

Trope Mereology: A Response to Robert K. Garcia's Gap Challenges

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Abstract

Trope Bundle Theory (TBT) has long been thought to provide a cogent account of the metaphysical composition of objects. The latter, according to TBT, are to be identified with bundles of particular properties (tropes); this, in turn, enables the theory to avoid many of the issues that bedevil other, rival theories (most notably Universal Bundle Theory and Substance-Attribute Theory). Recently, however, a number of challenges have been put forth by Robert K. Garcia that, at first blush, seem to significantly diminish TBT's ability to do its metaphysical work ('gap' challenges, Garcia terms them, because each reveals an explanatory gap in trope object-construction that the theory cannot account for). The aim of this essay is to address all of these challenges and show that, by understanding module tropes as particular characters rather than as characterized things, TBT can indeed successfully account for the metaphysical composition of objects. In doing so, we will moreover acquire some important insights into trope mereology, i.e. into some of the principles that hold in the case of trope-fusion, namely the Character-Fusion Principle (CFP) and a principle explaining why the same exactly co-located character-parts cannot compose different objects (C-HEP). This is an area of mereology that remains largely underexplored and the present investigation will, hopefully, provide a basis for further research.

Introduction: The metaphysical composition of objects

Trope theory has often been paired up with Bundle theory in recent metaphysical history. The former tells us that properties are particular, that is, that they can characterize only one thing, or at least only one thing at a time; the latter tells us that objects, like for example this billiard ball or that electron, are really nothing but bundles of their properties: The billiard ball is just a bundle of its sphericity, greenness, mass, etc., the electron of its charge, mass and spin and so on for every other object.

The upshot is a theory that identifies objects with bundles of particular properties, i.e. properties that, even though (possibly) perfectly similar to properties composing other bundles, are numerically distinct from them. We can call this theory Trope Bundle Theory (TBT). TBT gives us a *prima facie* cogent story of the metaphysical composition of objects. Traditionally, TBT has been thought to enjoy a variety of advantages over its universalist cousins (Universal Bundle Theory (UBT) and Substance-Attribute Theory (SA-Theory)), in particular) as well as their nemesis, Austere Nominalism (AN), when it comes to accounting for the metaphysical makeup of objects. Recently, however, a number of explanatory challenges have been put forth by Robert K. Garcia (2014, 2016) that threaten to undermine this supposed superiority ('gap' challenges, Garcia terms them, because each reveals an explanatory gap in trope object-construction that the theory cannot account for). In what follows, I will try to address these challenges and show that TBT can, when properly understood, offer us an understanding of object-composition that is both consistent with the standard theory of parts and wholes, what is sometimes referred to as classical extensional mereology (CEM), and explanatorily powerful.

At the core of Garcia's challenges, as we will see, lies his distinction between module and modifier tropes. As Keinänen (2025) argues, however, this distinction is problematic; it treats as fundamental

precisely those categories that TBT seeks to analyze in terms of the category of tropes (that is, the categories of property and object) and thus misunderstands the very nature of tropes. Still, and unlike Keinänen, I think that Garcia's distinction is philosophically productive; it allows us to pinpoint exactly what makes his challenge so compelling and, ultimately, to develop a cogent account of trope object-construction and some of its governing mereological principles.

To this end, it will first be important to get a better grip on the concepts of module and modifier trope. As we will see, it is only the former that Garcia's gap challenges afflict and hence it will be to module theory that we turn our attention for the rest of this paper (modifier theory, to be sure, even though unaffected by Garcia's arguments, has other more severe problems of its own).

For this reason, I will start by presenting the module-modifier distinction in the first section and carry on with discussing Garcia's gap challenges in the second. In the third and final section I will try to show how these challenges can be overcome by module theory, offering a more precise disambiguation of the concept of module trope as well as presenting some basic tenets of (module) trope mereology along the way (I'll be using the terms 'module trope mereology' and 'trope mereology' interchangeably hereon). As I hope to show, these results open up promising new avenues of mereological research for the future.

1. Module tropes and modifier tropes

As Garcia stresses in his 2015 work, it was Michael Loux who first introduced what is essentially the modifier/module distinction. According to Loux (2015: 31–32), tropes are to be understood in two ways: Either as particular properties, in which case he continues to use the term 'tropes' or as thinly characterized individuals like "*this individual red thing, this individual triangular thing [...]*" which he calls 'trovers'. Unlike tropes, trovers seem to be more like substances in that they are themselves characterized or propertied in some one specific way. A triangularity troper is itself triangular; a blueness troper, aside from making something else blue, is blue as well and so on.

Garcia adopts the trope/troper distinction and rebrands its terms as modifier and module tropes respectively. What's pivotal for him is that both modifier and module tropes are what he calls non-shareable (i.e. particular) character-grounders. They, in other words, are responsible for the various characters that objects exhibit, which is to say that it is "in virtue of having a trope (troper) that an object is characterized in some way" (Garcia 2015: 133). Hence, a triangular thing is triangular in virtue of having either a triangularity modifier or a triangularity module trope (in some sense of 'have' that is going to become clear later on) and the same goes for any other character.

This helps put the difference between modifier and module tropes in more clear terms: A modifier trope is a character-grounder that is *not* itself characterized by the character it confers. On the other hand, a module trope is a character-grounder that *is* characterized by the character it confers. According to Garcia this places modifier and module trope theory in distinct theoretical spaces. Modifier theory occupies the space that is closer to Universal Bundle Theory; module theory, on the contrary, occupies the space that

is closer to Austere Nominalism. The result is a picture of the theoretical similarities between these four theories that looks something like this:

Universal Properties Particular Objects

Universal Bundle Theory	Modifier Trope Theory	Module Trope Theory	Austere Nominalism
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The way Garcia argues in favor of the above picture is both quite illuminating of the terms in which he understands modifier and module tropes as well as helpful in giving us a better idea of what exactly modifier and module theory amount to. His basic strategy is to employ two distinctions that have dominated much of the contemporary debate between realism and nominalism, i.e. the particular/universal and the object/property distinctions and try and see how tropes fare in accommodating them. It will then become apparent that “there is room for two concepts of a trope” (Garcia 2015: 138). In other words, the nature of tropes, once considered within this traditional framework, will be seen to be twofold after all. As the particular/universal distinction is already familiar, let us focus on the object/property distinction instead.

