JEFFREY GRUPP

THE IMPOSSIBILITY OF RELATIONS BETWEEN NON-COLLOCATED SPATIAL OBJECTS AND NON-IDENTICAL TOPOLOGICAL SPACES

ABSTRACT. I argue that relations between non-collocated spatial entities, between non-identical topological spaces, and between non-identical basic building blocks of space, do not exist. If any spatially located entities are not at the same spatial location, or if any topological spaces or basic building blocks of space are non-identical, I will argue that there are no relations between or among them. The arguments I present are arguments that I have not seen in the literature.

1. INTRODUCTION

The goal of this paper is to put forward novel arguments for the position that any sort of *relation or relatedness* (alleged to exist) between or among any non-collocated spatial entities, or between or among any non-identical topological spaces or non-identical basic building blocks of space, *is impossible*. In this introduction I discuss *specifically which* of the relations discussed by philosophers that I am concerned with in this paper. In Sections 2 and 3 I will discuss hitherto unnoticed arguments for their non-existence.

Let me be clear, I only discuss two sorts of relations:

1. The relations that philosophers (and physicists) typically allege are constituents of space, since they interconnect basic building blocks of topological space,[1] or non-identical topological regions. In either case, these are relations that connect distinct topological locations or sets of locations.[2]
2. The relations that many philosophers allege exist between non-collocated spatial objects.

Relations pervade the theories of analytic metaphysics. Many of the relations discussed are relations between or among non-collocated spatial entities, and between or among non-identical topological

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regions or non-identical basic building blocks of space. Examples of a few of them include relations such as, *at a spatial distance from*, *taller than, gravitationally attracted to*,[3] *behind*, *spatially larger than*, some instantiations of the relation *causes*, and some instances of *loves*. I will use three examples throughout this paper: the relations, *brotherhood, parthood,* and topological *connectivity*. Throughout this paper I will refer to the relata connected by these relations as p_1 and p_2, where p_1 and p_2 are, for example, two lions that are brothers, a paw that is part of one and the lions (p_1 = paw, p_2 = lion), or p_1 and p_2 could be non-identical basic building blocks of space or non-identical topological regions.

I do not discuss relations an entity may have with itself (*loves oneself*, etc.). Also, I do not discuss relations between or among collocated spatial entities.[4] I only discuss that if spatially located entities do not occupy the very same topological region or basic building blocks of space, or if any topological regions or basic building blocks of space are non-identical, such objects, regions, or basic building blocks of space do not share any relations. (In the case of entities that are partially collocated, such entities would share relations where they collocate, but would not share relations where they are not collocated.)[5]

In the case of objects that *occupy* space (as opposed to objects that *makeup* space), by "non-collocated objects", I am denoting objects that do not occupy the same topological region or basic topological building blocks. And in the case of topological regions or the basic topological building blocks of space, by "non-identical basic building blocks", or "non-identical topological regions", I am denoting topological spaces that share topological relations such as, *distance*, *connectivity*,[6] and so on. (The topological *relations* between non-identical basic building blocks of space or between non-identical topological regions, are, along with the basic building blocks of space, *constituents of space*.[7])

I will next dixcuss the goals of this article. In Sections 2 and 3, I will argue that there is a specific problem to do with any variety of the relation between or among p_1 and p_2: they apparently cannot be spatial, S, (relations that are spatial, or that are located in space, I will call *non-platonistic* relations) nor aspatial, $\sim$S (relations that are aspatial, or that are not located in space, I will call *platonistic* relations). If relations between or among p_1 and p_2 are neither non-platonistic (S) nor platonistic ($\sim$S), they are apparently contradictory, since they would be describable as $\sim(S \vee \sim S)$, which translates to $\sim S \wedge S$.

In Section 2, I discuss hitherto unnoticed problems to do with non-platonistic relations (relations that are not outside of space,[8] S). If my reasoning is correct, only *platonistic* relations (abstract relations,[9] relations that are outside of nature, outside of space,[10] ~S) exist among p_1 and p_2. In section 3, I consider platonistic relations among p_1 and p_2, where I also come to serious problems when considering them.

In Section 4, I explore an objection some readers may have with the position that reality is devoid of relations between or among non-collocated spatial objects, and between or among non-identical topological regions or non-identical topological building blocks of space (between or among p_1 and p_2). This paper is not about what reality *is like* if the reasoning I give in Sections 2 and 3 is correct and relations of the sort that I am concerned with do not exist; I do not offer a "replacement metaphysics."[11] Rather, my goal in this paper is only to discuss specific hitherto unnoticed and apparently serious problems to do with the aforementioned relations which are between or among p_1 and p_2.

I will use the rest of this introduction to discuss the relations described in 1 and 2 above. In the case of the relation, *parthood*, a paw (p_1) of a lion (p_2) is not collocated with the lion, since there are many parts of the lion not collocated with the paw, such as the lion's abdomen or tail. And for that reason, *parthood* is a relation that connects *non-collocated* spatial entities. Simons writes:

> The most basic and most intuitive mereological concept, which gives the subject its name, is that of the relation of parts to whole. Examples of this relation are so legion, and it is so basic to our conceptual our conceptual scheme that it seems almost superfluous to offer examples…[12]

> The most obvious formal properties of the part-relation are its transitivity and asymmetry, from which follow its irreflexivity … These principles are partly constitutive of the meaning of 'part', which means that anyone who seriously disagrees with them has failed to understand the word.[13]

Despite the intuitive appeal of, and the apparent obviousness of, mereological relations, I will conclude in Sections 2 and 3 that they are contradictory if they are connections between or among non-collocated spatial entities or non-identical topological regions.

Topological relations are a particularly important variety of relation, since the very structure of space (and matter), is alleged to be topological.[14] Since topologies typically involve relations between or among p_1 and p_2 (between or among non-identical topological regions, non-identical basic building blocks of space, and non-collocated spatial objects), if my reasoning in Sections 2 and 3 is correct, it would show that these topologies rest upon contradictory relations, and the only topologies that would be non-contradictory would be topologies that do not involve relations between p_1 and p_2, and where all connections are ultimately described in terms of collocation. Mereotopology is the only theory I am aware of that could be formulated this way: without any relations between p_1 and p_2. My arguments in this paper specifically target the topological models that mereotopology is often considered to be an improvement upon, or even an apparent replacement of,[15] such as the topology of continuous space, where none of the points of space collocate, but are connected via interrelations across spatial distances. (I will discuss Mereotopology more in the next section.)

2. NON-PLATONISTIC RELATIONS BETWEEN NON-COLLOCATED SPATIAL ENTITIES

In this Section, I discuss apparent problems to do with non-platonistic relations. The position that relations are not outside of space is espoused by many contemporary and recent philosophers who discuss relations, such as David M. Armstrong,[16] Douglas Ehring,[17] and H. H. Price,[18] just to name a few. In subsections 2.2–2.4, I discuss problems to do with non-platonistic *non-complex* relations between p_1 and p_2. In subsection 2.5, I discuss problems to do with non-platonistic monadic relatedness. In Subsections 2.6 and 2.7, I discuss problems to do with specific sorts of non-platonistic *complex* relations that are not affected by the reasoning against non-platonistic *non-complex* relations between p_1 and p_2 given in Subsections 2.2–2.4. But first, in Subsection 2.1, I will give clarification of terminology and concepts relevant to the discussion of problems with both non-platonistic and platonistic relations between p_1 and p_2.

2.1. *Relations and topologies*

In this Subsection, I discuss complex and non-complex relations (2.1.1), and I discuss continuous, discrete, and gunky topologies, and mereotopology (2.1.2).

