …, a_n stand in *derived FOR* R if and only if the holding
> of R of a_1, …, a_n is generically identical with the joint holding of proto FORs holding
> between entities some of which are distinct from a_1, …, a_n [a_1, …, a_n are names of entities]

[BFOR]: Necessarily, entities a_1, …, a_n stand in *basic FOR* R if and only if R is a proto

FOR and the holding of R of a_1, …, a_n is not generically identical with the joint holding of

proto FORs holding between entities some of which are distinct from a_1, …, a_n.

The basic and derived FORs are mutually exclusive and jointly exhaustive. All *basic* FORs are

proto internal – for instance primitive (inexplicable) numerical identity for the holding of which

the mere existence of a primitively numerically identical entities is sufficient and exhaustively

necessary. A putative theoretical example of a derived FOR is Lowe's exemplification between a

substance (e.g. Dobbin the horse) and a universal property (e.g. warm-bloodness or whiteness)

(2006, 40, 92-3, 95, 206). In the four-category ontology, its holding may be construed as being

generically identical with the joint holding of

   (1) either instantiation between the universal property (e.g. whiteness) and a mode (being

   white) *and* characterization between the mode and the substance (e.g. Dobbin)

   (2) or instantiation between the substance and a kind (horse) *and* characterization between the

   kind and the universal property (Ibid.).

If the holding of this exemplification is necessary to the existence of the substance and the

universal property, it is a derived proto FOR. In the case that it is only contingent to them, then it

is a merely derived FOR.

Thus, among *proto FORs*, there is a further distinction between the basic and the derived. In order

for a basic FOR to hold, there need not be any specific entities distinct from the relata (e.g.

primitive numerical identity). *Derived proto* FORs hold of their relata in virtue of proto FORs

holding between entities some of which are distinct from the relata. The existence of the relata of a

derived proto FOR necessitates the existence of entities distinct from the relata. The necessary

form of Lowe's exemplification relation is a theoretical example of such a relation. Yet this

derived FOR is proto formal ontological because the existence of their relata is jointly sufficient and individually necessary for the holding of these relations.

Consequently, *the necessity and sufficiency basis* for the holding of a FOR depends on the type of the relation. The mere existence of the relata of a basic FOR is both jointly sufficient and exhaustively necessary for its holding (e.g. primitive numerical identity). In the case of a derived proto FOR, the mere existence of its relata is jointly sufficient and individually but not exhaustively necessary for its holding. The existence of entities distinct from the relata is also individually necessary. The holding of the derived proto FOR is generically identical with the joint holding of some proto FORs that bring in additional necessary entities. These additional relata complete the necessity basis of the holding of the derived proto internal relation. Again, the necessary form of Lowe's exemplification relation is a derived proto FOR.

If a FOR is merely derived (like the contingent form of Lowe's exemplification), then the existence of its relata is not jointly sufficient for its holding; the sufficiency (and necessity) basis needs to be supplemented by the existence of entities distinct from the relata. The holding of such a derived FOR is contingent upon the existence of its relata. This is made possible by the fact that the holding of the derived FOR is generically identical with the joint holding of some proto FORs that add relata entities. It is the joint existence of the relata of all these proto FORs that is sufficient and exhaustively necessary for the holding of the derived FOR.

To explicate this distinction further, recall that a generic-identity statement does not involve any commitment to the existence of conjunctive properties or facts, which someone might find metaphysically problematic. In contrast to objectual identity, the relata of generic identity do not have to be entities or the expressions flanking $\equiv$ designating, satisfied or true. Hence, the holdings of FORs can be generically identical with each other although FORs are not entities that the flanking expressions could designate – especially entities in the category of universal relational properties that are instantiated. Neither do FORs have to be particular relational entities of which

the flanking expressions are true (e.g. relational tropes). The generic identity of FORs is the sameness of really holding character-neutral relatednesses of entities. Note also that generic identity allows representational differences between the left-hand side and the right-hand side of ≡. Thus, the generic identity of the holding of a derived FOR with the joint holding of proto FORs may very well be symmetric *and* informative of the derived FOR. Furthermore, if generic identity is conjunctive, then the conjuncts can be individually more fundamental in some respect than the other side (cf. Dorr 2016, 43).