Garcia (2015) starts with Loux’s construal, according to which the object/property distinction expresses “the categorial gap between a *property* and a *property-possessor*” (p. 139). The issue, however, is that defining objects (or any category of entities) as property-possessors entails that, if it turns out that there are no properties, it will also follow that there are no property-possessors (in this case objects) either. Hence, this understanding of objects seems to beg the question against someone like the austere nominalist who, by accepting an object-only ontology, rejects the existence of properties altogether.

For this reason, Garcia (2015: 140) proposes a different construal of the distinction. According to him, objects are not to be understood as property-possessors, but rather as entities that are characterized without being characteristics or properties themselves. In this way the austere nominalist can consistently argue in favor of an object-only ontology, while the realist can postulate higher order properties (e.g. the property of being a color, a shape, etc.) without at the same time having to accept that lower-order properties like being green or being triangular are objects (due to them being property-possessors, that is).

Given these clarifications, it will now be easier to see how module theory compares to modifier theory and AN and why it occupies the middle ground between them. Module tropes, recall, are character-grounders that are themselves characterized by the character they convey. This seems (Garcia 2015: 144) to put them in the category of object rather than that of property: they may be responsible for an object’s character but they are not characteristics/properties themselves, like modifier tropes are. Moreover, the fact that they are characterized in only one way means that they only exhibit *thin character*; they are “singly or *maximally thinly* characterized objects” (Garcia 2015: 142). The nominalist’s objects, on the other hand, are *thickly characterized*; they exhibit more than one natural characteristic, which is to say that they are colored and shaped, massive and textured and so on (see also Garcia 2016: 501–502, for more on the thin/thick character distinction).

The difference then between module tropes and the traditional particular objects of the austere nominalist is just one of degree: The former are thinly characterized while the latter are thickly characterized. In contrast, modifier tropes, despite being particulars, are properties rather than objects, which makes them categorially different both from module tropes and the nominalist's particular objects. Hence, the modifier theorist takes two steps away from the nominalist by positing not only that objects are structured, but also that their components are non-objects themselves, i.e. properties. The module theorist, on the other hand, takes only one step away from the nominalist; she too recognizes that objects are complex entities, but doesn't seem to "open a categorial gap between a concrete object and its constituents [...]" (Garcia 2015: 143). It follows that module trope theory lies nearer to AN than modifier theory does; the latter occupies the theoretical space that is closer to realism, while the former occupies the theoretical space that is closer to nominalism.

Given these clarifications, it will now be easier to see why Trope Bundle Theory is much better accommodated by module tropes than by modifier tropes. The latter do not exhibit the character they ground, which means that a bundle of modifier tropes would be a bundle of character-less parts, namely a bundle of e.g. sphericalities that are not themselves spherical, greennesses that are not themselves green and so on. An additional entity is required to act as the character-bearer of the characters modifier tropes ground, an entity much like the SA-theorist's substratum or bare particular. Evidently however, the introduction of a substratum-like entity would render any bundle theory bundle theory no more. This is why in what follows, I'll assume it is module tropes we're talking about, unless stated differently.

Let us now consider Garcia's challenges and see how they afflict Trope Bundle Theory in its task of object-construction.

2. Garcia's Gap Challenges

Suppose that a billiard ball is a spherical, green, massive object (of course a regular billiard ball has other characteristics as well, but let's make things easy for ourselves). The basic worry underlying all of Garcia's challenges is this: Is bundling a sphericity trope, sphericity₁ (s₁), a greenness trope, greenness₁ (g₁) and a mass trope, mass₁ (m₁) enough to give us a billiard ball, i.e. enough to produce a concrete object that is green, spherical and massive? To better understand this worry, let us present each challenge in turn.

The first challenge, which Garcia (2014: 116) calls the *Generative Challenge* (GC), asks: How can the existence of s₁, g₁ and m₁ amount to the existence of an additional entity that has s₁, g₁ and m₁ as parts? In other words, how do you go from s₁, g₁ and m₁ all existing to there being an additional entity that is composed of s₁, g₁ and m₁?

The second challenge Garcia calls the *Non-Property Challenge* (NC). It asks: How can properties wholly constitute an entity that is not itself a (more complex) property? In other words, how can properties generate a non-property, an object? Implicit here is what Garcia (2014: 119) calls the *Property-Fusion*

Principle (PF): A whole composed entirely of properties must *itself* be a property. (Garcia (2014: 119) invokes, among others, Williams' (1953a: 10) own as well as L.A. Paul's (2002: 581) implicit commitment to PF in support of its cogency.)

The third explanatory challenge is called the *Character Challenge* (CC). It asks: How do s_1 , g_1 and m_1 constitute a whole which they also characterize? In other words, how do you go from s_1 , g_1 and m_1 wholly constituting a whole to s_1 , g_1 and m_1 also characterizing that whole, i.e. "to there being a new entity that is characterized in each of the ways specified by those properties" (Garcia 2014: 117)? Another, perhaps clearer, way to put this last challenge is by considering the following two propositions:

(C) Sphericity₁, Greenness₁ and Mass₁ compose a whole, W.

and

(O) There exists a billiard ball.

It's clear that the truth of (C) doesn't entail the truth of (O), which is to say that just because W is composed of s_1 , g_1 and m_1 it doesn't also follow that W is spherical, green and massive, i.e. that W is a billiard ball (Garcia 2016: 505). Something more has to be said by the bundle theorist to facilitate an inference of this sort, yet this additional stipulation, as we will see, comes with its own (pretty hefty) cost.