2.1.1. *Complex and non-complex relations*

Complex relations have parts: they are relations that are conjunctions of, or that are structures of, simpler sub-relations.[19] Relations are either (i) non-complex relations that are fundamental and irreducible, or they are (ii) complex relations that are non-fundamental and reducible.[20] Non-complex relations make up complex relations. Non-complex relations are typically held to be primitive and unanalyzable,[21] but some analysis of them is found in the literature, such as when relations are discussed as being platonistic (outside of space), physicalistic (not outside of space), and so on. But in general, there is very little analysis in the literature of the *precise details* of, and the *specific nature* of, relations that goes further than this.

2.1.2. *Topological theories*

My arguments in this paper hold regardless of whether or not space is (a) discrete, (b) continuous, or (c) gunky (devoid of basic building blocks), since each of these three topologies involve non-identical topological regions that are (allegedly) interrelated, or, in the case of (a) and (b) non-identical basic building blocks that are (allegedly) interrelated. (Parallel approaches also hold for the topology of matter, in the cases where matter and space are described as being distinct, since the topological models of matter are gunky, continuous, or discrete topologies.) In this paper, I do not restrict my focus to *one of* these topologies, and I instead will discuss *each* of them, and I will also discuss mereotopology, since there is no agreement among physicists and philosophers as to which is correct. I will next discuss each of these topologies, and in 2.1.2.4. I will discuss mereotopology.

2.1.2.1. *Discrete space*. In the case of (a), where space is considered to be discrete, and where the basic building blocks of space have *non-zero* size (such as the size of a Democritean atom, or of a Planck length or a Planck cell[22]), the statement, "relation between non-identical basic building blocks of space", would denote a relation between or among *two or more* non-identical basic building blocks of space. These relations are connections between non-identical basic building blocks of space, where the non-identical basic building blocks of space are non-identical spatial *locations*. (My arguments will specifically attack non-platonistic relations that connect different spatial locations.)

This sort of topology is often espoused by quantum gravity theorists,[23] who hold that the fundamental building blocks are not points, but are rings, strings, cells, or sheets. Madore, a leading mathematician in non-commutative geometry (which is believed to be a leading candidate theory on the structure of space, according to quantum gravity theorists[24]), writes:

[In non-commutiative geometry,] [s]ince points are… ill-defined we shall use the expression fuzzy space to designate what would have been the space of ordinary geometry… Points are… ill-defined and *fuzzy space-time* consists of elementary cells of volume… By the… uncertainty relation there is no longer a notion of a point in position space since one cannot measure both coordinates simultaneously but as before, position space can be thought of as divided into *Planck cells*. It has become fuzzy.[25]

2.1.2.2. *Continuous space*. In the case of (b), where space is considered to be continuous and consisting of continuum-many interrelated point-sized basic building blocks, there are (alleged to be) relations between or among the spatial points, since any point in the extended continuum of space is not immediately next to any other points. This sort of topology is typically espoused by relativity theorists (such as Einstein, and Hawking), where in relativity theories space is considered to be a set of interrelated points.[26] To my knowledge, this is the most widely accepted and discussed topology among philosophers. Cohn and Varzi call it "a normal space":

Another important factor is the kind of topological space one considers. In particular, one may draw a line between theories that take space to be dense (a *normal space*) and those that do not. Most accounts in the literature are of the first kind, but there are exceptions. In the following we shall remain neutral on this issue and work with arbitrary topological spaces.[27]

An example of someone who holds that space is dense is Stephen Hawking, in his 1994 book with Roger Penrose:

Although there have been suggestions that spacetime may have a discrete structure, *I see no reason to abandon the continuum theories that have been so successful*. General relativity is a beautiful theory that agrees with every observation that has been made. It may require modifications on the Planck scale, but I don't think that will affect many of the predictions that can be obtained from it. It may be only a low energy approximation to some more fundamental theory, like string theory, but I think string theory has been oversold.[28]

2.1.2.3. *Gunky space*. Next I will discuss (c): "gunky space" (or what Casati and Varzi call "atomlessness"[29]). Not every philosopher is convinced that there is a basic (irreducible, fundamental) level of nature. In a recent article, Schafer argues that not only is the position that there is a basic, fundamental level of nature *not* self-evidently true, but it is often *assumed* to be the correct position:

So the question of the evidence for fundamentality is best understood as the question: What is the evidence for mereological atoms? And here there is a *presupposition* that mereological atoms, if such exist, also comprise the ultimate supervenience base, that cast of the prime realizers, and subjects of the fundamental laws of nature.[30]

Many recent articles discuss the position that there are no basic building blocks of space or matter. This anti-atomic theory has been called "atomless gunk" by David Lewis,[31] and this is the name it often goes by in current debates. According to *gunkism,* as it might be called, any physical object, or any topological region, is further reducible into more fundamental parts, where even infinite divisions do not reveal point-sized fundamental building blocks.[32] According to gunkism, any material object or topological region can be described as an infinite regress of parts: a spatially extended object can be divided into halves, each half can be further divided into quarters, each quarter into eighths, ad infinitum. Part-whole relations connect the parts of a gunky object (where the *whole,* call it $whole_1$, that is a relatum of the part-whole relation, is actually a part of another whole, call it $whole_2$, where $whole_2$ is a part of another whole, $whole_3$, ad infinitum). If the part-whole relations are relations between *non-collocated spatial objects* or non-identical topological regions, then they are the sorts of relations I am concerned with in this paper (they are relations between p_1 and p_2). If space is gunky, a "gunky topology" also involves part-whole relations between non-identical topological regions, and a gunky topology of matter involves interrelated non-collocated entities.

2.1.2.4. *Mereotopology.* The only theory I know of that may avoid the problems I will discuss to do with relations between p_1 and p_2 is called *mereotopology*. Mereotopology is about the *contact* of spatial objects, where contact is discussed in terms of *collocation.* I will discuss this after an introductory passage about mereotopology from Pratt-Hartmann and Schoop:

The most basic part of Whitehead's mereotopology employs a single primitive binary relation $C(x, y)$, which may be read "x is in contact with y"; and this primitive has formed the basis for many subsequent approaches…

Whitehead refers to the relation denoted by C as *connection,* risking confusion with the mathematically well-established, and quite different, property of *connectedness.* We have resolved this terminology clash by substituting the word contact and its cognates for Whitehead's relation, and using the term *connected* in its usual topological sense. Nothing substantive should be read into this decision.[33]

Mereotopological theories might not be affected by my argumentation in the way other topological theories are since, to my knowledge, mereotopology is about the relation, *contact*, between entities, where *contact* involves *collocation*[34] In fact, the conclusions of this paper would even be in apparent *agreement* with mereotopology, as long as the mereotopologist is willing to grant that entities are only related at their collocated boundaries.

Mereotopology is a theory of boundaries. Barry Smith writes:

We wish… to capture the commonsensical intuition to the effect that boundaries exist only as boundaries, i.e. that boundaries are dependent particulars: entities which are such that, as a matter of necessity, they do not exist independently of the entities they bound… This thesis – which stands opposed to the set-theoretic conception of boundaries as, effectively, sets of points, each one of which can exist though all around it be annihilated – has a number of possible interpretations. One general statement of the thesis would assert that the existence of any boundary is such as to imply the existence of some entity of higher dimension which it bounds. Here, though, we may content ourselves with a simpler thesis, one whose formulation does not rest on the tricky notion of dimension, to the effect that every boundary is such that we can find an entity which it bounds of which it is a part and which is such as to have interior parts.[35]

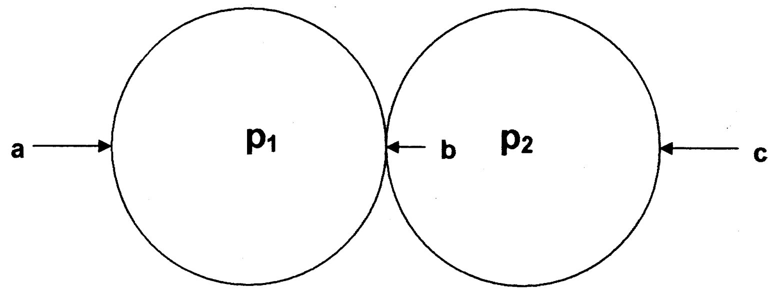
Smith describes material objects as consisting of coinciding boundaries: "Coincidence, as we shall here understand the notion, is exclusively the sort of thing that pertains to boundaries".[36]

