

# SUBSTANCE METAPHYSICS IS INCOMPATIBLE WITH THE CAUSAL CLOSURE OF THE METAPHYSICAL REALM

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**Abstract:** The present paper argues that substantialist metaphysics are in tension with the physicalist idea that the universe is causally closed. The argument is a rather specific one and proceeds through three steps. The first step consists in arguing that monistic substance metaphysics allow for the existence of entities that cannot belong to the intended first order domain. This result sensitively depends on the nature of substances as invariant entities. The second step concludes that, if further domains are to be admitted, then they are inhabited by “higher” or (systematically) “non-standard” entities and that, in both cases if not made somehow innocuous, such entities may take part on the metaphysical construction of the world through their own distinctive properties and causal powers. However, this latter claim is in contradiction with causal closure. But closure is the principle that mainly characterizes physicalist approaches in metaphysics and as such physicalist metaphysics cannot get rid of it. Who attempted making exotic properties and causal powers innocuous usually appealed to the *Supervenience Argument*. Unfortunately, as the third step proves, this argument is *invalid*. Finally, the paper looks forward and toward alternative models for physicalist metaphysics, like process-based models.

**Key-words:** Substance Metaphysics; Causal Closure; Supervenience Argument.

\*Ph.D. in Philosophy from the University of Padua (Italy). This article was supported by the FAPESP Postdoctoral Fellowship at CLE-UNICAMP just concluded (grant n° 2018/16465-6).

## 1 Introduction

Scientific literature is increasingly emphasizing the limits of traditional or substantialist approaches to physicalist metaphysics. Examples of works that are currently contributing to the debate are (Bickhard and Campbell 2000, Bickhard 2004, 2011, 2015; Campbell 2009, 2015; Campbell and Bickhard 2011; Corry 2013, Ferrari 2023; Ferrari and Bickhard 2023, Seibt 2002, 2009, 2010; Winter 2017). According to these works, traditional metaphysics is in tension with methodological physicalism in several ways. Just to mention some of them, Bickhard and Campbell both independently and together argue that the causal model offered by traditional metaphysics is empirically false and, so, that particularist metaphysics are unsound. Instead, Seibt and Ferrari respectively argue that the background ontology for traditional physicalist metaphysics lacks the required theoretical support and that it is even internally inconsistent.

The aim of this brief communication is in line with those criticisms. The present paper argues that traditional substantialist metaphysics are in an unsolvable tension with the main naturalist tenet: the causal closure of the whole universe. *Causal Closure* (hereafter *Closure*) the idea that every physical event must have (sufficient) causes that cannot be *non-physical*.

Causes of physical events must be physical too, no doubt. *Closure* is, indeed, the metaphysical correlate of the *conservation principles* that govern all natural sciences, like the conservation of mass, of energy, of angular momentum... and so on. In this sense, it is worth noticing, the satisfaction of *Closure* and of a more general ontological monism are the “precondition” of every “healthy” physicalist approaches to a metaphysics and an ontology whose characterization does not rely on arbitrary and/or stipulative definitions of what is the intended domain of the *physical*. Physicalist approaches share the idea that our metaphysical and ontological conclusions must start, be led, and even be supported by empirical observations and scientific considerations. But this is not enough. To be healthy, physicalist metaphysics must certify that *Closure*.

Whether or not *Closure* should hold in naturalists approaches is not a matter of empirical investigation but is an in principle requirement: if it doesn't, then the causes of physical events may belong to further non-physical domains. Accordingly, if *Closure* is

proved to be false in a given theory, then the intended metaphysics turns committed with what is traditionally called as metaphysical *dualism* – the other way around holds too. In other words, *Closure* contrasts with the metaphysical possibility of dualism and, generalizing, with the automatic generations of a  $n$ -ary hierarchy of ontic levels. Therefore, *Closure* counts as a *test* of the degree of flatness desiderata for all allegedly monistic physicalist metaphysics.

The present paper develops a rather complex but specific argument in three steps. First, from a result due to Ferrari (2022a, 2022b) it is argued that monistic substance metaphysics cannot preserve the *ontological closure* of the intended first order ontology. In other words, it is argued that monistic substance metaphysics cannot fix once and for all their own domain of existence or, equivalently, that they cannot restrict the meaning of what exists to what belongs to the intended or standard domain. For reasons that will be made explicit through the following sections, an allegedly monistic ontology of substances inevitably allows for the existence of non-standard entities. Non-standard entities belong to domains that are different from that of the intended first order ontology of the theory. The theory cannot get rid of them either because as higher entities they are essential for the unique characterization of the ontological realm, or because as non-standard ones they are the inevitable consequence of the theory.

At least in principle, however, such exotic entities may take part in the metaphysical construction of the world through their own non-standard properties and causal powers. This is the conclusion of the second step. Yet, the sole plausibility that exotic entities may be causally efficacious is in contradiction with *Closure*. The reason is that we are discussing at the metaphysical level. Accordingly, then, the theory should no longer be considered as adequate for physicalist purposes. Thus, how to make the properties of non-standard entities causally or metaphysically innocuous? How to preempt their causal efficacy and preserve *Closure* within monistic substance metaphysics?