By means of the tripartite distinction, I can answer the question with which I begun this section, *why do FORs hold*? Whether a FOR is basic, derived proto or merely derived, its holding boils down to the existence of some entities. Their existence jointly necessitates and is exhaustively necessary for the holding of the FOR. In the case of the basic FORs, these entities are the relata of the FOR. If the FOR is derived, there has to be at least one entity distinct from the relata that is necessary for the holding of the FOR. Depending on the fact whether this additional entity is only necessary or plays a part in completing the sufficiency basis for the holding of the FOR, the FOR is either derived proto or just derived. Be that as it may, *the ground for the holding of a FOR consists only of the existence of entities, rather than their character*. This is how it ought to be given my view that FORs are character-neutral internal relations.

Of these *de re* modalities, one may in principle hold any of the following three alternative metaphysical views. Let me facilitate my expression and focus on the necessity of the holding of a basic FOR upon the existence of its relata. (1) One may defend the view that this necessity is reducible to the existence of the relata of the basic FOR in possible worlds, of which there are several accounts available in the literature (for a mapping of alternatives, cf. Divers 2002). (2) One may take the necessity in question as a primitive fact: it is just an inexplicable brute fact that the existence of the relata is sufficient for the holding of the basic FOR (e.g. primitive numerical identity). (3) One grounds the necessity of the holding of a basic FOR in the inexplicable formal

essence of its relata, or at least one of them. We can read Lowe holding this view (2012, 241-3). Although I am leaning towards the second, primitivist view, I do not want to take any firm stance on this issue in this paper. I simply want to point out that my view of the ground of the holding of FORs is available to the upholders of more than one modal metaphysics.

By means of the notion of generic identity, I am also able to draw a further distinction among FORs, which is crucial for understanding formal ontological fundamentality. This distinction is distinguishing *simple FORs* from *complex FORs*. Simple FORs are FORs that generically identical *only* with themselves. Primitive numerical identity is a plausible example of a simple FOR. Complex FORs, by contrast, are generically identical with some generically different FORs jointly. A good theoretical example of such a relation is Lowe's exemplification discussed above.

The distinctions between simple and complex FORs and basic and derived FORs crosscut. Every simple FOR is basic (hence proto formal ontological) because it is generically identical only with itself. By contrast, not every basic FOR is simple; there hold both basic and derived complex FORs. The reason for this is simple: there can obtain a proto FOR whose holding between a_1, …, a_n is not generically identical with the joint holding of some generically different proto FORs holding between entities *some of which are distinct* from a_1, …, a_n. Rather, its holding between a_1, …, a_n is generically identical with the joint holding of generically different proto FORs holding between a_1, …, a_n: it is basic. So I distinguish between simple and complex basic FORs on the one hand and between basic and derived complex FORs on the other.

Formal Ontological Fundamentality and Non-Fundamentality

In the previous section, I argued that for an entity to have an ontological form is for it to be a relatum of a FOR or FORs jointly in an order. Consequently, for an entity to have a *simple ontological form* is for it to be a relatum of a simple FOR in an order, and for it to have a complex ontological form is for it to be a relatum of a complex FOR in an order. For example, on the

assumption that an entity is primitively numerically identical, it has the simple ontological form of being numerically identical. Primitive numerical identity is a simple FOR since it is basic and its holding is generically identical only with itself.

Simple ontological forms are *fundamental ontological forms* because simple FORs are *fundamental FORs*. Simple FORs are basic and their holding does not consist of anything: their holding is generically identical only with themselves. Formal ontological fundamentality is being unconstituted in the sense of generic identity. Thus, for an entity to have a fundamental ontological form is for to be a relatum of a simple FOR in an order.[7] *The full fundamental ontological form* of an entity is generically identical with a simple FOR or FORs jointly in an order.[8]

I can illustrate this with primitive numerical identity again: primitive numerical identity is a fundamental ontological form of the identical entity, but not necessarily its full fundamental ontological form. Primitive substances in Lowe, for instance, bear other simple FORs than numerical identity to some entities, such as instantiation (1998, 169-73).