In a nutshell, then, Garcia asks: How can a characterized object (say, a billiard ball) be generated out of a collection of properties (say, s_1 , g_1 and m_1)? What plays the role of the *object-maker* in TBT? He discusses a number of different object-makers (fusion, interdependence and co-location) but I'll just concentrate on *fusion*, i.e. the sort of mereological relation that obtains between the parts of a whole, what's sometimes called mereological composition (this is because I take it that module trope-fusion is enough to explain the thick character of concreta; still, co-location will play an important role in the resulting account, as we will see in section 3). According to Garcia (2014: 118), "the mereological composition relation is such that, if it holds between properties F and G , then there is a third entity that has F and G as parts". Pretty clearly then, Fusion addresses (GC). Two or more properties (or objects, in our case) make up a whole, which is an additional entity to the properties that compose it.

What about NC? Fusion seems to fare well in this case too. Since Garcia himself classifies module tropes as thinly characterized objects, we may assume a principle parallel to PF, namely the Object-Fusion Principle:

(OF) A fusion of objects must itself be an object.

Given Garcia's classification of module tropes as objects, it follows from OF that a whole composed entirely of module tropes is itself an object. (Note here that this response works within Garcia's

framework but loses its edge once the object-property distinction is abandoned. See fn. 8 for a fuller response that questions the object–property distinction presupposed by the challenge itself.)

This leaves us with (CC). Indeed, things are a bit more complicated here. We’ve seen that the truth of a proposition like (C) does not entail the truth of a proposition like (O), which indicates that two or more module tropes constituting a whole isn’t tantamount to this whole being also characterized by the characters of these module tropes. Something additional needs to be stipulated, a principle that secures the inference from tropes composing a whole to that whole bearing the character of its trope-parts and from which, as a result, we can safely deduce (O). A principle of this sort could be something like (P): For every (whole) w , if x and y are w ’s parts and Fx , Gy , then Fw and Gw .

The issue with (P), however, is that it appears to have some far-reaching consequences, consequences that do not, in any way, seem to be entailed by the concept of part-whole relation or fusion (Garcia 2016: 505; Garcia adds the concept of co-location to the mix, but this is not material to our purpose right now).

Consider for example the problem of material constitution. Is a piece of clay, Lump, identical to David, the statue constituted by it? Some theorists are of the opinion that it isn’t; Lump is squashable; David isn’t. David is aesthetically pleasing; Lump is not. Since, then, David and Lump differ in terms of their properties, they cannot be one and the same thing; we have to accept that they are two distinct objects occupying the same region of space. For these theorists (P) can prove to be quite troublesome. Do David and Lump, qua co-located but distinct objects, compose a whole? If (P) is the case, it is impossible that they do, on pain of contradiction: Their whole would be squashable and non-squashable, aesthetically pleasing and not aesthetically pleasing and so on for any pair of contradictory properties that Lump and David jointly have. Yet it is difficult to see how the concept of fusion entails the impossibility that Lump and David compose a whole (Garcia 2016: 505). But (P) *does* entail this impossibility; so it stands to reason that we can’t infer (P) from the mere concept of fusion. And if that’s so, then no clear inference can be drawn from (C) to (P). The trope theorist will simply have to take (P) to be axiomatic. This goes to show that $O1$ is not spherical and green because two of its proper *parts* (s_1 and g_1) are sphericity and greenness (i.e. not because of (C)), but because these parts somehow *confer character* (i.e. because of (P)). Or to put it another way, $O1$ is not spherical because one of its proper parts is spherical but because this part (s_1) *spherizes as well* (Garcia 2016: 506). This seems to indicate that an additional *sui generis* character-grounding relation (*sui generis* because it cannot be reduced down to fusion) has to be postulated to account for the inference from (C) to (O), namely the relation expressed by (P).

Unfortunately, this *sui generis* characterization relation appears to be quite similar to the exemplification or instantiation relation traditionally postulated by the SA-theorist. For now, we may ask what it is exactly that s_1 *spherizes*. Apart from it spherizing itself, there seem to be two options. Either it spherizes some substratum/bare particular or it spherizes the whole of which it is a part. In the first case bare particulars and exemplification relations are re-introduced, effectively reducing module theory to modifier theory. The second case is less clear. Certainly, the whole (w_1) that s_1 constitutes is not itself spherical (or massive or green) in virtue of having s_1 as a part, for, as we’ve already seen, fusion by itself is not enough

to address the Character Challenge. But then it seems that w_1 has, in and of itself, no properties; it has no (at least non-formal) character, acting as a property-less complex particular that exemplifies the characters of its parts. In that case too, then, module trope thing-construction would function very similarly to modifier thing-construction, meaning that module tropes would characterize property-less particulars, rendering them spherical and massive and green.

Even if these problems were to somehow be sidestepped, however, fusion (understood as mereological composition) brings with it the further dilemma of choosing between unrestricted and restricted composition (Garcia 2014: 118). In the first case, for every collection of properties, there is a whole (and an object, at that) that these properties constitute; in the second, there is some restrictive principle that determines whether a collection of properties constitutes a whole or not.

What we get in the first case, it will be easy to see, is worse than an inflated ontology; for not only is there a whole for any collection of properties whatsoever, but, given (P), there must also be objects with incompatible properties (Garcia 2014: 118). For if for every collection of properties there is an object characterized by these properties, then we are going to have to accept spherical cubes and green rednesses alongside billiard balls and atoms, which is absurd. Postulating a principle that restricts composition seems then to be the only way out of this conundrum for the trope theorist.

There are, however, two issues with a move of this sort. First, there is the obvious problem of actually finding a suitable restricting principle of composition, a task which, as recent mereological history has shown (Van Inwagen's arguments in *Material Beings* are a good example of this), is not at all easy. Second and perhaps more importantly, to concede that such a restricting principle has to be found is to also concede that fusion is not sufficient to play the role of the object-maker in and of itself; it will be this additional principle *together* with fusion that will now play the object-making role, which is to say that the initial claim of fusion being the sole object-maker falls on its head.