Who attempted a solution to these and related problems usually appealed to the *Supervenience Argument* (SA), regimented by Kim (*cf.* 2005, 2006) – see also Corry (2013) for an introduction. Accordingly, non-standard or higher properties are usually assumed to be *supervenient* upon the bottom “physical” ones. That is, (i) they are ontologically *dependent on* the bottom properties in a way that (ii) their causal powers are *fully characterized* (and explainable) by the properties of the standard bottom level entities. Yet, as

the third step argues, SA is *invalid*. In following (Corry 2013; Ferrari 2023, Ferrari and Bickhard 2023) I propose a rather new argument.<sup>1</sup>

Thus, starting from a proof of the *ontological opening* of monistic substance ontologies, it will be proved that, *if* the SA is invalid, then monistic substance metaphysics cannot keep valid *Closure*. The key point is the proof of SA's invalidity.

Although, dualism arguably revamps as a science-based metaphysics, through the increasing tendency to accept interpretations that accommodated physicalist metaphysics within a dualist frameworks (*cf.* Albert 1992),<sup>2</sup> problems with dualist residuals are still among the most serious, especially for metaphysics. Indeed, being dualist is a matter of inner consistency of the physicalist metaphysics because, as physicalist, the theory must keep the causal closure of its own metaphysical model, namely that nothing external to the intended material/physical domain can causally affect and interact with material/physical entities making the universe – neither God, souls, and angels, nor intentions, abstract entities, and so on.

In addition to that and in conclusion of the paper, I carry out a further step: I look for alternative models for physicalist metaphysics and argue that they must be process-based models.

## 2 Physicalist substances metaphysics and dualism

According to Seibt (2002, 2010, 2022) two main and mutually exclusive trends are to be distinguished in ontology and metaphysics: those that are *substantialist* and those that are *process-based* – or *interactionist* (*cf.* Bickhard 2004, 2009). Metaphysics is loaded with substantialist presuppositions when primitive entities are *fundamental*, *ontologically independent* (isolable), and *non-relational* (local) (*cf.* also Winter 2017). Accordingly, “particulars”, “tropes”, “facts”, “events”, “well-defined (abstract or concrete) objects” are

<sup>1</sup>It is worth noticing that SA is arguably *unsound* (*cf.* Bickhard and Campbell 2000, Bickhard 2011, 2015; Campbell and Bickhard 2011).

<sup>2</sup>One may recall the debate on the interpretations of quantum mechanics and the von Neumann-Wigner solution that places human consciousness in the center of the ontological stage.

all substances.

From the formal standpoint, substances are *first order* and *invariant* entities, namely they are *self-identical* and *context-independent* in the precise sense offered by primitive equivalence relations (reflexive, symmetrical, and transitive relations). Metaphysics and ontologies that assume the validity of the *Classical Theory of Identity* (CTI) (Arenhart *et al.* 2019; Catren 2022, Ferrari 2022a, 2022b, French and Krause 2006) are example of this trend.<sup>3</sup> Despite being relational, even first order structures can be considered as (abstract) substances<sup>4</sup> because, as Rodin (2007, 2011, 2017) tells us, in defining structures, primitive first order isomorphisms play an analogous role of primitive equivalences, in that they *preserve* the structural organization.

Contemporary scientific literature offers two main examples of naturalist metaphysics that are based on substances. The first is what Kim (1989, 2005, 2006) calls “Ontological Physicalism” (OP) and a second is the one called “Ontic Structural Realism” (OSR) (*cf.* Ainsworth 2010). In both cases, the interplay between the naturalist aspiration of the theories and the “degree of flatness” of their own models, namely the number of ontic domains/levels the theory is committed with, seems to lead to problems. The reason is that both theories have models that are inevitably dualistic or non-monistic.

In the case of OSR, as Cordovil *et al.* (2022) recognise, “this endorsement of flat ontology is not a consequence or requirement of OSR” (p.7). Instead, that endorsement is due to “additional” assumptions that are all “independent of OSR” (p.17) and that restrict the model in such a way that it is now one-layered or monistic. Yet, such assumptions or constraints are additional to and independent of the theory because they are not supported by the intended OSR-model. The OSR theory *automatically generates* further domains, all arranged in an ontic hierarchy of levels. Leaving details aside, in one way or another those *physicalists* constraints make metaphysically innocuous all the domains whose order is above the first. In this way, the causal efficacy of the OSR-model is restricted to the first order domain and the theory is preserved as physicalist in the sense of being consistent with *Closure*. Yet, as such, OSR is rather a weakly physicalist theory, because it does not have the resources to block the automatic generation of further levels and domains of its own intended model. Indeed, OSR-metaphysics has only one fundamental level, and this

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<sup>3</sup>In the next section, I am going to define and discuss CTI.

<sup>4</sup>This claim goes *contra* my own work (Ferrari 2021).

is because “this level is given by modern physics (properly understood)” (p.13).

Problems with dualism also directed Kim’s pursuit of a physicalist metaphysics. It is well known how Kim strongly rejected the metaphysical posits of Non-Reductive Physicalism (NRP) (Kim 1989). Despite that most of Kim’s arguments and works are directed to solve the specific problems due to the mind-body dualism and the related issue of mental causality, they may be easily generalized to all genuine cases of dualism and higher causation that involve the emergence of structural organization (*cf.* Cordovil *et al.* 2022, Ferrari 2023, Santos 2015, Wilson 2021). In a nutshell, Kim argues that NRP cannot accept genuine higher causation, like mental interactions, because otherwise NRP would be either committed with dualism or simply self-inconsistent, in virtue of Kim’s *Supervenience Argument* (2005, 2006) that tells us that irreducible supervenient causation, if any, is preempted by the intended (physicalist) causal model. In a few words, either mental or higher interactions are admitted, but they can “never enter into causal transactions with physical [lower] processes, constituting their own autonomous causal world” (Kim 1989, p. 47), or irreducible supervenient causation is to be eliminated because it is in contradiction with the physicalist principles that frame *the* causal model: with the aforementioned *Closure* and/or with *Causal Exclusion*, namely the thesis that physical events have at most a (sufficient) cause. In conclusion of his work, Kim writes:

[E]ither you have espoused eliminativism, or else you are moving further in the direction of dualism, a dualism that posits a realm of the mental in total causal isolation from the physical realm. This doesn’t look to me much like materialism. (1989, p. 47)

Unfortunately, Kim seems to believe that OP is safe from the problems with dualism that affect NRP. Kim, actually, seems to believe that OP is the appropriate monistic metaphysics for physicalism. The paper concludes the contrary. In the next section, I am going to argue that the ontology at the background of monistic substance metaphysics, as OP, is actually dualistic.

### 3 Ontological Physicalism and ontological closure

The ontology at the background of OP is clearly particularist. According to Kim, (purely) physical systems are made of material particulars or *bits of matter* within the spatio-temporal fabric and behave in agreement with the laws of physics (2005, 2006). Any other further entity like holistic structural organizations of groups of particulars do not take part in a (pure) physical system but, rather, supervene upon that (2005, 2006). OP claims to be flat or monistic, in the precise sense that the intended or standard OP-ontology(-model) is made by only *one* domain of particulars. Physical entities, then, are those particulars that belong to the intended OP-domain.

The intended domain of OP is thus to be considered as the whole ontological realm, namely the domain of what exists according to OP and, as such, it is supposed to be *ontologically closed* like any universe should be: all the entities that the OP-theory allows to exist must belong to the intended OP-model, the one that define the intended meaning of “being a particular” (“being a physical entity”).

Yet, is it true that OP is *ontologically closed* with respect to its intended ontology? Is the intended domain of particulars sufficient to include all possible entities according to OP? Is the intended OP-model specified in such a way that it is impossible to prove, from the resources of the theory, that there exist “particulars” that cannot belong to it? Such questions are all but matters of theoretical speculation since the first and main aim of an ontological theory is that of specifying its own intended model without any further presupposition, even less ontological ones. If the ontology of OP cannot be proved to be *monistic* in the sense of being committed with one only domain (coinciding with the intended one), then problems concerning the validity of *Closure* may arise and, then, also problems concerning the physicalist adequacy of the theory.

Particulars, as cases of substances, are *invariant* entities and, as such, they are defined by *equivalence* relations like the relation of identity – as well as a resemblance relations or even other sorts of relations like isomorphic functions. Within allegedly monistic frameworks, particulars like particles are characterized by something of the sort of the CTI, a first order theory according to which entities are *self-identical* ( $\forall x = x$ ) and *context-*

*independent* (if  $x = y$ , then  $\phi(x) \leftrightarrow \phi(y)$ , with  $\phi$  a letter for first order formulas). The common understanding of particle-like metaphysics is based on CTI (*cf.* Arenhart *et al.* 2019, French and Krause 2006).

Yet, according to my previous works (Ferrari 2022a, 2022b) in formal ontology, it is arguably impossible to obtain a consistent monistic (non-dualistic) ontology from the assumptions of CTI or something analogous and, equivalently, of only one domain of primitive first order invariant entities, like (abstract or concrete) objects and particulars, and even when conceived as bundles of tropes (*cf.* Campbell 1990). In other words, any particulars-only ontology turns systematically dualistic and, then, self-contradictory. This result is primarily due to the fact that invariant entities like particulars are obtained by equivalence relations, like identity or similarity, that are made somehow invariant. Yet, equivalence relations can be made invariant only if we appeal to higher logics and languages (fully) interpreted to (genuine) higher domains (*cf.* Shapiro 2002). This is the only way in which an intended first order domain of discrete entities may be rendered unique (up to isomorphism). This “higher” solution is arguably unsatisfactory, though, because it commits theories like OP with *higher* entities and domains and higher entities are precisely what monistic theories of that sort *cannot* be committed with.

Still, in those works I discuss alternative approaches that address the invariance of first order equivalence relations in terms of their “logicality”. Examples of this latter approach are Tarski’s semantic *test for logicality* (1986) and Bonnay’s and Westerståhl’s syntactic *method of extraction functions* (2012). Yet, also these methods are provably unsatisfactory for ontological purposes – namely, when we are dealing with the specification of the ontological domain itself. On the one hand, the former test *presupposes* a given domain of individuals (particulars) in order to define the “invariance” that is supposed to specify the individuals themselves. Thus, identity (equivalence) relation turns “logical” only when domains of individuals are considered. This is a heavy problem for metaphysicists because, the approach makes the ontological space asymmetric, privileging particularists/objectual ontologies by means of strong substantialist “metaphysical presuppositions” (*cf.* Dutilh-Novaes 2014) that exclude non-objectual frameworks. The latter method is, instead, simply *insensitive* to the distinction between logical and non-logical invariance. As a consequence, some additional semantic presuppositions (“meaning postulates”) of the kind of the ones presumed by the former test are to be assumed (*cf.* Bonnay



2012).