The *full fundamental ontological form* does not have to be the full mere ontological form either. An entity may have the full fundamental ontological form and bear a *derived* FOR to something. For example, an entity *can* be fundamentally a part and numerically identical but bear the derived FOR of proper parthood to a whole that has two proper parts.[9] In that case, being a relatum of the simple FORs of parthood and numerical identity does not exhaust the ontological form of this part: its ontological form is partly generically identical with the holding of the derived FOR of proper parthood. Therefore, I should say that the *full ontological form* of an entity is generically identical with a FOR or FORs jointly in an order.

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[7] Formal ontological fundamentality is not to be confused with the fundamentality of entities, which may be dubbed "ontological fundamentality". As such, the possible fundamental ontological form of being a property, for instance, differs from the putative fact that some but not all properties are fundamental entities (Tahko 2018).

[8] Note that it might be possible that there is not any fundamental ontological form since there does not hold any simple FORs. "Gunky" formal ontology in which every ontological form is complex seems to be possible.

[9] The example denies holism because the part has primitive numerical identity and it could exist without the whole.

If the full ontological form of an entity involves a derived FOR (proto or not), the full ontological form is *non-fundamental*. Hence, for an entity to have a *non-fundamental ontological form* is for it to be a relatum of a derived FOR in an order. Any derived FOR is a non-fundamental FOR for the very reason that its holding is generically identical with the joint holding of generically different FORs that involve additional necessary relata entities. The sole existence of the relata of the derived FOR is not exhaustively necessary for the holding of the derived FOR – even if their existence was jointly sufficient. The holding of every derived FOR is constituted in terms of generic identity. The generically different FORs are then *individually* more fundamental and the ontological form of the relata of the derived FOR is at least partly generically identical with them. Therefore, the *fundamental* form of existence of these relata (if they have one), that is, the fundamental way in which they exist cannot be even partly generically identical with the holding of the derived FOR.

To use the previous example of the whole with two parts again, the proper parthood of the first part is its non-fundamental ontological form. The mere existence of this part and the whole is not exhaustively necessary for the holding of proper parthood between them since the *whole* would not exist and proper parthood hold without the existence of the other part of the whole. So the holding of proper parthood between the first part and the whole is somehow derived from FORs that have the other part as a relatum (proper parthood is standardly considered dyadic). For the first part, bearing proper parthood to the whole is not something that this part fundamentally is in formal ontological terms. By contrast, the whole would not have *any* ontological form without the non-fundamental ontological form of bearing proper parthood to two numerically distinct entities. The whole would not exist without the two parts existing. This whole is a non-fundamental entity in formal ontological terms (bearing in mind the anti-holism of the example).

3.   Fundamental Ontological Form of Tropes

Now I can apply my metatheory about formal ontology of the previous sections to the Strong

Nuclear Theory of tropes, substances and the relation of inherence between them (recall,

"SNT").[10] *Ontologically*, tropes are entities that are standardly identified with characters or

natures: what tropes are like. Plausible examples of tropes or characters in scientifically informed

metaphysics are determinate basic quantities: rest masses, charges and spin quantum numbers.

These characters are "thin" or qualitatively simple: they do not have even aspects that would be

numerically identical with them. They can also be indiscernible and numerically distinct; the

ontological principle of the identity of indiscernibles does not hold true of tropes.

In this paper, however, my focus is on the *ontological form* of tropes, their (relational) form of

existence rather than their ontology. According to the SNT, there are two *primitive* FORs *qua*

terms: numerical identity and parthood. They are not defined in the theory. One of the *derivative*

FORs in it (i.e. FORs *qua* defined terms), numerical distinctness, is defined as the negation of

numerical identity. Another derivative FOR, proper parthood is defined by numerical identity and

parthood: x is a proper part of y =$_{df}$ x is a part of y AND x is not numerically identical with y.

The third derivative ontological form is strong rigid (existential) dependence that is defined

modally by the notion of existence, numerical identity and parthood. A contingent entity x is

strongly rigidly dependent on a contingent entity y if and only if

   (1) it is not metaphysically possible that x exists and y does not exist

   (2) x and y are not numerically identical

   (3) y is not a part of x (cf. Keinänen 2011, 431).