All in all, then, it is unclear how fusion can account for thick-charactered objects (hereafter also referred to as 'concrete objects' or 'concreta'), and thereby address the *Character Challenge* (CC). Moreover, even if such an account were to be found, it would come with a series of consequences that seem rather hard to accept. In what follows, I'll try to show both that, given a clear concept of module trope, fusion can account for the thick character of concrete objects, as well as that the purported consequences of this account aren't as disagreeable as they may initially seem. I'll conclude by presenting two of the general principles of trope mereology and by discussing their relationship to classical extensional mereology (CEM).

3. Trope Mereology

3.1 The Character-Fusion Principle

Let us then start by disambiguating the concept of module trope and see how the disambiguated version may help us in addressing Garcia's Character Challenge. Module tropes, it will be important to recall, are

sometimes presented as objects that *exhibit* or *have* a single determinate characteristic, i.e. as singly-charactered substances. They *convey* that character to the (thickly-charactered) objects they are a part of, their advantage over their modifier brethren being that they convey a character they already have as opposed to the *de novo* character production that happens in the case of the latter. This is one way of understanding module tropes (call it the A-understanding of module tropes), but it is not the only or the metaphysically most fruitful one.

Another way is to understand them not as having or exhibiting some determinate characteristic or other but as themselves *being* these very determinate characteristics, i.e. the very sphericalities and rednesses we see, the hardnesses and masses we feel, and so on (call this the B-understanding of module tropes; see also Fisher 2018: 155 and Keinänen 2025: 201–202 for what I think is essentially the same underlying idea). Under the B-understanding, module tropes do not characterize the objects they are a part of through some characterization relation *additional to parthood* (as Garcia seems to believe in his 2016 work), but rather *are* their characteristics, i.e. they are their sphericalities and rednesses we see and it is in this sense that they are the (metaphysically) thin parts out of which concreta are composed. This is to say that, for example, r_1 does not convey its redness to R, but quite literally *is* its redness, which means that it renders R red *by being its redness-part*, the same way that a cupboard renders a table a cupboard-table by being its cupboard-part.

The problem that the Character Challenge seems to pose under the A-understanding of module tropes, then, is this: Module tropes are thinly characterized objects, which, at the very least, means that there is a characterization relation obtaining between them and their (thin) character. The issue, is that it isn't at all clear how this characterization relation carries over from relating just the character and the module trope to also relating the character and the whole of which the module trope is a part. This is the 'gap' in characterization that Garcia is observing. Or, to put it another way, there is no visible path from some character characterizing some module trope to that same character characterizing the whole this module trope composes (indeed, this assumption gets us in a lot of metaphysical trouble, as we've already seen in the previous section).

But note that this is only a problem if we treat module tropes as *charactered things* rather than as *characters themselves*. Under this second understanding of module tropes, there is no characterization relation between trope and character to be carried over at all; it is the greenness being a part of the whole that makes the whole green just as it is the leather-covering being a part of the chair that makes the chair a leather chair. (Does the question of whether chairs covered with leather are leather chairs pose a challenge analogous to Garcia's gap challenge? I don't think it does.) Characterizing an object and being its part is the *same* thing when it comes to module tropes; character-grounding is reduced to parthood (although as we will see shortly, parthood by itself is not enough). This is to say that module tropes characterize a thing by *being its parts*.

We may express this tenet of trope mereology by replacing (P)

(P): For every (whole) w , if x and y are w 's parts and Fx , Gy , then Fw and Gw .

with (P*)

(P*) For every w , if x and y are w 's trope-parts and Fx , Gy , then Fw and Gw .

The problem with (P), recall, was that even though it secures the inference from module tropes composing a whole to that whole bearing the character of its trope-parts (i.e. the inference from (C) to (O)), it also entails that objects like David and Lump cannot compose a whole, since their whole would be both squashable and non-squashable, aesthetically pleasing and not aesthetically pleasing and so on. However, it is highly doubtful that the concept of fusion or combination entails the impossibility of Lump and David (or of any other similar pair) composing a whole. Yet (P) *does* entail this impossibility; so it stands to reason that we can't infer (P) from just the concept of fusion/combination. And if that's correct, then no clear inference can be drawn from (C) to (P).

The issue here, it seems, is that there hasn't been a sufficiently sharp distinction between module trope-fusion and concreta-fusion, with (P) expressing a content-neutral mereological principle that holds true for trope-parts and concrete-parts alike. (P*), then, allows us to make the more modest claim that it's just in the case of thin characters, i.e. tropes, that parts characterize their wholes, without burdening the concept of combination/fusion with unnecessary (and hard to justify) entailments.

Still, P* appears to face issues of its own. Most importantly, it seems to commit us to a version of the compositional fallacy, i.e. to the idea that parts and wholes necessarily share character. Consider a car and its front-right tire. Roundness is a trope-part of the tire, and the tire is a concrete part of the car. Thus, by the transitivity of parthood, it would appear that roundness is part of the car and, hence, by virtue of P*, that the car is round as well.

Evidently, however, this is an unacceptable result. The roundness of the tire is not identical with the shape character of the car but only with a part of it (the relevant round part) and P* clearly has to find some way to express distinctions of this sort. One way to do this, is to take into account the peculiar relation of module tropes to space and specifically their ability to co-occupy the same region of space their whole occupies, as in the case of sphericity, greenness and mass module tropes co-occupying the same region of space our familiar billiard ball does.

It seems then that the trope-parts of an object for which P* holds are those trope-parts that occupy the same region of space that the object occupies and not a sub-region, as is the case with the roundness trope-part, which occupies the sub-region that the tire occupies, but not the region that the whole car occupies. This distinction, based on Fisher (see his 2018: 157; 2025: 143–145 for a much more detailed discussion as well as some additional necessary distinctions), enables us to distinguish between those module tropes that directly constitute the character of the whole they are a part of and those that don't. In the former case, a greenness trope is *identical* with the color character of the whole it constitutes, while in the latter it just is *a part* of that character. We'll see more on this aspect of trope object-construction in the following section.