Each point within the interior of a two- or three-dimensional continuum is in fact an infinite (and as it were maximally compressed) collection of distinct but coincident points…[37]

A pair of spatial entities are in contact with each other directly when their respective boundaries, in whole or in part, coincide.[38]

So mereotopology is, in general, not affected by my arguments in this paper against relations between p_1 and p_2, since "[b]odies are in contact in the broader sense when they and all their parts are connected to one another, possibly via others, in such a way as to establish *a seamless chain of direct contact* [i.e., *coincidence*]."[39]

According to mereotopology, if p_1 and p_2 are two billiard balls that *touch* at boundary interface b, as the diagram below illustrates, then the areas on the boundary that are opposite b, call them a and c, do not touch,:



But by this touching at b, the mereotopologist can coherently maintain that since the billiard balls are complexes of coinciding boundaries, the billiard balls *are in contact,* since they form a "seamless chain" of contact.[40] (a and c do not *touch,* but they *contact.*) If my reasoning in Sections 2 and 3 is correct, then with respect to the diagram of billiard balls p_1 and p_2 above, the statement, "a *is related to* c" is false, since a and c are non-collocated parts of the entities in contact. But if mereotopologists are correct, the statement, "p_1 *is in contact with* to p_2 is true because of b, and because of the "seamless chain" of collocated boundaries that p_1 and p_2 involve.

This concludes my clarification of issues relevant to discussion of relations between p_1 and p_2.

2.2. *Non-complex relations of non-zero spatial size*

It appears that there are two ways to conceptualize a non-platonistic relation, if the relation is between or among p_1 and p_2.

1. A non-platonistic relation is *spatially extended between* p_1 and p_2 (and for that reason is apparently a relation that is some sort of a *material object* connecting other material objects, perhaps roughly analogous to the way a rope connects a boat and a dock). The position that relations are spatially extended objects is a position that, to my knowledge, has not been held by any philosopher, and which is rarely discussed in the literature,[41] if at all, since relations are typically considered to be spatially *unextended:* relations are considered to be either platonistic, and for that reason, of no spatial size at all, and when relations are considered to be non-platonistic, they are also typically considered spatially unextended.

I am going to discuss spatially extended relations just to cover all the possibilities there might be. I will discuss varieties of this sort of relation in this subsection, and in parts of other subsections of this section, where I will discuss relations that, in connecting p_1 and p_2, are spatially *in-between* p_1 and p_2.[42]

2. The second way to conceptualize non-platonistic relations between p_1 and p_2 is by considering non-platonistic relations as *not spatially extended between* p_1 and p_2. This is the commonly-held position, where spatially located relations are considered spatially *unextended* entities which do not resemble material objects, even if the non-platonistic relation is considered *physical* (as in Armstrong's realism), or if the relation is considered to be a trope of, or a non-aspatial instance or copy of, a platonistic universal. I discuss this commonly held position that non-platonistic relations are not spatially extended in Subsection 2.5 and other subsections.

In this subsection, I discuss spatially extended non-platonistic relations that *occupy* space (2.2.1) and spatially extended non-platonistic relations that *make up* space (2.2.2). In either case, I am only considering relations of non-zero spatial size and that occupy or connect *at least two non-identical spatial locations*. For the remainder of this subsection, call the spatial locations, x and z.

2.2.1. *Non-complex relations of nonzero size that occupy two or more spatial locations*

I next give an argument against non-platonistic, *spatially extended, non-complex* relations between non-collocated spatial entities. Such relations *occupy* at least two spatial locations, such as the location where p_1 is (call this x), and the location where p_2 is (call this Z). If spatially extended, non-complex, non-platonistic relations between non-collocated spatial entities *occupy* at least two non-identical spatial locations, then they are apparently contradictory, for the following reasons.

If a spatially extended relation is partless (non-complex) and fundamental, it is a *single* entity. If a spatially extended, non-complex relation is describable by a statement then the *entire* relation is describable by the statement. For example, the entire relation would be describable by the statements, "located at x", and, "located at z". If the relation is located at z, and if $x \neq z$, then by being at z, the non-complex non-platonistic relation is describable by the statement, "not located at x". This could be said of any non-x location that the non-platonistic non-complex relation occupies. If the relation occupies more than two basic building blocks of space, and for that reason is located at three spatial locations, x, y, and z, at locations y and z the relation would be describable by the statement, "not located at x". These are, however, statements that lead to contradictory descriptions of the relation: since the relation is one, partless entity, if it is located at x, and not located at x, each of these statements must describe the *entire* non-complex non-platonistic relation, and that implies the entire relation would be describable by self-contradictory conjunction of the above statements: "located at x and not located at x".

2.2.2. *Non-complex topological relations of non-zero spatial size that connect two or more locations*

Next I consider non-complex spatially extended relations that *make up space,* rather than *occupy* space. It is standard to hold that non-complex non-platonistic relations, along with the basic building blocks of space, are not *occupants of* space, but rather are relations that contribute to the *makeup* of space. In their interesting article, Cohn and Varzi writes:

> … our focus will be on the logical spectrum of theories concerned with the topological structure of space, as opposed to things *located* in space. This makes our study independent of questions of location, which call for a different sort of theory…[43]

In this subsection, I will argue that despite what topologically oriented philosophers have told us, relations that are constituents of topological space, if they are non-platonistic, *can only be spatially located*: *they only can be occupants of space*, just as the relations discussed in 2.2.1 are *occupants* of space.

The basic building blocks of space are typically considered to be *locations*; and the relations between or among the basic building blocks of space, which also make up space, are typically *not* considered locations. If there are non-platonistic relations that contribute to the makeup of space, since they *interrelate* basic building blocks of space, or non-identical topological regions, such topoiogical relations must *coincide* with those basic building blocks of space (locations) that they interrelate. Basic building blocks of space are partless entities, and if they are relata of topological (or any other) relations, then it can only be the case that the entire basic building block of space coincides with the relation that it is a relatum of. It cannot be the case that, for example, with respect to a Planck cell, that the relation just contacts the surface of, or a left side, of the Planck cell (if a "side" or "surface" of a Planck cell can even be discussed at all, since "side" and "surface" *may* be references to *parts of* the Planck cell, which is not possible since there are no parts of a Planck cell). Only global properties are permitted for a Planck cell, or any *basic* building block of space, and any statement describing it can only describe the entire basic building block of space, and thus a non-platonistic relation must coincide with the entirety of the basic building block of space that is a relatum of the topological relation. Of course, if a relation did not attach or link to its relata (where "attach" and "link" denote the special exemplification tie that holds relations to their relata[44]), then there would be a *gap,* or a discontinuity, between the topological relation and its relata (basic building blocks of space), which is absurd, since the relations then would not attach or link to their relata, and thus would they would be relations that do not interrelate their relata.

For reasons just given non-platonistic relations that are constituents in the makeup of space *coincide* with the basic building blocks of space, or any topological regions, that they connect. I will next discuss that this implies that non-platonistic topological relations *cannot also be locations,* even though the topological relations are *constituents* of space. If the topological relations were *also* locations, then both the basic building blocks of space *and* the topological relations that connect the basic building block of space to one another, would coincide (overlap), where these coinciding entities *would each be locations*. This has obvious problems, however, since two locations that spatially overlap or coincide are not at a distance from one another, and cannot *each* be locations, unless they are *identical*. But this cannot be the case, since the relation must *distinct from* its relata. This implies that if there are non-platonistic relations that are topological entities, since they are in space but are not locations, then they could only be *located at* places in space, in order to avoid the problems just discussed. But if that is the case, then non-platonistic relations that are topological relations *would be spatially located relations that occupy space,* just as the relations discussed in Subsection 2.2.1 are relations that *occupy space,* and which were found to be apparently contradictory. (Hereafter, for reasons just given, I will only discuss non-platonistic non-complex relations of any sort as being *occupants* of space, regardless if they are constituents of space or not.)