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[10] For the references to the articles presenting and defending the SNT, cf. Introduction. I shall not repeat the references
here.

This differs from strong generic (existential) dependence that is the fourth derivative ontological form in the SNT. Roughly, any contingent entity *x of kind P* is strongly generically dependent on some contingent entity *y of kind R* if and only if

(1) it is not metaphysically possible that any *x* of kind *P* exist and no *y* of kind *R* exists

(2) *x* of kind *P* and *y* of kind *R* are not numerically identical

(3) *y* of kind *R* is not a part of *x* of kind *P* (Ibid.).

The numerical identity of tropes is not only a primitive term but also their *simple* reflexive FOR in the SNT. The holding of the FOR of numerical identity of each trope is not generically identical with any different FOR. Since every simple FOR is basic, the only explanation for the holding of numerical identity of each trope is the mere existence of the trope. This involves that each trope is a unity (i.e. one or countable) and an individual.

Another simple and basic reflexive FOR in the SNT is parthood that holds of every trope: each trope is a part. Consider any trope whatsoever and its sole existence is sufficient and exhaustively necessary for it being a part. This ontological form distinguishes tropes from modes in Lowe's four-category ontology, for instance. Lowe denies that modes are parts (2006, 97). According to the SNT, however, no trope is a terminus of the defined FOR of proper parthood (i.e. a whole). The SNT states that tropes are mereologically simple (mereological atoms).

The element that distinguishes the SNT from some other trope theories such as Campbell's (1990), Ehring's (2011, 98ff.) or Maurin's (2011) view is that tropes are strongly rigidly or generically *dependent* (cf. Simons 1994). It is not possible that there is a trope without some entity numerically and wholly distinct from the trope existing. The defined but simple (hence basic) FOR of strong rigid dependence or strong generic dependence holds of every trope. The standard case in the SNT is that there is a group of *mutually strongly rigidly* dependent tropes: the nuclear tropes of a substance (more about this below).

In sum, according to the SNT the simple ontological forms of tropes are that they are strongly rigidly or generically dependent, individual entities (i.e. numerically identical unities) that are simple parts. As I argued above, for an entity to have a fundamental ontological form is for to be a relatum of a simple FOR in an order. Therefore the holding of each of these simple FORs is a fundamental ontological form of any trope. Their joint holding is generically identical with the *full fundamental* ontological form of any trope. Fundamentally, in formal ontological terms, tropes are strongly rigidly or generically dependent individual simple parts. This is their character-neutral relational way of existence, which will turn out to be a crucial result for responding to certain objections to trope theory in the next section.

4.   Applying the Fundamental Ontological Form of Tropes

From this already, one can see that the dichotomy between objects and properties is not at all the right way to understand what tropes fundamentally are in formal ontological terms in the SNT, or any trope theory, *contra*, what for example Garcia and Maurin say about tropes. For instance, if one follows Armstrong and understands his talk of tropes as junior substances meaning that tropes are more akin to objects than properties, one gets on the wrong track right from the start.

The formal ontological distinction between objects and properties presupposes some FOR holding between them. Objects are one relatum of this relation and properties the other relatum. In realist metaphysical theories about universals, this relation is instantiation, participation or exemplification, depending on the theory. In nominalist theories that are committed to the existence of properties, it is for instance class/set-membership, inherence, modification or characterization.

The SNT is among such theories but it gives a reductive metaphysical *analysis* of the relation of inherence: inherence consists of other relations such as parthood and strong rigid dependence (cf. Keinänen's paper in this collection and Fisher 2018). This is due to the point that the SNT, like

any trope theory, such as Maurin's account (2011), is a *bundle-theory of objects*. For an entity to be an object is for it to be a terminus of inherence since for an entity to be an object is for it to be a bearer of properties. In the bundle-theories, objects are complex entities constructed by tropes (or, universals) and the holding of certain relations such as parthood and strong dependence or compresence (e.g. Campbell 1990, ch. 1; Maurin 2011; Fisher 2018). Therefore, not only objecthood but also inherence is in the *analysandum* in trope theories. So it would be viciously circular if inherence were one the relations in the *analysans*. Consequently, in trope theories the holding of the analyzing relations has to constitute the holding of inherence. Therefore, inherence is not a simple FOR in the SNT, or any trope theory, because it is incorrect to say that inherence is generically identical only with itself.