To sum up, in order to univocally specify the intended domain of (first order) invariant entities the ontologists must assume primitive *equivalence* relations, like identities or, even, isomorphic mappings and, then, make them *invariant*. However, to make such relations invariant, the appeal to the resources of second order languages and logics equipped with full second order semantics is required. Consequently, the ontological commitment of theories like OP that makes a substantive use of equivalence relations cannot be restricted to one domain of existence only, because they imply the existence of further domains. The OP and the like cannot be monistic theories.<sup>5</sup>

As a matter of fact, then, the ontological commitment of particulars-only theories (like OP) cannot be restricted to the intended first order domain. Consequently, the ontology of OP is probably committed with further higher domains. This makes the theory strongly non-monistic (dualistic). Quite naturally, this issue raises the question about the metaphysical innocence of the entities that inhabit these domains: are higher entities causally innocuous? Just in case they are proved to be so, in fact, *Closure* would be kept valid and OP “physicalistally” adequate despite being ontologically dualistic. In order to give a satisfactory response to that question Kim proposed the *Supervenient Argument*. Yet, before dealing with that, let me make two additional considerations.

Let assume, for sake of argument, that it is possible to argue that the first order identity and equivalence relations are *logical* relations. In this way, we could reasonably claim that a monistic ontology of particulars is somehow safe from dualism. After all, we would no longer be in need of appealing to second order resources to make first order identity (equivalence) relation invariant.

Yet, as it is proved (Arenhart *et al.* 2019, French and Krause 2006), theories that assume first order identity and equivalences like CTI are unable to fix the meaning of

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<sup>5</sup>Of course it is possible to extend the conclusions to structural theories like OSR. The possibility is due to the fact that first-order (relational) structures are given by primitive first order isomorphisms and that, following Rodin (2007, 2011, 2017), isomorphisms play an analogous role to that played by equivalence relations. Of course the crucial point is that of showing how isomorphisms can be made invariant: just appealing to second order isomorphisms. Furthermore, it is hard to see how it can be argued that isomorphisms are invariant because “logical”. After all, they are functions and, as such, they are formally construed as (complex) *non*-logical terms. To address the main argument is just to reformulate my previous works (2022a, 2022b) in terms of the second order comprehension principle for complex terms (functions) and to reformulate the nominalist semantics for those terms with all the opportune and required changes.

“existential claims” once and for all. As it is well known, CTI implies the existence of first order entities that cannot belong to any *intended* model. As a matter of logical fact, for first order theories equipped with CTI (and as powerful as first order Peano’s Arithmetic)<sup>6</sup> there are infinitely many *non-standard* models. Each of these models is non-standard because it is inhabited by denumerably infinite *non-standard* first order entities that in the case of OP are denumerably infinite non-standard (non-physical) *particulars*. Non-standard entities, indeed, *systematically* do *not* and *cannot* belong to the intended domain of the theory.<sup>7</sup> In fewer words, for any theory like OP there exist further domains made of (first order) entities that are by construction *different* from the one of the intended model: they are *differently* particulars, with respect to the standard ones. Accordingly, then, it is easy to see that either OP (and the like) is dualistic or it is ontologically *open*, namely unable to specify once and for all its own ontology.<sup>8</sup>

To sum up, either OP is *dualistic* and, then, the intended first order OP-model alone, despite being precisely fixed, is not enough to define what the theory allows to “exist” – and thus the intended ontology must be “vertically open” and give a room to second or higher order entities and domains – or OP is “horizontally open in the precise sense that any time a particular (denumerably infinite) first order domain, say  $D$ , is associated to the first order theory as the intended OP-model, it is possible to show that there exist entities  $d_i^*$  that are first order as well as entities  $d_j \in D$  but such that they differ from any  $d_j \in D$  ( $\forall i, j \in \mathbf{N}$ ) and, so, they do belong to further domain  $D^* \neq D$  of OP. The domain  $D^*$  is a non-standard domain and for first order theories there are infinitely many domains like that. Therefore, in both cases OP cannot be *ontologically closed* with respect to its

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<sup>6</sup>In ontology this is a natural condition, for one reason: laws of nature are mathematizable. This means that we have to model a theory that is as powerful as the foundational theories of mathematics like Peano’s Arithmetic and/or (standard) set theories.

<sup>7</sup>By construction, non-standard models are made of denumerably infinite sets of denumerably infinite entities that are *different from* (not identical to) all the infinitely many entities belonging to the standard model. The construction is by induction.

<sup>8</sup>One last note. If the model for the OP is *finite*, then CTI will be no longer ontologically *innocent*, for it may be used to specify the number of entities in the model. This certainly makes the ontology itself fixed but, also, too “factual”. The point is not that specifying the number of entities for a given ontology but, rather, that of specifying what are the existing entities. For this reason the language of OP must be at least that of first order predicate logic plus CTI and equipped with a *denumerably infinite* model. Yet, in this case, a model of a theory/language that is not *isomorphic* to the intended or standard model. This latter result is as a consequence of *Skolem-Löwenheim Theorem* and, thus, also a consequence of *Gödel’s Incompleteness*.

intended first order OP-model.

## 4 From ontological dualism to metaphysical dualism

The second consideration is the following one. An immediate consequence that can be drawn from the arguments of the previous sections is the idea that a naturalist metaphysics of invariant objects, if it gets rid of the ontological import of relations, is arguably inconsistent. After all, it is impossible to have particulars without (equivalence) relations – eventually axiomatized along the line of CTI. Thus, what is critical with regard to relations is arguing for their ontological innocence or formality. This may be a sufficient motivation for putting OP aside and appealing to proposals that include relations from the start as an essential part of the whole metaphysical picture. OSR, for example, makes an essential use of relations (*cf.* Ainsworth 2010). In addition, OSR is supported by empirical motivation also, namely motivations originated from empirical observations.