2.3. *Spatially extended relations only located at entire spaces*

In this Subsection, I discuss an objection to the reasoning given in 2.2.1 and 2.2.2, where non-platonistic non-complex relations were found to be contradictory if they occupy two or more spatial locations.

Some may object to the reasoning of the previous subsection, and hold that spatially extended, non-complex, non-platonistic relations that occupy two or more spatial locations in their interrelating p_1 and p_2, have been inaccurately described, since it may be the case that non-complex non-platonistic relations might only be accurately described as being *at their entire topological space* (call it *xyz*), not at a *part* (subspace) of the entire relation's spatial location, such as the basic spaces, *x*, *y*, or *z*.[45] According to this objection, the spatially extended non-platonistic relation is *not* located at the basic building blocks of its space, *x*, *y*, and *z*, of the topological space *xyz*. Rather, only the *entire* topological space, *xyz*, that the relation is at, can be called the non-complex, non-platonistic, spatially extended relation's location. On this scenario, the statement,

"The non-complex non-platonistic relation between p_1 and p_2 is located at space *xyz*,"

is true, and the statements about the relation being at any non-basic subspace of *xyz* (i.e., space *xy*, or space *yz*), or at the individual basic subspaces, of *xyz*, are all false, such as the statements,

"The non-complex non-platonistic relation between p_1 and p_2 is located at *x*"
"The non-complex non-platonistic relation between p_1 and p_2 is located at *y*", or
"The non-complex non-platonistic relation between p_1 and p_2 is located at *z*,"

In this section, I will argue that this objection fails. The problem, I will argue, is in considering a simple (partless) entity at a non-simple space. Or put in similar words: there is a problem in considering a non-basic space containing an irreducible, partless item.

According to this objection, the spatially extended, non-complex, non-platonistic relation is at space *xyz*, but aspects of the relation at *x*, *y*, or *z* cannot be discussed, since there are no such aspects of the relation that are non-identical to the whole of the spatially extended non-complex relation.

Since the relation extends spatially between *x* and *z*, it is important to note that all of the individual basic spaces, *x*, *y*, or *z* *can only be* *occupied* by something to do with the relation. By this I mean that these subspaces are *not unoccupied* with respect to the relation. The reason that *x*, *y*, or *z* must be occupied by something to do with the relation is because the space, *xyz*, that the relation is at is a space that is made up of more fundamental topological spaces, and if an entity is at a non-basic topological space (such as, *xyz*) and accordingly fills the entire space, it must also be the case that the relation occupying *xyz* leads to each of the subspaces that make up *xyz also* being filled. A space would not be occupied at all if none of its subspaces that compose it were occupied. Put in slightly different words, if a relation occupying a space (*xyz*) does not occupy more fundamental spaces (*xy*, *yz*), or any of the basic building blocks of the space (*x*, *y*, *z*), then the entity does not occupy the *entire* space. For these reasons, then the relation's being at *xyz* must also lead to all of the subspaces of *xyz* being occupied. But this poses a serious problem for the non-complex, spatially extended, non-platonistic relation at space *xyz*: if the relation occupies subspaces of *xyz*, the problems of the previous subsection ensue.

The reasoning about topological spaces just given, where non-basic topological spaces are discussed as being composed of subspaces, is the case for any non-basic topological space, since any non-basic topological space is made up of more fundamental topological spaces. (For example, in point-set topology, non-degenerate spaces are made up of degenerate spaces, where the interrelated degenerate spaces are interrelated points.[46]) If it were the case that a non-basic topological space, such as *xyz*, were *not* made up of more fundamental, or basic, topological spaces, then an extended and non-basic topological space would not be made up of anything, and it would not be a topological space at all. For these reasons, a non-basic space is composed of more fundamental subspaces, or basic subspaces, and an entity's occupying a non-basic space must accordingly result in the more fundamental subspaces, or basic subspaces of the space also being occupied. The non-complex, spatially extended, non-platonistic relation, for these reasons, cannot, be located at *xyz* since the relation cannot be located at any of the subspaces make up *xyz*. This sets up a fatal problem for the coherence of the relation: since no subspace or basic building block of the relation's entire topological space (*xyz*) can have *anything* to do with the relation, then the non-platonistic relation, which is not outside of space, cannot be a spatial entity at all, which is a contradiction.

2.4. *Spatially located, spatially unextended, non-complex relations*

An objection that the defender of non-platonistic relations could suggest to the reasoning given in the above subsections is that (somehow) a non-platonistic *interrelation* of p_1 and p_2 does not involve a connection *across* space, *extending between* p_1 and p_2. Rather, the interrelation of p_1 and p_2 exists *only at* p_1 and p_2, and not at the space *in-between* p_1 and p_2. On this scenario, an interrelation of p_1 and p_2 is *in nature,* where p_1 and p_2 are, but the non-complex, non-platonistic relation is spatially *unextended,* since according to this objection, the non-platonistic relation is located where and only where p_1 and p_2 are. This is the more widely held account of non-platonistic relations, since relations are typically held to be entities without a spatial magnitude.

I will next argue that this position on spatially unextended, non-complex, non-platonistic relations is also seriously problematic.

First I will consider the scenario where the relation, *parthood,* among p_1 and p_2 where p_1 = paw (part), and p_2 = lion (whole), is a spatially *unextended*, non-complex, non-platonistic relation. On this account, the connection among p_1 and p_2 is a connection among *non-collocated* spatial entities, since pieces of p_2 are non-collocated with p_1: p_1 (part) is at p_2's (whole's) spatial locations, but p_1 does not collocate with many of p_2's spatial locations, such as where the lion's heart, brain, or mane are. For these reasons, the relation, *parthood,* between p_2 (whole) and p_1 (part), connects non-collocated entities, which is the very sort of relation I am concerned with in this paper.

This scenario has the following restrictions. Being a spatial entity, p_1 cannot fail to be at a spatial location; call p_1's location, a_n (which is the topological region or the collection of basic building blocks of space that p_1 occupies). This implies that p_1 only participates in the co-exemplification of polyadic properties (such as, *parthood*) at a_n and nowhere else, since the spatially located entity p_1 is nowhere else *but* at a_n. If one of the spatially unextended, non-complex, non-platonistic relation's relata is not at a_n, then p_1 is not one of the relation's relata. p_2, being a spatially located entity, also cannot fail to be at a spatial location, b_n (which is the topological region or the collection of basic building blocks of space that p_2 occupies). This implies that p_2 only participates in the co-exemplification of non-platonistic polyadic properties at b_n and nowhere else, since spatially located object p_2 is nowhere else *but* at

b_n. If one of relation's relata is not at b_n, then p_2 is not one of the relation's relata.

I will next explain that these restrictions imply that p_1 and p_2 could *not* be interrelated at the spatial locations that *they are not collocated at*. If p_1 is only at a_n, and if p_2 is only at b_n, and if many of p_2's spatial locations are not identical to p_1's spatial locations (they are not identical since if $a_n \subset b_n$, then $a_n \neq b_n$),[47] and if on this account the non-platonistic interrelation of p_1 and p_2 is not being considered as spatially *between* p_1 and p_2, then at those spatial locations where p_1 and p_2 do not collocate, p_1 and p_2 apparently cannot have any sort of dealings with one another (such as being interrelated by the relation, *parthood)*. It appears that in order for p_1 to, for example, participate in the co-exemplification *parthood* with p_2, p_1, which is wholly at a_n, must also be at all of p_2's spatial locations, and thus must apparently take on characteristics that are self-contradictory.