Second, both natural and formal languages seem to imply a distinction between character and the thing characterized that is foreign to the nature of tropes. We already saw this distinction at play in both Loux and Garcia's work, where calling module tropes 'charactered things or individuals' served as a pathway to the Character Challenge and we moreover encountered the same distinction in the way P was originally expressed, distinguishing between argument and function or, less formally, between property and entity. In both cases, the underlying idea was that the character possessed by the part (the 'F' of Fx) was somehow transmitted to its whole (w thus becoming Fw), without explaining how this transmission of character was possible.

Taking these two points into account, P* can now be recast as the Character-Fusion Principle (CFP):

(CFP) For every whole w and every character F, if F directly constitutes w, then w is F.

This improves (P*) in a number of ways: First, the term 'character F' (or, alternatively, F-character) no longer implies a distinction between character and trope; an F-character is not a character that exhibits F as a property or characteristic. It simply is identical to F. For this reason, the terms 'character' or 'F-character', 'G-character', and so on will be used interchangeably with the term module trope from now on. Tropes like g_1 , s_1 , etc. are hence simply (particular) characters.

Second, the term 'directly constitutes' prevents the roundness of a tire or the character of any other concrete proper part from characterizing the whole it constitutes. We could express this more formally as: $\forall w \forall c [(F\text{-character}(c) \wedge \text{DCR}(c, w)) \rightarrow Fw]$. Here, $\text{DCR}(c, w)$ means that c is a character-part of w and is exactly co-located with w. Thus, c directly constitutes w itself rather than merely constituting one of w's proper concrete parts.

This means that when it comes to the fusion of characters or module tropes, we can distinguish between two notions of character-constitution: on the one hand, we have direct constitution, where the character and its whole are co-located. This is the case of the billiard ball and its spherical shape. On the other, we have indirect character constitution, where the character and its whole are *not* co-located, even though a character that indirectly constitutes a whole partially constitutes one of the characters that directly constitute the same whole. This is the case with the roundness of the tire and the car.

All in all, then, (CFP) simply tells us that when an F-trope or character directly constitutes a whole, that whole is F. This isn't to say that F's F-ness now somehow characterizes the whole on top of characterizing F; it rather means that F is one of the directly constitutive character-parts whose fusion is identical with w: F is both part of and exactly co-located with w, and thus contributes directly to w's thick character, to recall the earlier distinction between thin and thick character. Importantly, this means that (CFP) does not supplement fusion with an additional character-transmission principle. It rather expresses what it is for an F-character to be a direct constituent of a thick character in the first place.

Interestingly, an additional mereological principle, equally specific to trope mereology, seems to follow from (CFP). This is the principle of Co-locational Hyper-Extensionality (C-HEP):

(C-HEP) For every object x , necessarily, for every object y , if x and y have exactly the same character-parts and each of those character-parts directly constitutes both x and y , then $x = y$.

I use the term 'object' here rather than the term 'whole' because of the connection that the notion of object has to the notion of thick character when it comes to TBT. Recall that, for trope theory, an object is identical to the bundle of its tropes, which is to say that it is identical to its *thick* character, namely the character that these tropes constitute. What (C-HEP) essentially tells us then is that sameness of directly constitutive character-parts necessarily equals sameness of thick character. The same directly constitutive trope-parts cannot produce wholes with different thick characters. And since, for trope theory, objects *are* thick characters, this principle applies to objects equally.

This helps put the relation between (CFP) and (C-HEP) into context; according to the former, each character F that directly constitutes a whole makes that whole F by being one of the directly constitutive character-parts that make up the whole's thick character. If the whole is an object, then it is always identical with its thick character. According to the latter, if two objects have exactly the same character-parts and each of those parts directly constitutes both objects, then they are identical. The latter then follows from the former because it cannot be the case that a whole's directly constitutive character-parts fully determine its thick character without it also being the case that objects with the exact same directly constitutive character-parts are identical, given that objects are thick characters.

Another important characteristic of (C-HEP) is the fact that it has a modal element in it, unlike the standard extensionality principle at play in (CEM). This means that (C-HEP) tells us that sameness of parts results in sameness of objects across possible worlds, which, as we already saw, means that character/trope-parts, like sphericality₁, greenness₁, and mass₁, *can only* compose one particular thick character and hence one object, in our familiar case, a billiard ball.

This doesn't seem to be the case with concrete parts such as the cogs and pins of a watch or the Lego pieces that make up a Lego boat; standard extensionality does not imply that knowing which concrete parts compose a whole is sufficient to determine that whole's qualitative character. The proper parts of a watch, for example, may be arranged so that their fusion is a perfectly functional watch, a convoluted and dysfunctional contraption, or simply a pile of cogs, pins, and dials, its thick character varying accordingly (the same, it will be easy to see, goes for the Lego pieces at one time constituting a Lego boat and at another time a Lego house).

(C-HEP), by contrast, leaves no room for such variability in spatial arrangement. This is simply to say that concrete pieces admit different arrangements that may alter their qualitative contribution, while mutually exactly co-located character-pieces do *not* admit alternative arrangements that may alter their qualitative contribution: there cannot, for example, be a pile of the ball's color, shape, and mass because a pile requires its components to occupy distinct subregions and stand in ordering relations. Hence, assuming that trope-fusion, just like standard mereological fusion, introduces no arrangement or structure additional to its trope-members, it follows that knowing which tropes are part of a fusion is *enough* to determine the thick character/object they make up. Nothing capable of varying the compositional

outcome remains and hence no additional information is necessary to determine the qualitative content of a character-fusion, i.e. its thick character, unlike the case of concrete-part fusion. (C-HEP) expresses this aspect of trope mereology.

Having discussed the source of Garcia's Character Challenge, how we should understand the nature of module tropes in view of it, as well as two basic tenets of trope mereology that seem to flow from this understanding, let us now consider some objections to our proposed solution as well as the relation between trope mereology and mereological universalism more generally.