Imagine doing physics without genuinely relational entities, like forces, entangled (quantum) correlations, (quantum) fields, transformations of states, the notion of limit, and so on. Unlike equivalence relations and, even, the spatio-temporal fabric that are generally supposed to specify the basic metaphysics but without contributing to the causal construction of the whole universe, all those kinds of relations are supposed to be metaphysically (causally) relevant and efficacious from the start. In a few words, not only we cannot get rid of relations but also relations do have some causal efficacy and metaphysical import. Relations, indeed, play a significant and essential role in the determination of the properties that specify the nature and the causal powers of the particulars that are making the “physical” system that is under empirical observation.

Relations are, then, to be added to the ontological furniture of the world, perhaps side by side with particulars. Unfortunately, the conceptualization of relations stemming from substantialist approaches imposes that relations *presupposes* “atomistic” *relata* as their ontological support – otherwise, (relational or strong) OSR seems to encounter several problems concerning its own consistency (Park 2021). According to this point of

view, relations are usually understood as *ontologically dependent on* their relata that, ultimately, must be invariant entities like objects or substances – it is worth noticing that, if we substitute objects with nodes of relations as well as other (sub-)structures as it occurs within strong or relational OSR, then we will still be assuming that those nodes are invariant entities.

However, this approach is the source of a rather uncomfortable situation: on the one hand, relations are to be taken as *derivative* from the relata (i.e., relations are non-fundamental and non-autonomous entities) because they are (fully) dependent on these latter while, on the other hand, relations are to be taken as *primitive*, namely as systematically or genuinely distinct from their relata (i.e., relations are irreducible to or not obtainable from them) and, then, as belonging to a second ontological category (domain). If relations are derivative (from their relata), then the ontological category to which relations do belong is *non-primitive*; while, if relations are systematically distinct from their relata, then the category to which they belong *cannot* come from or be part of the other one of atomistic relata – i.e., the category of (standard) particulars. But, either relations and invariant objects belong to the same category of entities, or they do not: after all, because of the substantialist nature of particular objects, any “third” or “in between” option still presupposes the definition of a precise boundary between the (category of) objectual relata and (the one of) the relations among them. In other words, either relations among particulars do *not* belong to a further domain(s) of existence (monism), or they are (in principle) *irreducible to objects* (dualism), *tertium non datur*.

Yet, from the time of the axiomatic regimentation of Cantor’s (naïve) set theory we know that the monistic picture is problematic. In a nutshell, when we try to map relations among objects *into* the intended domain of the objectual relata, we first have to render relations somehow objectual too, i.e., as classes of sets. Just then, it is possible to prove whether or not relational objects belong to the domain of their relata – i.e., whether or not classes are sets. As the old discussion on set theories teaches us, there are certain relations that are *necessary* to characterize both the very entities of the model, namely the sets, and the whole model of the theory, namely the set-theoretic hierarchy as a whole. Unfortunately, within standard frameworks, unlike most of relations, such necessary relations cannot be modeled as a their own relata – namely, there are classes that are not sets. In a few words, they cannot be elements of the model they specify. Examples are

the *membership relation* as well as that of *identity*: both of them cannot be rendered as the (first order) objectual entities among which they hold. Thus, if considered as objects, these relations are necessarily to be considered as *higher* or non-standard objects, namely as entities that systematically belong to further or second (higher) domains of existence. The relations that are *necessary* for specifying the model are *genuinely relational* in the sense that they cannot belong to the intended model they are contributing to specify and, as such, are necessarily higher and/or non-standard entities.

Therefore, it seems that, from these bases no solution is available for the primitive-derivative status of relations: relations among invariant objects cannot be both primitive and derivative, on pain of contradiction and, furthermore, they cannot be taken as derivative. Thus, if genuine relational entities are necessary for the model and these are also higher or non-standard entities, then nothing forbids them to have their own distinctive properties.

Yet, if relations have their own distinctive properties, what forbids these properties to define legitimate and perhaps autonomous causal powers? Furthermore, once we have to accept genuinely relational entities, like structural organizations, for reasons of ontological necessity, what preempts relations to causally interact with standard particulars? The “intuition” tells us that in this case the *causal closure* of the fundamental intended domain would be broken and, then, that the naturalist inspirations of any substance metaphysics would be failed.

To get rid of the problem by focusing on structural ontologies is, thus, a concrete temptation. Yet, if we look at OSR, things do clearly change but, ultimately, problems are still there. Indeed, the OSR-model “automatically generates” higher or further ontological levels (Cordovil et al. 2022). The naturalist appeal of OSR is, thus, bounded to the application of some “physicalist constraint” concerning the restriction to the first order level of existence that is provided by some external source, like physics. That is, the bottom level is “legitimately” allowed to be the only domain metaphysically or causally relevant by *physical necessity*. Yet, physical necessity differs from metaphysical necessity as facts differ from principles. And this difference is mirrored by the fact that the “physicalist” constraints are *applied to* the OSR-model but are also *independent of* it. In other words, the appeal to additional constraints to keep the OSR-model suitable for physicalist foundations requires the support of some *further* justification and arguments accounting for

the universal validity of their association to the model. After all, the OSR-theory does not have the resources for that, otherwise the constraint would not be independent.