I will next consider the scenario, where p_1 and p_2 are basic building blocks of space.[48] Building block of space, p_1, for example, participates in the co-exemplification of polyadic properties (such as, the topological relation *connectivity*) only where it is, since it is nowhere else but where it is. If one of the spatially located relation's relata is not identical to p_1 then p_1 is not a relatum of the spatially unextended, non-complex, non-platonistic relation. If basic building block of space p_2 is a spatial location, then p_2 only participates in the co-exemplification polyadic properties where it is and nowhere else, since basic building block of space p_2 is not at or identical to another building block of space, such as p_1. If one of the relation's relata is not p_2, then p_2 is not a relatum of the relation.

These restrictions imply that any non-identical basic building blocks of space, p_1 and p_2, could not be related by a non-complex, spatially unextended, non-platonistic relation, for the following reasons. Since $p_1 \neq p_2$, and since on this account the non-platonistic interrelation of p_1 and p_2 is not being considered as spatially *between* p_1 and p_2, but only at locations p_1 and p_2, then p_1 and p_2 apparently cannot have any sort of dealings with one another (such as being interrelated by the topological relation, *connectivity*). It appears that in order for p_1, for example, to co-exemplify a spatially *unextended* relation of the sort I am discussing here, which is a non-platonistic, non-complex, non-platonistic relation shared with p_2, p_1 *must also be identical to* p_2, and thus must apparently take on characteristics that are self-contradictory (e.g., p_1 is identical to itself and is not identical to itself). Similarly, in order for p_2 to share a spatially unextended non-complex, non-platonistic relation with p_1, p_2 *must also be identical to* p_1, and thus must apparently take on characteristics that are self-contradictory.

If my reasoning in this sub-section is correct, it is apparently the case that non-complex, spatially *unextended,* non-platonistic relation relations cannot account for any connection or relatedness among p_1 and p_2.

2.5. *Non-platonistic monadic relatedness*

Some philosophers may argue that an account of non-platonistic *monadic relatedness*, which, like the account of relations in the previous subsection, *are not* connections that are located at the spaces *in-between* p_1 and p_2, but monadic relatedness apparently only exists at p_1 or p_2, not both p_1 and p_2, and for that reason, may avoid the problems discussed in the previous subsection. Some readers may immediately object to the idea that monadic relatedness can account for a connection between p_1 and p_2, since the reasoning of the previous subsections implies that, if spatially unextended non-complex non-platonistic relations are not at the spaces *in-between* p_1 and p_2, or do not extend in space between p_1 and p_2, then p_2 can only have dealings with p_1 if either p_2 is at p_1's spatially location (i.e., if p_1 and p_2 collocate) in the case where p_1 and p_2 are *occupants* of space, or if p_1 and p_2 are identical, in the case where p_1 and p_2 are basic building blocks of space or topological regions. I will next argue that this is apparently not correct.

If p_1 has, for example, the non-platonistic monadic property, *related to p_2*, and is instantiated by, for example, the basic building block of space p_1, then the non-platonistic monadic property, *related to p_2*, that is only at p_1, has involvement with *both* p_1 *and* p_2. If p_1 only has dealings with other entities where p_1 is and nowhere else (such as having dealings with p_2 by p_1's exemplifying the non-platonistic monadic property, *related to* p_2, since p_1 is nowhere else but where it is, then if a non-platonistic property is not where p_1 is, it cannot be instantiated by p_1 since it would not link to t_1. For this reason, p_2 cannot have anything to do with a non-platonistic monadic property instantiated at p_1 (and hence located at p_1, and not at p_2), such as p_1's monadic property, *related to P_2*, since that property is where p_1 is, and not where p_2 is. If this reasoning is correct, then p_1, for example, cannot have monadic properties, such as, *related to p_2*.

2.6. *A complex relation as an extended continuum of non-complex relations*

Since *non-complex* relations make up complex relations, it may appear that non-platonistic *complex* relations between or among p_1 and p_2, are also contradictory. But there may be varieties of spatially located complex relations not susceptible to the problems discussed up to this point in the paper. In Subsections 2.2–2.4, I discussed apparent serious problems with *non-complex* non-platonistic relations between or among p_1 and p_2, where those non-complex relations are either spatially extended or spatially unextended. In the case of spatially *extended* non-complex non-platonistic relations, the apparent problems I discussed draw from the combination of the *partlessness* and *extendedness* (extended larger than one basic building block of space) of the non-complex spatially located relation. In the case of spatially *unextended* non-complex, non-platonistic relations, the apparent problems I discussed draw from the non-complex relation not being able to connect p_1 and p_2 if non-platonistic, non-complex relations are not in any way *extended between* relata. Perhaps a complex relation of a very specific sort can avoid these problems.

A spatially located, spatially extended, *complex* relation between or among p_1 and p_2 that is a relation composed of discrete sub-relations that have a basic size, such as the size of a Planck lengths, or that is a relation composed of an extended *continuum* of point-size, non-complex, non-platonistic sub-relations between p_1 and p_2, avoids the problems of non-complex relations I discussed in Subsections 2.2–2.4. Roughly put, by a physical analogy, perhaps one could imagine this relation as sub-relations in tandem, linked one after the other, as chain links are linked in a chain. (Interestingly, Loux uses "link" to denote the tying of relations to other relations in one particularly interesting passage.[49]) This is not a relation that I have seen discussed often in the literature, other than for a few specific cases.[50] If there is such a complex relation, as I just described, one might consider it to be a continuum of point-sized sub-relations. I will consider such "continuous complex relations", but I will also consider these complex relations as being composed of discrete Planck-scale sized sub-relations, since if some of the current leading theories of quantum gravity are correct (such as string theories, which might be described by non-commutative geometries), there are no point-sized entities in nature since the smallest entity is a Planck cell or Planck length. Since each scenario is taken seriously by physicists and philosophers, below I will consider each scenario, where the sub-relations are point-sized (2.6.1 and 2.6.2), and where the sub-relations are the size of a Planck cell or Planck length (2.6.3). I will find that in either scenario, they cannot compose a complex relation.

2.6.1. *A complex relation as a continuum of point-sized non-complex relations, Part 1*

I will next discuss reasons why a non-platonistic complex relation composed of continuum-many point-sized non-complex relations apparently cannot constitute a connection between p_1 and p_2.

It might seem that continuum-many non-complex sub-relations constituting a spatially located complex relation between p_1 and p_2 is a complex relation that consists of sub-relations that *connect to one another,* in order to result in an extended connection between p_1 and p_2. But if this were the case, the spatially located complex relation would be denoted by a statement that describes an infinite regress of sub-relations: "p_1 is related to the relation that is related to the relation that is related to the relation…" This may, however, imply that p_1 and p_2 are *not* related, since there is no last step in this regress of sub-relations between p_1 and p_2, which may render p_1 and p_2 *unrelated.* This infinite regress attempts to complete a task by an infinite sequence of steps, where the "completion" "at infinity", some might claim, in fact never occurs, since an infinite set of items has no *last* item. Chisholm considers this sort of regress vicious; Moreland lucidly writes about Chisholm's position:

> There are at least three forms of infinite regress arguments… [One form] involves claiming that a thesis generates a "vicious" infinite regress. How should "vicious" be characterized here? … Roderick Chisholm says that "One is confronted with a vicious infinite regress when one attempts a task of the following sort: Every step needed to begin the task requires a preliminary step". [Chisholm, 1996, p. 53.] For example, if the only way to tie together any two things whatever is to connect them with a rope, then one would have to use two ropes to tie the two the two things to the initial connecting ropes, and use additional ropes to tie them to these subsequent ropes, and so on. According to Chisholm, this is a vicious infinite regress because the task cannot be accomplished.[51]

Phillips also straightforwardly discusses the problem involved in this sort of regress:

> The regress is set up by treating the relation the spatially located, unextended sub-relation] as a term, as the same sort of thing, logically, as its relata [i.e., the relata are also relations]. Without an argument that a relation is a different sort of critter, it seems that if a third thing is required to relate two things, then the third thing requires equally a fourth and fifth to tie it up with the first two, *ad infinitum.* The

regress is vicious: unlike an infinite series of causes that does not undermine the notion that a present *x* has *y* as its cause, the relation regress does undermine the work proposed for the relator. *The relator, the third thing, cannot relate the two items without help* form *the fourth and fifth things* (*ad infinitum*) *needed to tie it up with the first two*[52]

2.6.2. *A complex relation as a continuum of point-sized non-complex relations, Part 2*

Some philosophers consider infinities to involve paradoxes, and for that reason, they make a point to avoid infinities when describing physical collections. But others may object to such a position, and may object to the reasoning given in the last section, claiming that physical infinities *can* exist, and there is no problem in considering a physical collection to have a cardinality that is infinitely large. Philosophers who do not object to physical infinities might consider examples of such collections to be, for example, the collection of spatial locations, the collection of time-instants before this present moment,[53] or, perhaps, the collection of sub-relations constituting a spatially extended complex relation between or among p_1 and p_2.