Hence, it is not stated in the SNT—as it ought not in any trope theory—that tropes are *formal ontologically fundamentally* properties or objects, or more akin to one than the other. One just cannot consider the fundamental ontological form of tropes in these terms when one considers trope theories. Rather, ontologically tropes are identified with thin natures and in the SNT, their full fundamental ontological form is to be a strongly rigidly or generically dependent individual simple part. The dichotomous question set-up of properties or objects or more akin to either of them is a non-starter from the point of view of the SNT – as it should be in any trope theory as a bundle account of objects.

In order to argue against trope theory, Garcia (2016, 2) has recently introduced a distinction between module and modifier tropes. In terms of my metatheory of formal ontology, this distinction is based on the fundamental FOR of self-inherence. Module tropes are fundamentally self-inhering, whereas modifier tropes are not:

> "In this stronger sense [of module tropes], 'particularizing a property' involves ascribing objecthood to a property. Here, particularization involves converting a

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shareable and singly characterizing property (an immanent [Armstrongian] universal) into a non-shareable and *thinly propertied object*: a module trope. So understood, the Slogan fixes on the concept of a module trope: a *primitively*, naturally, and thinly charactered *object*." (Ibid.; emphases added)

"Here, the Slogan fixes on the concept of *a modifier trope*: a non-shareable and *non-self-exemplifying* property." (Ibid.; cf. 2016, 5; 2015, 138, 144, 148; emphases added)

So take any F module trope and it just is F, but an F modifier trope is not F. Module tropes are fundamentally self-inhering thinly propertied objects while modifier tropes are not.

Garcia's distinction is also a non-starter in the SNT, or any trope theory. This distinction presupposes that inherence can be a simple FOR holding of tropes because self-inherence is presumed to be such a relation. However, I just argued above that as a trope theory, the SNT denies the formal ontological simplicity and hence fundamentality of inherence. Therefore Garcia's distinction between module and modifier tropes does not apply to the SNT, or any trope theory. Garcia's argument against trope theories that is based on this distinction does not hit the target at all (Garcia 2016; 2015; cf. Garcia 2014a, sec. 2).

In addition to properties or objects, another putative ontological form typically associated with tropes is that they are *particulars*, in contrast to universal thin natures. This is not correct about the ontological form of tropes in the SNT. Particularity is not among the ontological forms of tropes in it. Formal ontologically, particularity is not theoretically needed for anything: it does not do any theoretical work. There is no contrasting class here because as a nominalist theory the SNT is not committed to the existence of universals. It is only in discussions with the realists that we can inform them that tropes are the subjects but not the termini of the FOR of instantiation,

participation or exemplification of the *realists*. However, the SNT cannot accommodate any of these FORs since each of them presupposes the existence of universals.

Someone might object here that it does not presuppose universals to say that tropes are particulars because they can be indiscernible and numerically distinct. The principle of the identity of indiscernibles does not hold true of tropes. Therefore even a nominalist can hold that tropes are particulars; Williams (1986) and Ehring (2011, 35), for instance, put particularity in this way.

My response to this possible objection is that my account of ontological form is not compatible with this characterization of the ontological form of particularity. *Being indiscernible from* (exactly resembling to many metaphysicians) is not a FOR since it is a character-dependent relation. The statement that *x* and *y* are indiscernible tells us, if true, something about the character of *x* and *y* even without further assumptions – namely that they are indiscernible and are of the same type or kind. Hence, when the formal ontological side of the SNT is put in terms of my metatheory of formal ontology, the SNT cannot accommodate Williams' and Ehring's characterization of particularity either. This does not mean, however, that it is false that the principle of the identity of indiscernibles does not hold true of tropes. On the contrary, the SNT is committed to the denial of this ontological principle although it is not considered a formal ontological principle in the SNT.