Yet, the debate about OSR is too vast and problematic for the scope and purpose of the present paper, although a discussion supported by an generous assessment on the effective chances of success of the several approaches is strongly required. For sake of completeness, it can be said that arguments devoted to justify the application of those ontological restrictions to the OSR-model mainly consist in attempts to justify the appeal to *epistemic* interpretations of the relations themselves, as well as of the higher or non-standard entities (*cf.* Cordovil et al. 2022). In this way, the objectual relata are the only metaphysical component left with genuine ontological interpretation, along the line of OP. The automatic generation of further “relational” levels is conceived, more or less, as a matter of epistemic arbitrariness. Other approaches, instead, propose more “deviant” epistemic interpretation of structuralism. For example, Morganti (2004) argues for the suspension of the judgment on the ontological status of fundamental objectual relata. The motivation for this proposal is that we could never ‘enter in contact’ with them for reasons concerning our empirical limits and, so, it does not make sense to continue asserting their existence: it is much better to keep ourselves just at the level of relations.

Nonetheless, these lattes are all but ontological solutions to the problem of the dualism relata-relations. What we are left with, in the end, is that not only OP and OSR are non-monistic ontologies, but also that relations must belong to a category that cannot be formally reduced to that of their relata. But relations are also essential to both models. Therefore, relations or, else, higher or non-standard entities that have their distinctive properties may causally interact with their relata (particulars).

In the absence of an alternative solution, relation cannot be derivative and the derivative-primitive status ends in an unavoidable tension. That genuinely relational entities can causally affect and interact with the “physical” world is an in-principle possibility and, then, an ontological “fact”. This would be a tragedy for anyone pursuing a genuinely physicalist metaphysics, given that higher and/or non-standard entities may be (and have been traditionally) interpreted as God or minds, as well as intentions or concepts – as well as more neutral structural organizations. This is the reason why friends of physicalist substance metaphysics like OP proposed the *Supervenience Argument*.

## 5 The failure of the Supervenience Argument

An attempt to solve the primitive-derivative tension has already been presented within particularist environments. As Maurin (2002) recalls us, Campbell (1990, p. 38) thinks that equivalence relations can be both derivative and primitive. Campbell's trick to avoid the inner tension, Maurin continues, is to take relations derivative in the sense of being "a 'pseudo addiction' to what it relates" (p. 215). Campbell, among the many, is thinking to genuine relations as being *supervenient* upon what they relates (1990, p. 37): "[s]upervenient 'additions' to ontology are pseudo-additions" in the sense that they do not alter "the basic metaphysical scheme" (Maurin 2002, p. 215). This would suffice to make genuine relations no longer causally efficacious. Indeed, if *supervenient* upon their relations, genuine relations are "no more burdensome", although "automatic inevitable" (p. 37). In a few words, if interpreted as supervenient, the primitivity of relations would be a matter of pure formality because they can be kept as causally innocuous.

However, the metaphysical availability of this and similar positions rely on the presupposition that there are *valid* arguments that prove how supervenience can make properties causally innocuous. That is, valid arguments the claim that the supposed causal efficacy of higher or non-standard properties is preempted, if these latter are taken as supervenient upon the intended "physical" properties.

The appeal to supervenience and to arguments of this sort is the cornerstone of both Humean and Neo-Humean empiricism. But not only. The *Supervenience Argument* (SA) is also a pillar of OP, as witnessed by Kim (2005, 2006) – see (Corry 2013) for a detailed presentation and complete discussion of Kim's SA.<sup>9</sup>

Kim, while pursuing the available metaphysics for physicalism (1989, 2005, 2006), recognises that a (constructive) proof for (systematic) reduction of the higher or non-standard to the lower or standard "may not be true" (2005:22). The fact is that, despite desirable, as in the case previously discussed, higher properties cannot in principle be systematically rendered as lower properties. Thus, the only likely way out from the metaphysical tension between the primitive-derivative status of genuine relations, and from

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<sup>9</sup>I have already discussed the topic in some previous works of mine (Ferrari 2023, Ferrari and Bickhard 2023) as an essential part of a more complex argument that proves that it is arguably impossible to keep OP self-consistent.

the consequent tension between dualism and monism in metaphysics is to provide arguments in favor of the idea that the causal efficacy of higher or non-standard properties, like properties of higher sets (classes) or of structural organizations of first order particulars, is in *contradiction* with the causal model. As Corry (2013) emphasizes, the original formulation of SA can be rendered in terms of arguments by *Reductio*.

Kim's argument is precisely addressed to do so. Leaving details apart, the discussion of some general points of Kim's SA will be sufficient for the present purposes. SA moves from the following further assumptions. *Emergence claim*: higher or non-standard properties are *emergent from* the properties of fundamental (first order) standard or "physical" particulars; *Supervenience Claim* (SC): if higher or non-standard properties are emergent, then they are *supervenient*, namely supervenient upon or *fully ontologically dependent on* the standard "physical" properties.

Given that the subject matter of the present paper is the relation between physicalists metaphysics and *Closure*, the focus of what follows is the version "from *Closure*" of SA (Corry 2013), whose general structure is the following:

- H Supposes there is supervenient causation from the higher or non-standard property  $M$  to the higher or non-standard property  $M^*$ ;
- 2 ...;
- 3 Then, because of *Closure*, a contradiction is obtained between [H] and the model of causation and, more specifically, with *Exclusion*;
- C Therefore, again because of *Closure*, for *Reductio* there cannot be emergent/supervenient causation".

Even the most recent literature on the topic (*cf.* Wilson 2021, Cordovill et al. 2022) considers SA as a valid argument: higher or non-standard properties cannot be causally efficacious. Yet, according to other literature the many versions of SA are provably *invalid* (*cf.* Corry 2013; Ferrari 2023, Ferrari and Bickhard 2023) – in addition to being *unsound* (Bickhard and Campbell 2000, Bickhard 2004, 2015; Campbell and Bickhard 2011; Ferrari and Bickhard 2023).