An extended continuum of point-size sub-relations resembles an extended continuum of points. In comparing this sort of complex relation between p_i and p_2 to some models of topological space which treat the basic building blocks of the topology as points, such as point-set topology (which is in conflict with the non-commutative geometries that might describe quantum gravity), both the complex relation composed of sub-relations, and any non-basic region of the topological space, each consist of $\aleph_1$ spatially unextended, spatially located, but *spatially non-collocated* objects (sub-relations in the case of the relation, or points in the case of the region in the point-set topology), that give rise to an *extended* entity (the extended continuum). For these reasons, hereafter I will consider a complex relation that is composed of continuum many sub-relations to be a complex relation *that is a continuum of sub-relations*.

Points in a topological continuum do not directly contact one another, since any point in a continuum is not immediately next to any other points. This reasoning would apply to an extended continuum of spatially located point-size sub-relations extending between p_1 and p_2: none of the sub-relations are immediately next to one another. For this reason, a complex relation *merely* composed of point-size sub-relations cannot give rise to a complex relational connection between or among p_1 and p_2.[54]

Continuums of *points are*, however, typically considered to be composed of *interrelated* points.[55] Perhaps, as with the point-set topological account of space, *point-size* sub-relations could be basic components in an *extended continuous connection* between p_1 and p_2, if the complex relation had the topological features of an extended *interrelated* continuum of point-size sub-relations. If so, perhaps the reasoning of the previous paragraph, where sub-relations were considered to be the only constituents of a continuum, is misguided[56]. Instead of discussing the sub-relations as *directly* attached to one another (which is impossible), the sub-relations instead should be considered to as interconnected by a spatially located topological relation, call it *connectedness* (or *connectivity*), which is perhaps analogous to point-set topological accounts of *connectedness* spatial points in the spatial manifold, and which is a non-platonistic relation between or among the continuum-many non-platonistic sub-relations.

If a continuum is extended and interconnected, since the point-size items of the continuum cannot account for the interconnectivity (or extension) of the continuum, there are *two* constituents of the complex relation between p_1 and p_2: (1) the collection of point-sized, physical sub-relations, and (2) a point-set topological relation, *connectedness,* between or among the sub-relations. Considering points (point-sets, or degenerate intervals) as *connected* (*interrelated*) in *neighborhoods* or *unions* (some topologists might denote this interrelatedness with the words, "nearness"[57], "closeness", or "connectivity") is standard among topologists, since point-set topology is concerned with structures that are composed of points and relations between points (or what are often called *point sets*).

I will next argue that a non-platonistic, point-set topological relation between or among a continuum of point-size sub-relations of the complex relation between p_1 and p_2 cannot connect the sub-relations.

Consider the following issues.

A. If a complex relation of point-size sub-relations connects p_1 and p_2, the relation must consist of interconnected point-sized sub-relations. Since none of the non-platonistic, point-size sub-relations are immediately next to one another, the topological relation, *connectedness,* between or among the points, is a relation between or among *non-identical points* (the points are at a distance from one another).

B. If the relation, *connectedenss*, connecting the continuum of sub-relations were itself *also* a continuum of point-size sub-relations, *it too would consist either of continuum-many sub-relations that are disconnected* (not directly attached, not immediately next to one another). If the *connectedness* between the point-sized sub-relations were also composed of *point-sized sub-relations*, the relation, *interconnectedness,* would itself provide no continuous connection between the non-collocated sub-relations of the complex relation between or among p_1 and p_2.

C. If *interconnectedness* is a relation between or among the non-collocated sub-relations (point A above), and if the *interconnectedness* is not a complex extended relation composed of a continuum of point-size sub-relations (point B above), in order to interconnect the sub-relations, the *connectivity* relation apparently must be a *non-platonistic*, *non-complex* relation between *non-collocated sub-relations and which is located at more than one spatial location*. But this is exactly the sort of relation found to be apparently contradictory in Section 2.2.

Given (C), a topological *connectedness* among continuum-many sub-relations that compose the complex non-platonistic relation connecting p_1 and p_2 is apparently contradictory. I do not know of any way to consider a continuous relation between p_1 and p_2, and for that reason I will move to the other scenario: a complex relation composed of discrete sub-relations.

2.6.3. *A complex relation composed of Planck length-sized sub-relations*

I will next, consider discrete space, I will argue that there are no complex, non-platonistic relations, if the complex relation is composed of a tandem of discrete sub-relations that are the size of a discrete basic building block of space (any discrete sub-relation larger than the size of a basic building block of space would give rise to problems discussed in previous subsections since it would occupy more than one spatial location). To see why this is the case, I only need to consider the minimum case, where two Planck cells, call them p_1 and p_2, are interconnected, which I will do next.

I will follow quantum gravity theorists and consider the scenario where the discrete parts of complex, non-platonistic sub-relations composed of discrete parts are relations that are not smaller than the size of a Planck cell. The smallest sub-relation that can be considered that connects two Planck cells is a relation between two contiguous or adjacent Planck cells, call them p_1 and p_2. In connecting p_1 and p_2, notice that the sub-relation, in this minimum case of connecting two Planck cells, is (i) non-complex, and (ii) must coincide with p_1 and p_2 in order to connect them. If the relation is located at p_1 and p_2, which it appears it must be if it is to connect to them, then this relation is a non-complex relation connecting two non-identical Planck cells, which is exactly the sort of relation I found to be contradictory in the previous subsections, and for that reason I will not discuss it further.

If we go against quantum gravity theorists, and imagine that the discrete sub-relations of the complex relation between p_1 and p_2 are somehow larger than a point, but *smaller* than the Planck scale, this sort of relation is one that ignores restrictions of point-set topology, and Planck scale topologies (such as non-commutative geometry), and can be considered as a mere set of interconnected discrete sub-relations. The sub-relations of this relation exist in space (they occupy space), and would suffer from problems of previous subsections if the sub-relations are larger than the basic building blocks of space they occupy. So the sub-relations could not be larger than a basic building block of space. The sub-relations can be precisely the size of a basic building block of space. This scenario however is just like the one above in considering Planck-sized sub-relations, since in considering two basic building blocks as interconnected by a sub-relation, the sub-relations in the minimum case, where they connect two discrete basic building blocks, must coincide with each basic building block, and *ipso facto*, the relation occupies two locations and thus suffers from the problems of the above subsections.

If sub-relations are imagined to only exactly coincide with discrete basic building blocks of space, and are imagined to link up to one another while they each occupy only one discrete basic building block of space, it is unclear how these discrete sub-relations could link to one another. They cannot link, in this case, by partial collocation, and if they link by some sort of mere abutment without overlap, then in that case, they sub-relations could not link up to one another in a way where the relations coincide, and without coincidence, it is entirely unclear how these relations can be relata of one another. Such relations would be without relata: they would be relations that do not relate.