My metatheory also undermines any argument against tropes that is premised upon the holding of indiscernibility, exact resemblance/similarity, resemblance/similarity or their opposite *in respect of some ontological form*. For instance, one might claim that the nuclear tropes of a simple substance in the SNT are exactly resembling with respect to particularity or strong rigid dependence. Ehring (2011, 182) and Garcia (2014b, secs. II-IV) are examples of such arguments in the literature.

One of the premises of Ehring's argument is that there are tropes that are exactly or inexactly similar "with respect to their particularity" (2011, 182). Garcia's argument is based on the notion

of dependency profile: "A trope *t*'s dependency profile specifies all the distinct token and/or types of tropes on which *t* is (rigidly or generically) dependent." (2014b, 169) If the dependency profile of a trope were in its character, then the SNT would deny it. According to the SNT, tropes do not depend for their existence because of their character. So the charitable reading of Garcia is that in the SNT, the dependency profile of a trope has to consist of the FORs of strong rigid and generic dependence that this trope bears. Of the dependency profiles, Garcia maintains that they "admit of qualitative differences and similarities" and goes on to argue against the SNT with that claim (Ibid. 170 and secs. III & IV). Garcia's argument against the SNT is then premised upon the statement that the FORs of strong rigid and generic dependence can stand in the relations of similarity and difference.

Let us grant for Ehring for the sake of the argument that tropes have the ontological form of particularity although I could rebut his argument simply by saying that the SNT does not have to state that tropes are particulars. Proceeding with this assumption, I can respond to Ehring and Garcia that according to my metatheory, *no entity bears indiscernibility, exact resemblance/similarity, resemblance/similarity or their opposite in respect of any ontological form*. The reason for this is simple: these character-dependent relations can hold only among entities. However, ontological forms, that is, FORs are not entities in themselves; FORs are internal relations. Thus, ontological forms or FORs can stand in neither indiscernibility, exactly resemblance/similarity, resemblance/similarity nor their opposite. This undermines any argument that assumes such a standing – especially Ehring's and Garcia's lines of reasoning that take the putative ontological forms of particularity and strong rigid or generic dependence of tropes as their targets.

Ehring (2011, 179-80) has another argument against standard tropes that are simple entities identified with thin natures or characters: they are not simple, *pace* the SNT. This argument is similar to Herbert Hochberg's earlier line of reasoning (2004, 39; cf. Moreland 2001, 70-1;

Armstrong 2005, 310). A key premise in Ehring's argument is that "arbitrarily different internal relations" must have distinct relata. The holdings of arbitrarily different internal relations vary or are realized independently from each other. Exact resemblance and numerical distinctness among standard tropes are arbitrarily different internal relations. Thus, they have distinct relata and no individual trope can be both exactly similar, numerically distinct and simple. The simplicity of standard tropes is refuted. (Ehring 2011, 177-80)

Hochberg's (2004, 39) a key premise is that the internal relations of exact similarity and numerical distinctness *qua* logically independent basic propositions cannot have the same truthmakers. If it is logically possible that any basic proposition is true and another false (and *vice versa*), then these basic propositions are logically independent.

My metatheory supplies the SNT with resources to answer these arguments (cf. Hakkarainen & Keinänen 2017). The SNT can deny both Ehring's and Hochberg's key premises and therefore refute their arguments against simple tropes. Exact resemblance is a character-dependent internal relation, whereas numerical distinctness is a character-neutral internal relation, that is, a FOR. Yet their holdings can have numerically identical grounds. Let us assume that there are two numerically distinct exactly resembling tropes. As I argued above, the ground of their numerical distinctness is nothing but their existence. Ontologically each of these two tropes is identified with a character. So there holds no numerical distinctness between their existence and character; they are entities identified with the character that they are. Now, these two tropes exactly resemble because of the characters they are. Thus, the grounds of these tropes being numerically distinct and exactly resembling are not numerically distinct. These two internal relations do not have to have numerically distinct relata or truthmakers *qua* propositions.