3.2 Universalism and other issues

A number of objections can be raised against trope mereology as presented so far; in what follows, I'll consider two of what I take to be the strongest ones.

First, Garcia's Character Challenge can be restated, even if slightly modified: We've seen that co-located tropes can be arranged in only one way (we've expressed this feature of trope mereology through C-HEP) and moreover that they characterize the wholes they are parts of (we've expressed that feature of trope mereology through CFP). But why should the fact that these tropes can be arranged in only one way entail that the resulting whole is one of the concrete objects of experience and science—an ordinary watch, billiard ball, or electron? All we seem to know in virtue of (C-HEP) and (CFP) is that tropes like s_1 , g_1 and m_1 can only give us one object—one thick character—and that this object is spherical, green, and massive. But this, in and of itself, does not tell us that trope-composed objects are identical with concrete objects. A sphericity trope and a greenness trope could compose a sphericity–greenness fusion that is itself a complex trope but not a concrete object (I thank an anonymous reviewer for pointing this out). Something more is needed to make the inference from trope-fusions to concreta.

Drawing on A. R. J. Fisher's (2020) account of the abstract–concrete distinction, this concern can be addressed by recognizing that trope theory (or at least the version of trope theory currently under consideration) does not treat abstractness and concreteness as two distinct ontological categories that somehow have to be bridged. By calling tropes 'abstract,' the (module) trope theorist does not mean to allude to the nature of extra-spatial and extra-temporal objects like numbers or Platonic ideas (in fact, and as we saw earlier, our current understanding of module tropes goes explicitly against this allusion). Rather, the main idea here, following Williams (1960/1986: 3), is that abstracta have a different relation to space than concreta do; some entity E is then

1. concrete iff it uses up or exhausts the content of the region of space it occupies or is identical with the content of that region.

and

1. abstract iff it fails to use up or exhaust the content of the region it occupies or is just part of the content of that region (formulations due to Fisher 2020: 44–45).

Take the billiard ball's greenness, for example; it does not take or use up all the content of the region it occupies, for there are other facets or parts of the billiard ball like its sphericity that are also parts of that content. By contrast, the billiard ball itself does use up ('exhaust' is the term Fisher uses) the content of the region it occupies, which is why it is to be considered concrete as opposed to its greenness or sphericity.

Consequently, abstractness and concreteness are to be understood on a spectrum; the thicker a character gets (meaning, the more it exhausts the region it occupies), the closer it gets to being a concretum, a concrete object like a table or an electron. Concreta then are just those module trope-fusions that exhaust the region of space they occupy, rather than members of a separate fundamental ontological category. As Fisher (2020: 50) puts it:

The fact that abstractness comes in degrees is part and parcel of the thesis that the distinction between abstracta and concreta does not represent an ontological divide between two basic kinds of entity. After all, an abstract entity is a special sort of part of a whole. When we consider a concrete whole and its abstract parts the abstractness of each abstract part is not abstract simpliciter but abstract to a degree. To illustrate, the football is a concurrent sum of tropes. Call it 'S'. Suppose that S is composed of the following abstract parts: a, b, c, and d. S is maximally concrete relative to its abstract parts. The sum $a + b + c$ is less concrete and more abstract than $a + b + c + d$. The sum $a + b$ is less concrete and more abstract than $a + b + c$. If a, b, c, and d are simples (i.e., they lack proper abstract parts), they are perfectly abstract.

There is, then, no difference between an exhaustive trope-fusion and a fully concrete object in terms of concreteness: the thicker a trope-fusion gets, the more it exhausts the content of the region it occupies, to the point it becomes maximally concrete and minimally abstract. On Fisher's account, such an exhaustive fusion does not merely resemble a concrete object; it qualifies as one.

Still, someone could insist. So far we've seen that (at least) co-located module tropes can be arranged in only one way, that they characterize the wholes they are a part of and that these wholes are (or can be, given they exhaust the content of the region they occupy) concrete. But how do we know that these concrete wholes are to be identified with the concrete objects of experience and science, that they are tables, electrons, and billiard balls?

My tentative answer to this is the following: Even though we cannot deductively establish what sort of concreta module tropes compose, it seems unreasonable to assume that trope composition results in some, as of yet metaphysically unknown, kind of concretum, *when we have a clear alternative available, namely that tropes compose the concrete objects of experience and science.*

The critic may indeed want to insist that the whole constituted by a sphericity trope, a greenness trope, and a mass trope is not—or at least need not be identified with—a billiard ball, even though it is itself concrete, spherical, green, and massive. Note, however, that in that case we are entitled to ask: What is the metaphysical difference between that whole and the billiard ball? If no such difference can be found,

then it seems that assuming the existence of a concretum that has just the same properties as the billiard ball but is not the billiard ball would be not only explanatorily idle but also ontologically cumbersome. It would complicate our ontology without adding anything to our understanding of the metaphysical composition of objects.

Hence, until the critic provides us with at least one informative alternative, it would appear that we have good reason to be wary of her rejection. If the theory defended here gives a cogent story of the metaphysical composition of objects and is internally consistent, then it seems that the burden of proof has shifted: the identification of trope-fusions with ordinary concrete objects should be the natural starting point for understanding trope bundles and module trope thing-construction, rather than the other way around.

Let us now consider the second issue. It can be phrased in terms of the following question: Does trope mereology, as so far formulated, allow for wholes with incompatible properties, such as wholes that are both spherical and triangular, blue and green, and so on? Before proceeding, it is important to clarify the sense of “incompatible” relevant here. The claim is not that such wholes are contradictory or cannot exist in any possible world whatsoever: triangularity and sphericity do not form the same pair as triangularity and non-triangularity. Rather, the point is simply that, as a matter of brute fact, no such wholes appear to exist in the actual world.

There seem to be two cases to consider. The first concerns familiar wholes like the billiard ball, that is, non-scattered wholes occupying a single continuous region of space. The second concerns scattered wholes, and presupposes a well-known mereological principle, sometimes called mereological universalism (MU). According to (MU), for any collection of things whatsoever, there is a whole composed of them, meaning that there is equally a whole composed of Brad Pitt and the outer ring of Saturn, as well as a whole composed of the billiard ball’s sphericity and a yield sign’s triangularity.