If my reasoning in this section is correct, there cannot be any relations between p_1 and p_2 if the relations are non-platonistic relations.

3. PLATONISTIC RELATIONS BETWEEN OR AMONG NON-COLLOCATED SPATIAL ENTITIES

3.1. *Piatonistic interrelating between or among spatial entities*

To avoid the problems discussed in Section 2, relations among p_1 and p_2 could be considered relations that are not in space, not at the locations that p_1 and p_2 are at (call those locations x and y). Rather, *relations* among p_1 and p_2 are *spatially unlocated*: they are spatially unlocated universals (platonic universals) *exemplified* by p_1 and p_2 and not *at* x or y (the interrelation of p_1 and p_2 is not *in* nature). On this scenario, p_1 and p_2 are interrelated since they *co-exemplify a* spatially unlocated relation. The interrelation of p_1 and p_2 is, in the platonic sense, *nowhere* (it is in the spatially unlocated platonic realm). Considering platonistic relations as spatially unlocated is the standard position on platonia. In using the word "non-spatial" to mean "not in space", Grossman, a major platonist philosopher, writes:

According to Plato, as we have seen, there are two realms: the realm of temporal things, of things which exist in time, and the realm of a temporal things, of things which do not exist in time. To the first realm belong the individual things around us; to the second, their properties [including their polyadic, or *relational*, properties].

The question arises naturally of whether it is also the case that all individual things are in *space*, are spatial, while all properties do not exist in space, are not spatial. In other words, does the distinction between temporal and atemporal things coincide with the distinction between spatial and non-spatial things?[58]

… [S]ome philosophers, and especially Plato, have held that all properties are non-spatial… … [T]he color of the apple is not located anywhere in space… … [A]ll properties are both atemporal and non-spatial…

Plato… speaks of 'abstract quality'. I shall speak of abstract things (entities, existents) in general. An abstract thing is a thing which is neither temporal nor spatial. A concrete thing, on the other hand, is a thing which is temporal and/or spatial.[59]

… [P]roperties… are abstract things; they are not spatio-temporal. It follows that they do not belong to the universe. They are not part of the universe. The shade of red we talked about, for example, surprising as this appears, is not a (spatio-temporal) part of the universe. And what holds for this particular property holds for every other: none of these things is a part of the universe. But this means that there are things which are not parts of the universe.[60]

Others who hold this position are Michael Jubien, J. P. Moreland, Quentin Smith, just to name a few.[61]

In this section, I argue that a platonistic account of relations is a contradictory account of relations among p_1 and p_2. I will not argue against the existence of spatially unlocated objects, nor will I argue for physicalism. Rather, I will only argue that any sort of tie between physical objects and spatially unlocated platonic objects has serious problems.

The *exemplification* of relations by p_1 and p_2 on the platonistic account involves the *platonistic exemplification tie,* which is a "realm crossing tie", connecting universals in the spatially unlocated platonistic realm (where relations, such as, *connectivity* or *parthood*, and any other platonistic relation, are) to entities in the spatial realm (where p_1 and p_2 are). I borrow the phrase "realm crossing" from one of D. M. Armstrong's passages where he discusses platonistic exemplification (but where he refers to it as the *instantiation relation* instead of an exemplification tie) between or among spatially unlocated entities (platonic universals) and spatially located entities (platonistic thin particulars[62]):

Once you have uninstantiated spatially unlocated] universals you need somewhere to put them, a "Platonic heaven," as philosophers often say. *They are not to be found in the ordinary world of space and time*. And since it seems that any instantiated universal might have been uninstantiated… then if uninstantiated universals are in a Platonic heaven, it will be natural to place all universals in that heaven. The result is that we get two realms: the realm of universals and the realm of particulars, the latter being ordinary things in space and time… Instantiation then becomes a very big deal: a relation between universals and particulars that crosses *realms*[63]

I will discuss an objection to the concept of *realm crossing* in Subsection 3.4.

I will argue that there is a specific problem with the platonic account of polyadic property possession since, I will discuss, there may be a fatal problem involved with such "realm crossing" ties.[64] If I am correct, and if the problem is serious enough, a spatially unlocated platonistic relation cannot relate p_1 and p_2 (p_1 and p_2 cannot be platonistically interrelated).

3.2. *Realm crossing relations and realm crossing unmediated attachments*

Before discussing the realm crossing relation, I will discuss how I use the terms "exemplification tie" and "unmediated attachment", which are terms relevant to the discussion of any (alleged) platonistic interrelation of non-collocated spatial entities.

There are two types of realm crossing between spatially unlocated platonic universals and spatially located platonistic thin particulars.

(i) A *realm crossing exemplification tie,* which is an intermediary connecting a spatially located platonistic thin particular (the thin particularity of p_1 or p_2) and the spatially unlocated platonistic n-adic properties (properties such as, *relatedness*, or relations, such as, *connectivity* or *parthood*).
(ii) A realm crossing *unmediated attachment*, which either the spatially located platonistic thin particular and the exemplification tie are involved in, or which a spatially unlocated platonic universal or the exemplification tie are involved in (or which, as I will explain below, parts of the platonistic exemplification tie, if it has parts, might be involved in).

Let "realm crossing exemplification tie" denote what is denoted by spatially located entities p_1 and p_2 "exemplify" R, or p_1 and p_2 "have" the polyadic property, R (R is a platonic universal). The realm crossing exemplification tie is the entity *between* the spatially located physical particulars and the spatially unlocated platonistic universals.

Exemplification is an intermediary *between* entities, and is the opposite scenario of *unmediated* attachment. Let "unmediated attachment" express the concept of an attachment which does not involve an intermediary. An unmediated attachment is not a relation between entities, and it does not involve non-relational ties, or *any* sort of entity that is *between* the attached entities. Unmediated attachment is normally how exemplification is conceived to attach to a property and to the platonistic thin particular. The concept of unmediated attachment comes from responses to F.H. Bradley's work on the paradox of the relations regress. Loux lucidly explains:

According to the [platonist], for a particular, a, to be *F*, it is required that both the particular, a, and the universal, *F-ness,* exist. But more is required; it is required, in addition, that a *exemplify F-ness*. As we have formulated the [platonist's] theory, however, a's exemplifying *F-ness* is a relational fact. It is a matter of a and *F-ness* entering into the relation of exemplification. But the realist insists that relations are themselves universals and that a pair of objects can bear a relation to each other only if they exemplify it by entering into it. The consequence, then, is that if we are to have the result that a is *F*, we need a new, higher-level form of exemplification (call it $exemplification_2$) whose function it is to insure that a and *F-ness* enter into the exemplification relation. Unfortunately, exemplification is itself a further relation, so that we need a still higher-level form of exemplification ($exemplification_3$) whose role it is to insure that a, *F-ness*, and exemplification are related by $exemplifiaction_2$; and obviously there will be no end to the ascending levels of exemplification that are required here. So it appears… that the only way we will ever secure the desired result that *a* is F is by denying that exemplification is a notion to which the realist's theory applies.

The argument just set out is a version of the famous argument developed by F.H. Bradley. Bradley's argument sought to show that there can be no such things as relations… [PIatonists] claim that while relations can bind objects together only by the mediating link of exemplification, exemplification links objects into relational facts without the mediation of any further links. It is, we are told, an unmediated linker; and this fact is taken to be a primitive categorial feature of the concept of exemplification. So, whereas we have so far spoken of exemplification as a relation tying particulars to universals and universals to each other, we more accurately reflect the realist thinking about the notion if we follow realists and speak of exemplification as a 'tie' or 'nexus' where the use of these terms has the force of binging out the *nonrelational* nature of the linkage this notion provides.[65]

Exemplification is a non-relational tie or nexus[66] between or among properties and platonistic thin particulars, or between or among properties and other properties. Exemplification is not *related* to the relation (*connectivity*, *parthood*) or to the non-collocated spatial entities (p_1 and p_2); and exemplification is not a *relation* between or among the relation (*connectivity*, *parthood*) and the non-collocated spatial entities (p_1 and p_2). Given exemplification's apparent non-relational nature, in this paper, I will discuss exemplification as a *tie,* rather than as a *relation*.