Nonetheless, numerical distinctness and exact resemblance among tropes in general can be arbitrarily different internal relations or their propositions logically independent. Let us consider the former first. The holding of any exact resemblance depends on the character of its relata. By

contrast, the holding of the FOR of numerical distinctness between tropes in general does not depend on the characters that the tropes are. So tropes may or may not be numerically distinct independent from the characters they are. Tropes of exactly similar or different character can be numerically distinct. The holdings of numerical distinctness and exact resemblance can vary or be realized independently from one another, which is a sufficient condition for them being arbitrarily different. Furthermore, this independence of variation and realization may also be construed as *logical* in nature. Thus, numerical distinctness and exact resemblance among simple tropes are also logically independent as propositions. Hence, they are both logically independent *qua* basic propositions and arbitrarily different internal relations. As was seen just above, these logically independent basic propositions do not have to have distinct truthmakers or arbitrarily different internal relations distinct relata. Thus, the SNT denies Ehring's and Hochberg's key premises and hence refutes their arguments.

5.   Of the Non-Fundamental Ontological Form of Tropes

According to the SNT, tropes have also *derived* ontological forms. Let us take two examples although the main topic of this paper is not the non-fundamental ontological forms of tropes. In the SNT, every trope is necessarily a *proper part* of a substance: there are no "free-floating tropes". To expound the constitution of the relation of proper parthood between tropes and substances, let us first facilitate the presentation and take the example of an arbitrary minimal substance in the SNT. Such a substance is a simple substance since it does not have parts that are substances; it has only two trope parts, say, a rest mass trope and a charge trope. It is a minimal substance. Let us also assume that the two tropes are mutually strongly rigidly dependent: neither of them can exist without the other. They are the only tropes and nuclear tropes of the minimal substance. Consequently, also their plurality has to exist given the contingent existence of one of them.

By the Conditioning Principle adapted from Simons (1987, 322), the plurality of these two tropes is not existentially dependent on any other entity than the rest mass trope and the charge trope. This principle states that necessarily, if plurality x is such that every dependent entity of it (its element) has all the entities on which the entity depends also in x, then x is not dependent on anything else than its elements. In other words, the elements of x satisfy its "existential needs". Thus, the plurality of the two tropes is a strongly rigidly *in*dependent entity: it does not depend for its existence on any entity that is wholly distinct from it, that is, that does not share parts with it. The plurality depends for its existence only on the rest mass trope and the charge trope. Since the definition of strong rigid dependence rules out dependence on parts, the plurality satisfies the condition of being a substance in the SNT: it is a strongly rigidly independent entity. Hence, the consequence is that here we have actually an individual.

Regarding the relation of proper parthood holding between the arbitrary minimal substance and its two mutually rigidly dependent trope parts, the upshot is that the *holding* of this relation from one of the tropes to the substance requires the existence of the other trope. This result generalizes in the SNT. Thus, proper parthood from any trope to a simple substance is a *derived* FOR (note that it is standard to consider proper parthood dyadic).

It follows that this FOR of proper parthood between a trope and a simple substance is neither a simple nor a fundamental ontological form of any trope in the SNT, in contrast to the parthood reflexively holding of tropes. Since the trope is an arbitrary trope in the SNT, no trope is *fundamentally* a proper part of a substance. Proper parthood between them is a neither simple nor basic FOR.[11]

Connected to this, recall that Armstrong claims that tropes are junior substances. If this involves that tropes have the ontological form of independence, it is not correct in the SNT either. Tropes

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[11] This also means that being a substance is not a fundamental ontological form in the SNT.

are strongly rigidly or generically *dependent* entities, whereas even simple substances are strongly rigidly *in*dependent entities.

Concreteness is another derived ontological form of each trope. According to the SNT, every trope is located in space-time. This entails that no trope is abstract, that is, an entity not having even a temporal location. Assuming that concreteness is an ontological form, some FOR has to hold between each trope and space-time. What this FOR is depends on the theory of space-time.[12] Yet it must be a *derived* FOR because the mere existence of an arbitrary trope and space-time is not exhaustively necessary for its holding (it may be sufficient though). At least the existence of a relational trope or space-time point is required. Hence, the ontological form of tropes being concrete is derived.