Let us start with the former, familiar case. As we’ve already seen, it is (CFP) that governs the characterization of non-scattered, spatially continuous wholes such as billiard balls by their trope parts. The key notion here, recall, is the notion of direct constitution; for a trope to directly constitute a whole, it needs to be both part of the whole *and* be co-located with it. This means that the tropes directly constituting a whole are all co-located with that whole and, consequently, with one another, since co-location is a transitive relation.

But now note that a sphericity cannot occupy *exactly* the same region of space as a triangularity. Certain different shapes cannot be exactly co-located, for they extend in space in incompatible ways (at least this seems to be a brute fact in our—the actual—world; I don’t mean to make the stronger claim that a sphericity cannot occupy the same region of space as a triangularity in every possible world here). A triangularity occupies its region triangularly, whereas a sphericity occupies its region spherically. Since one and the same region cannot be occupied in both of these ways in the actual world, the two tropes cannot exactly coincide spatially.

If this is correct, then module trope theory and (CFP) can provide us with an explanation of why there are no triangular billiard balls, spherical yield signs, or any other counter-intuitive wholes and moreover do so by appealing to the natures of tropes themselves: if a trope is to characterize its whole, it needs to be co-located with that whole and hence with the other tropes characterizing it. But certain tropes cannot be co-located with certain other tropes; hence, given (CFP), tropes of this sort cannot directly constitute and characterize the same continuous whole.

Importantly, modifier theories and, more generally, theories based on *ante rem* properties cannot offer us an explanation of this sort, for in their case properties are extra-spatial and extra-temporal entities, characterizing objects via a *sui generis* characterization relation. A modifier theorist could certainly stipulate that certain pairs of properties cannot—or at least do not—jointly characterize any object, but such a stipulation would be *ad hoc*. It would tell us that sphericity and triangularity cannot characterize the same object, but not what about these properties prevents them from doing so. By contrast, module theory explains this restriction through the spatial natures of the tropes themselves: for the same whole to be both triangular and spherical, a triangularity and a sphericity would have to occupy exactly the same region of space, which, as we have already seen, they do not do in the actual world, given the different ways in which they extend through space.

Let us now consider the latter case. To this end, consider two objects, a red sphere R and a blue triangle B. Given the trope-theoretical analysis of objects, R is composed of a redness trope r_1 and a sphericity trope s_1 and B is composed of a blueness trope b_1 and a triangularity trope t_1 . But if (MU) is true, then r_1 and b_1 also compose a whole, w_1 , and s_1 and t_1 compose another whole, w_2 . This means that we now have two additional wholes, one composed of a redness and a blueness and another composed of a sphericity and a triangularity. Note, however, that this needn't alert us. Since both w_1 and w_2 are scattered wholes, none of their trope-parts is exactly co-located with the whole it composes and hence none directly constitutes that whole. (CFP) therefore does not entail that w_1 is both red and blue or that w_2 is both spherical and triangular. The existence of these scattered wholes thus causes no trouble for the module theorist.

Finally, even if someone were to, for some reason, replace (CFP) with (P*), thus claiming that trope-parts always characterize their wholes, this would still be no cause for concern for the module theorist. For, in that case, w_2 would indeed be both spherical and triangular, but its triangularity would occupy a different region of space from its sphericity; w_2 , therefore, would not be triangular and spherical in the *same* region. Recall that it was exactly this feature of a triangular billiard ball that made it so objectionable, and it is this feature that scattered wholes like w_2 lack. In this sense, w_2 is just an additional peculiar whole, alongside wholes such as the one composed of Brad Pitt and the outer ring of Saturn, whose existence mereological universalism already permits.

Taking Stock

The starting point of this paper was to find a way to address all three of Garcia's gap challenges while remaining within a trope-theoretic framework. Its central argument has been that, given a certain understanding of module tropes as identical with the characters of objects (such as this billiard ball's sphericity or greenness)—the B-understanding—a genuinely new trope-mereological principle can be extracted: the Character-Fusion Principle (CFP). From (CFP) and given certain further conditions, another trope-mereological principle follows: (C-HEP). Together with the B-understanding, these principles show how, for example, a particular sphericity, greenness, and mass can constitute a whole that is fully concrete and itself spherical, green, and massive—that is, an ordinary object of experience such as a billiard ball. Explaining this transition from collections of tropes to concreta such as billiard balls is, in essence, to address Garcia's three challenges.

Next, we focused on trope mereology itself, as distinctly characterized by (CFP) and (C-HEP). We saw that it is consistent with (CEM) by being both extensional—indeed, hyper-extensional—and compatible with mereological universalism. According to the latter, for any collection of tropes, there exists a whole they compose, even though not every such whole qualifies as an ordinary concretum like a billiard ball. (CEM too, note, does not accord every fusion the status of an ordinary concretum.) Finally, trope mereology introduces no distinctive type of fusion: the distinctive features of trope-fusion arise from the nature of the entities fused rather than from the nature of the fusion relation itself. Accordingly, and with respect to ontological commitments, trope mereology appears to require none beyond those of classical mereology, apart, of course, from a commitment to tropes themselves and to the manifold of objects compossible from them.

Admittedly, the study of trope mereology is only beginning to take its first careful steps. Apart from Fisher's (2025) very informative reconstruction of D. C. Williams' own views on mereology and of how these views carry over into his trope theory—a very important contribution in its own right—I am aware of little work devoted specifically to systematically articulating the principles governing trope-fusion. Much therefore remains to be done: the theory's axioms must be made explicit, and their interrelations, consequences, and finer points laid bare. Given the present results, however, I think this is a project well worth undertaking.

Declarations

Author Contribution

I (Jason Krontiras) am the sole author of this paper.