The core of the invalidity result is the fact that SA is an argument by *reductio*.<sup>10</sup> Arguments by *reductio* prove the reference model – namely the model in which the argument is evaluated – is consistent with an hypothesis, by proving the inconsistency of the negated hypothesis with the reference model. Leaving apart technical and logical considerations, this means that the relevant premise of SA, namely [H], is actually a negation of a formula compatible with the model and then with *Closure*.<sup>11</sup> So, [H] is actually in contradiction with the reference model from the outset. Namely, [H] is assumed to be true just *for sake of argument*. That is, [H] is not supported by the reference model and/or, again, [H] is false and cannot be true according to the model. So, the reference model on which Kim is modeling SA cannot accept supervenient causation, because otherwise the model would support [H] and allow for higher or non-standard properties being causally efficacious. Furthermore, according to SA, if [H] were true (valid), then the model would have been in contradiction with OP-model and *Closure* false. But – and this is the problem concerning the invalidity of SA – *Closure*, cannot be refuted in naturalist environments, because it is an essential desiderata of any naturalist framework.

So, either higher or non-standard causation and *Closure* are necessarily incompatible or they are not. *Question*: are there reasons to think of *Closure* and higher or non-standard causation as being compatible? According to Bickhard (2004, 2011, 2015) and (Campbell, 2009, 2015) there is a *conditional* way to make *Closure* and non-standard higher causation compatible: (i) if, we reject substantialist (and dualist) presuppositions from the outset, and (ii) if we reject the aforementioned SC. After all, SC is employed by Kim – and also by British Emergentists – to link emergence to supervenience and, so, to an ontology of particulars. Only then, as Campbell and Bickhard (2011) argue, nothing forbids to take higher or non-standard causation as a case of *physical* causality without entailing all the problems Kim wants to avoid. From this result Ferrari and Bickhard (2022) can argue that (i) not only *Closure* may be kept valid among emergentist environments but, even, that (ii) SA is generally *invalid*.

The key point is the following: to make the contradiction following from [H] with

<sup>10</sup>This, in turn, stems from the fact that a constructive proof of reduction is actually impossible from the formal, logical, and ontological bases of OP and the likes.

<sup>11</sup>OP is clearly based on classical logic according to which the double negation rule/law holds. Accordingly, [H] is equivalent to its double negation  $[\neg\neg H]$ , with the formula  $[\neg H]$  being, thus, consistent with the reference model and with *Closure*.

necessity, Kim must interpret *Closure* in a way that is incompatible with genuine higher or non-standard causation. The crucial point is that SA implicitly takes “physical” and “higher or non-standard” as defined in a mutually exclusive way, i.e., OP implicitly defines “physical” as “non-higher or non-non-standard” (standard) and “higher or non-standard” as “non-physical”. But these definitions are *not* analytically true.<sup>12</sup> These notions and their definitions sensitively depend on the appropriate causal model. Thus, *Closure* could have been interpreted *à la* emergentist without leading [H] to contradiction with *Exclusion*.

Now that we proved that SA is generally invalid, OP does not have any strategy at hand to preempt the causal efficacy of the properties of higher or non-standard entities. It seems then that *Closure* cannot be preserved within OP. Moreover, if things are so, then not only OP breaks *Closure*, but also OP cannot be used for naturalist and/or physicalist purposes.

## 6 Looking forward: towards a process-based model

The last step consists in looking at formal presuppositions that are hidden within SA starting from the reference model.

*Closure* and *Exclusion* play an essential role in framing the causal model for OP. According to their interplay, it is always (in principle) possible to identify *the* sufficient cause of any physical event. The individuation of the (sufficient) cause is clearly a metaphysical mirror of the intended OP-model whose basic characterization is due to CTI. However, this consideration alone tells us nothing about the conditions that crucially allowed Kim to tacitly assume that definition that enforced the contradiction between [H] and *Exclusion*, from *Closure*.

The reason why the definition of “physical” is left implicit (tacit) is to be imputed to the widespread idea, shared by Kim too, that a “conceptual definition, does not count as an additional premise” (2006, p. 554). According to this idea the introduction of defi-

<sup>12</sup>Perhaps, it could be argued that that definition is analytically true in models and languages compatible with classical logic. But classical logic and its model theoretic ontology/semantics is no longer the *standard* and the paradigm neither.

nitions does not change anything in the deduction sequence and, thus can be left implicit. This is the “stipulative” view of definitions (*cf.* Cellucci 2013, 2022) according to which definitions are simply syntactic abbreviations of complex terms and, as such, they do not bring new further information in the theory/model. This is precisely why Kim is a friend of reductionism.

As we know, stipulative definitions hold for extensional languages and models only.<sup>13</sup> Extensional models are specified by CTI. Models like the intended OP-model are the only models that allow for the logic to be extensional and, thus, for the definitions to be stipulative. The information of the theory is preserved in the model in such a way that emergence of novelty is *logically* preempted from the outset.

Unfortunately, although SA is precisely conceived as an argument against emergence, it presupposes that the model is extensional and thus that the introduction of new information is impossible. This is like assuming the extensional model as if it were the only possible model. But doing this is to commit a *petitio principii*.