The derived status of concreteness and the proper parthood of a substance does not mean, however, that no trope is *necessarily* concrete and a proper part of a substance. On the opposite, the SNT states that every trope is necessarily a proper part of some simple substance. Let us take nuclear tropes as an example (bracketing the limiting case of singular nuclear tropes). Necessarily, if there is an arbitrary nuclear trope, then there is another trope or there are other tropes and these tropes are strongly rigidly dependent on each other. By the Conditioning Principle, it follows that the arbitrary trope is also necessarily a proper part of a simple substance. Equally, necessarily for any arbitrary trope, the trope exists at a spatio-temporal location. Proper parthood between an arbitrary nuclear trope and a simple substance and the concreteness of every trope are derived *proto* FORs in the SNT. It is necessary to any trope that it is a relatum of these two FORs.

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[12] The SNT does not involve any commitment to a specific theory of space-time.

6. Conclusion

I have argued that according to the Strong Nuclear Theory, the full fundamental ontological form of every trope is to be a strongly rigidly or generically dependent individual entity that is a simple part. In these formal ontological terms, each trope is non-fundamentally but necessarily a proper part of a simple substance and concrete. The proper parthood and concreteness of every trope is one of its derived ontological forms. Ontologically, the SNT identifies each trope with a thin character. It is also rather an ontological than formal ontological feature of each trope in the SNT that the principle of the identity of indiscernibles does not hold true of it.

This summarizes the way in which I put the SNT in terms of my metatheory of formal ontology and its difference from ontology. Ontology studies existence question such are whether there are properties from the unique point of view provided by formal ontology. The core subject matter of formal ontology is ontological form, of which I have a relational account. My account employs the notion of generic identity, which is a form of generalized identity distinguished from the familiar numerical or objectual identity.

In terms of generic identity, for an entity to have an ontological form is for it to be a relatum of a formal ontological relation or relations jointly, that is, character-neutral internal relation or relations jointly in an order. Internal relations actually hold of their relata although they are not entities numerically distinct from the relata. The holding of internal relations can be in principle asserted by relational statements. The statements about character-neutral internal relations do not say anything about the character of the relata of the relations without further assumptions (*contra* character-dependent internal relations). The character of an entity is what the entity is like. In addition to entities themselves, their possible characters belong to the extension of the concept of existence or being, which I assume to be interchangeable univocal concepts.

In the fourth section, I showed that putting the SNT in terms of my metatheory is fecund because it gives resources to answer the arguments against tropes advanced by Douglas Ehring, Robert K. Garcia and Herbert Hochberg. These arguments do not distinguish the formal ontology of tropes from their ontology. Their argumentative gap lies in overlooking this distinction.

I distinguish fundamental ontological form from the non-fundamental by the distinction between simple and derived formal ontological relations that builds upon a tripartite distinction among proto, derived and basic internal relations. For an entity to have a fundamental ontological form is for it to be a relatum of a simple formal ontological relation in an order. Every simple formal ontological relation is basic. The mere existence of the relata of a simple formal ontological relation is jointly sufficient and exhaustively necessary for the holding of the relation. It is also simple because the holding of such a relation is generically identical only with itself. So the holding of a simple formal ontological relation is not constituted in the sense of generic identity.

By contrast, for an entity to have a non-fundamental ontological form is for it to be a relatum of a derived formal ontological relation in an order. The holding of a derived formal ontological relation is, roughly, generically identical with generically different formal ontological relations that jointly hold of entities some of which are numerically distinct from the relata of the derived formal ontological relation.

Applying my metatheory to the SNT and trope theories establishes that the typical dichotomous set-up of asking whether tropes are rather properties than objects is a non-starter in the SNT. The same is correct of the talk about tropes as particular properties or particularized properties when one understands this talk as concerning the fundamental ontological form of tropes. First, the SNT does not need particularity theoretically for anything. Secondly, being a property, object or something more akin to either presupposes the relation of inherence that is not a fundamental formal ontological relation in the SNT, or any trope theory as a bundle theory of objects.

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