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Footnotes

1. See Williams (1953a, 1953b), Campbell (1990), and Maurin (2002) for typical examples.
2. Paul (2017: 471) classifies Williams as an early mereological bundle theorist but observes that he provides no explicit definition of qualitative parthood, no account of whether trope-fusion is restricted or unrestricted, and no explanation of how qualitative parthood relates to spatiotemporal parthood. The present proposal develops some of these underexplored aspects of the Williamsian conception through two mereological principles distinctive of trope theory—CFP and C-HEP—and by examining their compatibility with unrestricted composition.
3. To give a few examples, TBT easily accounts for the possibility of non-identical yet perfectly similar bundles through the postulation of particular rather than universal properties. It does away with the mysterious substrata that supposedly serve as the subjects of property-exemplification. It accords objects a metaphysical structure and hence avoids metaphysical blobs and the various issues usually associated with them.
4. For a systematic treatment of mereology and its central principles, see Simons (1987).
5. The notion of character is a rather intuitive one in Garcia's work. He seems to employ it to refer to any sort of natural or formal feature something may have, whether it is the sphericity of this ball (its spherical character) or the property of being self-identical that all entities seem to possess (their self-identical character, so to speak). It appears, however, to be more fundamental or primitive than the notion of property, not constituting or belonging to an ontological category *per se*. We could therefore say that it is an ontologically neutral concept that can both be used interchangeably with other commonsense concepts like for example those expressed by 'feature', 'characteristic' or 'aspect' and to refer to the overall character a thing has, i.e. the sum of its features.
6. McDaniel (2001) likewise identifies ordinary physical objects with mereological fusions of tropes, including the relational tropes obtaining among their parts. His concern, however, is the application of this account to puzzles of material constitution, rather than the character-transmission problem raised by Garcia.
7. I think that both of Williams' 1953a and 1953b papers are excellent and highly illuminating studies on what module tropes conceived of in this second sense amount to and why it is quite intuitive to think of their bundles as identifiable with the fully concrete objects of science and experience. The issue is that Williams does not clearly distinguish them from either modifier tropes or module tropes conceived of in the first sense, which in turn sets the stage for much confusion as to what is or isn't intuitive when it comes to trope thing-construction.
8. Under this understanding of module tropes, the initial module/modifier distinction seems to track the more ancient distinction between *ante rem* and *in re* universals. Just like *ante rem* universals, modifier tropes are extra-spatial and extra-temporal, being related to the objects they characterize via an exemplification relation. And while they are the formal causes of an object's character, i.e. they are that *in virtue of which* the object has that character, they are not its characteristics *per se*. Module tropes, on the other hand, are both spatial and temporal and are in need of no such exemplification relation. They are *in re*, as we already saw, i.e. the greennesses, sphericities and masses we perceive and that make up the thick character of an object.

9. It should be noted that understanding module tropes as characters blurs the object–property boundary and weakens the distinction’s significance when it comes to tropes (see p. 5). Are module tropes characterized? Only derivatively: a greenness is green because it is a greenness, not because it exemplifies greenness. Are they properties/characteristics? Unlike modifier tropes, they do not characterize a substance through a *sui generis* relation, yet they are in the truest sense the greennesses and sphericalities of the objects we encounter (recall that Garcia’s criterion for something to qualify as an object was that it is characterized without itself being a characteristic). For this and other reasons, Keinänen is right in arguing that tropes ultimately constitute a new ontological category; it is then in terms of this new category that both objects and their possession of properties are analyzed. In this context, Garcia’s Non-Property Challenge loses its force. His challenge assumes that trope-fusion must somehow cross a fundamental categorial divide from properties to objects; if both categories are derivative, however, no such transition is required. Still, and as noted earlier, even though tropes do not fall on either side of Garcia’s object–property distinction, his approach remains philosophically productive, for it allows us to understand how exactly trope object-construction works.
10. Note here that C-HEP presupposes TBT’s conception of objects as non-trivial fusions of character-parts; characterless entities therefore fall outside its domain.
11. There remains the interesting question whether TBT admits wholes that are not objects. The answer depends partly on the distinction between concrete and less-than-concrete wholes and on whether objecthood requires full concreteness. If some less-than-concrete wholes fail to qualify as objects, “object” is narrower than “whole”; otherwise, the two are coextensive. Nothing here requires that question to be settled: (CFP) applies to wholes generally, whereas (C-HEP) concerns those wholes that qualify as objects.
12. The reader might have noticed that I didn’t present tropes as abstract entities in the introduction and have not referred to their abstractness up until now. This is not because I take abstractness to be an unimportant feature of tropes, but rather because introducing it at an earlier stage would likely have obscured rather than clarified the nature of tropes, given the many connotations associated with abstractness.
13. One consequence of this definition, as Fisher (2020: 48) himself observes, is that concreta cannot be co-located with other concreta, which rules out cases of material constitution such as that of Lump and David, in which the statue and the clay constituting it occupy the same region of space. Fisher (2025: 103ff.) explores several interesting strategies for addressing this and related issues. Be that as it may, it’s worth briefly noting that the exclusion of cases such as Lump and David results not from the concept of fusion itself, as in Garcia’s case, nor from (CFP) and (C-HEP), but from the adopted spatial account of the abstract–concrete distinction.
14. This seems specifically to be the case for tropes that fall under the same determinable, like different color or shape tropes, although further work is needed to establish whether this holds across all determinables.

15. This response assumes that a scattered fusion is exactly located at the fusion of the regions exactly occupied by its parts. This reflects the locational principle associated with Markosian's (2014) regionalism and formally examined by Gilmore and Leonard (2020). Their discussion concerns material objects and their parts; here, the underlying locational principle is extended to spatially located tropes.
16. It is worth noting here that McDaniel too rejects an unrestricted inference from an F-trope's being part of an object to that object's being F, partly because unrestricted composition would generate fusions of incompatible tropes (Caplan and Bright 2005: 80 n. 27). CFP provides a principled basis for this restriction: only trope-parts that directly constitute—and hence are exactly co-located with—their wholes characterize those wholes.