To see the ontological asymmetry that stem from this way of thinking it is sufficient to look at SC. Recall that SC links emergence to supervenience in such a way that higher or non-standard properties fully depend on the physical ones which, in turn, are the only locus of causation – this is the conclusion of SA. The intended OP-model is, thus, this locus but, given that it is made of entities specified by CTI, it is clearly extensional, and cannot be otherwise for metaphysical and formal necessity. Indeed, SA and SC are valid only if the model is extensional. This latter condition on the validity of Kim’s argument is precisely the presupposition that I am making explicit.<sup>14</sup>

Yet, if the validity of SA is not made conditional, SA is no longer valid *simpliciter*. Rather, what may turn out to be valid is the conditional validity of SA. The reason is that there exists non-extensional models that refute CTI and non-constructive (primitive) uses of equivalence relations. The analyses of some “exotic” class of formal models due to

<sup>13</sup>This limiting result is known as the *Beth Theorem*, a result on definability, according to which stipulative definition holds only in first order theories equipped with denumerably infinite models. In all other cases, like second order logics and theories, definitions bring new information and count as new axioms (premises).

<sup>14</sup>In other words, the stipulative character of the definitions is a symptom of extensionality and extensionality is the formal correlate of reductive substance presuppositions. After all, allowing for stipulative definitions is also equivalent to presuppose that all (consistent) definitions are analytically true, and that the intended causal model for OP is the only possible causal model.

Rodin (2007, 2011, 2017) and Heller (2016) (*cf.* also Ferrari, 2022a, 2022b) may help to understand that (any) Kim's argument (against emergence or against the introduction of new information in a system) should have been assessed in these models rather than in the extensional ones.

Rodin and Heller, independently, prove that the claim that relations presuppose and depend on fundamental invariant objects is not necessarily true – i.e., there is a class of models in which relations do not presuppose or depend on invariant objects. This result means that the idea of relations without atomistic relata is proved *a priori* (formally) consistent. Rodin and Heller reach this conclusion by showing that specific *non-extensional* category-theoretic models are genuinely relational in the relevant sense that they model *transformations* as a kind of relations among entities that are *not* invariant. Indeed, these models are not based on CTI (Heller 2016, Rodin 2017).

The regimentation of genuine process-based models as non-extensional category theoretic models is not part of the purpose of this work. However, I should say something more about the link between that and the process-based model. According to Ferrari (2022a) the project seems to be promising for those who aim to make *Closure* compatible with physicalist systems that do not appeal to additional independent constraints and/or epistemic interpretation of some sort. One of the reasons is certainly that transformational models of that sort get rid of fundamental domains of invariant entities. As argued so far, this was the very source of incompatibility with *Closure*. Within such non-extensional category-theoretic models also quantification and identity(-ies) do not operate the way they do and that characterize extensional models. The effect is that they put at work a “substantial” change in the way a theory is ontologically or existentially committed with its own entities (*cf.* Ferrari 2022a).

In addition, without being committed with invariant objects (CTI), the standard distinction between first and higher or non-standard entities becomes blurred (Rodin 2017), as well as that between what is “fundamental” and what is not. But, then without such a distinction, “everything” becomes relational and thus reductionist attitudes become little interesting. On the other hand, unlike substantialist frameworks, every entity is somehow depending on some other, no one excluded. Accordingly then, for all these reasons, processual or non-extensional systems of that sort seem no longer incompatible with *Closure*, while compatible with genuine emergent causation.

## 7 Conclusion

The present paper supports a process-based view for physicalist metaphysics along the line of recent literature (*cf.* Bickhard and Campbell 2000, Bickhard 2004, 2015; Campbell 2009, 2015; Campbell and Bickhard 2011; Ferrari and Bickhard 2023; Seibt 2002, 2009, 2010, 2022; Winters 2017). And it does so arguing for the existence of a tension between substance metaphysics of physicalist inspiration and the causal closure of the metaphysical world.

First, we recalled the reason why it is impossible to obtain a consistent monist model from the substantialist assumptions of primitive invariances. The case study was OP. We argued that the OP-model is *ontologically open*. The reason is that allegedly monist substantialist ontologies are unable to (categorically) fix their own domain or universe. Then, we also proved that OP cannot ensure the validity of *Causal Closure*. The main reason is that Kim's SA is invalid for reasons that are essentially linked to the substantialist presuppositions hidden within the argument (extensionality) that are mirrored by the import of CTI in characterizing the ontological theory. Thus, we concluded, friends of monistic substance metaphysics like OP cannot claim that their theories have models compatible with physicalism (*Closure*).

But the paper's plan was also that of reaching a first discussion about the plausibility and the advantages of "unorthodox" approaches to naturalist ontology and metaphysics that avoid the ontological presuppositions nested in the traditional models used for doing naturalistic metaphysics. Process-based models may be suitable candidates because they do not endorse substance presuppositions. They seem to be promising for two main reasons. First, such models are non-extensional models and, as such, they are no longer made of domains of invariant entities. Second, because of that, these models blur the distinction between standard first order entities and higher or non-standard ones that was the source of the tension between OP and *Closure*. In other words, these models do not automatically generate further ontological levels. Without that distinction, notions like that of *genuine emergence* and principles like *Closure* should no longer constitute a problem for physicalist metaphysics. Even with respect to OSR, process-based models show advantages. Not only, indeed, like OSR, these are relational models, but if, as it seems, these models do

not automatically generate further levels of existence and causation, then, unlike what is currently done with OSR, we should not have to formulate, to apply and, then, to justify assumptions that are independent of and additional to the intended (process-based) model.

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