The exemplification tie is not *merely* the unmediated attachment of a property with a platonistic thin particular. If this were the case, a Bradley-esque regress would ensue. When we say, "x *has* F", there must be a truthmaker denoted by "has". For this (and other) reasons, the exemplification tie is an *additional* entity (in the broadest sense of the word "entity"), in addition to the aspatial property and physical particular, which connects the platonistic factor of thin physical particularity to the platonistic spatially unlocated universal. If, however, *somehow* exemplification were not a third entity, distinct from the property and thin particular, then in the scenario where a particular *has* a property, a Bradley-esque regress would ensue. Some might consider that exemplification is merely the very *tying* (unmediated attachment) of a property directly to a particular, but Bradley's work showed that such tying is viciously regressive, whereby a *non-relational exemplification* is needed in order to avoid the regress.[67] When Loux mentions that exemplification is a "nexus", his word choice is a good one since "nexus" clearly denotes how exemplification is a *bridging intermediary between* property and particular, distinct from property and particular, which keeps property and particular from being involved in an unmediated attachment, whereby a Bradley-esque regress would ensue. (I discuss this much more in paragraphs below.)

Some may object that this position, described by Loux, is fatally flawed, since "unmediated attachment" must have a truthmaker, but if there is a verbal referent to "unmediated attachment", then an unmediated attachment, as described by Loux and myself above, is impossible, since unmediated attachment would refer to a third entity, *distinct from* the exemplification tie and the particular. This objection fails for the following reasons. The referent of "unmediated attachment", if I understand Loux's terminology correctly, is *not* a *third entity* distinct from the tie, property, and particular, but is a *manner or way* in which the property and the exemplification tie, or particular and the exemplification tie, are *linked*, to use Loux's word. For example, Loux describes the exemplification tie as a "linker", and the word "link" might imply a chain-like connection, to use a rough analogy, where only the pieces of a chain are involved, and a third *mediating* entity (analogous to a rope *between* a boat and a dock, which is an intermediary between the boat and dock), that is an entity different from the chain links, is not required for the linking of the chain links to ensue.

The non-relational tie of exemplification is needed in the scenario of p_1 and p_2 platonistically interrelating by the relations *parthood* or *connectivity* (or any other relations), lest a Bradley-esque regress ensue. (I will repeatedly refer to the relations *parthood* and *connectivity* that I used in Section 2 in this section also, so as to keep it straight as to what I am discussing.) To avoid a Bradley-esque regress in the scenario where p_1 and p_2 are interrelated platonistically, four entities are involved: (a) p_1, (b) p_2, (c) the relation (*connectivity*, *parthood*) (d) the exemplification tie which involves an unmediated attachment to both p_1 and p_2, and which involves an unmediated attachment to the relation. Exemplification is a tie, and apparently is not a relation, because the exemplification tie holds the relation and non-collocated spatial entities together without the Bradley-esque regress ensuing. It is false that a platonistic relation, such as *connectivity* or *parthood*, exemplify *exemplifies connectivity*, since *exemplification* involves unmediated attachments with *connectivity* and also involves unmediated attachments with the spatial particulars. The phrase "exemplifies *exemplifies connectivity*" is either a category mistake or is a redundant way of saying "exemplifies *connectivity*".

The ontological role of the exemplification tie is to act as the non-relational intermediary between (I) the interrelated entities (p_1 and p_2), and (II) the relation (*connectivity or parthood*) without a Bradley-eqsue regress ensuing. (To my knowledge, platonists have not told us how the exemplification ties without being related to property and particular, but have merely asserted that: in order for platonism to be coherent, the exemplification tie must somehow tie *non-relationally*.)

The relation (*connectivity*, *parthood*) does not involve an unmediated attachment to the spatially located entities. Rather the relation (*connectivity or parthood*) involves unmediated attachments to the exemplification tie. Likewise, the interrelated entities (p_1 and p_2) are not involved in unmediated attachments to the relation (*connectivity, parthooood*). Rather, the interrelated entities (p_1 and p_2), and the relation (*connectivity*, *parthood*), involve an unmediated attachment to the exemplification tie, which itself involves an unmediated attachment to the relation, and to the spatially located entities. The relation (*connectivity*, *parthood*), and interrelated entities (p_1 and p_2), do not involve unmediated attachments to each other; rather these together form an unordered set [relation (*connectivity* or *parthood*), object p_1, object p_2]. The members of this set involve unmediated attachments to the exemplification tie, in such a way as to constitute the interrelated entities (p_1 and p_2) *being* interrelated *with* each other. Here "*being*" and "*with*", in "*being* interrelated *with*", denote the exemplification tie.

It is worth emphasizing these distinctions for the sake of further clarifying what is meant by "exemplification". We refer to the exemplification tie when we say that the interrelated entities (p_1 and p_2) *are* interrelated (…are…). The exemplification tie is also expressed when we say that the interrelated entities *stand in a* relation to each other; we use "stands in… to" to denote the exemplification tie that involves unmediated attachments with the spatially unlocated relation, and with the platonistic thin particulars. "Two things p_1 and p_2 stand in the relation R" means (in my terminology) "the two things exemplify the relation R".[68]

3.3. *Realm crossing exemplification: relations are not realm crossers*

In this section, I will be mainly concerned with the realm crossing exemplification tie, delaying most discussion of unmediated attachments it has with properties and particulars until the next section. In this section, I explain the thesis that a relation, such as *connectivity* or *parthood*, is not a realm crosser, but rather, it is the *exemplification tie* that crosses realms. As I will explain, this thesis follows from issue of the multiple locatedness of universals. The multiple locatedness of universals has led metaphysicians to consider relations as either wholly in space, or wholly outside of space. If relations are wholly in one of these two realms, I will argue that being wholly in one of the realms indicates that relations are apparently not connections between the realms. The concept of a realm crossing exemplification tie follows from these issues to do with universals, and to do with the thesis that relations are wholly spatially located or wholly spatially unlocated.

Since I am considering the relation (*connectivity*, *parthood*) between interrelated entities (p_1 and p_2) to be a spatially unlocated relation in this part of the paper, for there to be a connection between relations and interrelated entities, an entity needs to cross the realms from the relation (spatially unlocated) to the interrelated entities (p_1 and p_2, spatially located); or spatially located entities and spatially unlocated entities would (somehow) be involved in an unmediated attachment. I will discuss realm crossers now, and unmediated attachments in the next section. If realm crossers are responsible for the connecting of spatially located entities and spatially unlocated entities, it may not be immediately clear *which* entity, either the relation (*connectivity*, *parthood*) or the exemplification tie, is the realm crosser. But many metaphysicians tell us that relations are *wholly* spatially unlocated (as with a platonistic account of relations), and others tell us that they are *wholly* spatially located (as with a physicalist, nominalist, or Aristotelian realist account of relations).[69,70]

A perceived need for realm crossing exemplification arose from the theories of abstract objects that originated with Plato in his discussion of Forms (or Ideas)[71], and with the debates between Aristotle and Plato. Aristotle held that a universal, say *sphericity,* is located where the spherical entity is, and Plato held that a Form is spatially unlocated. For platonists, the Aristotelian-based idea of spatially located universals ("universals in things"[72]) gives rise to an apparently problematic issue: the problem of a *single* object being *multiply* spatially located. This apparent problem is allegedly solved by introducing an ontology that places universals not at the multiple spatial locations that the physical particulars are at, but outside of space, whereby universals are *connected* to the physical particulars by exemplification. Armstrong, a physicalist, writes:

> Plato appears to be raising this difficulty in the *Philebus*, 15b–c. There he asked about a Form: "Can it be as a whole outside itself, and thus come to be one and identical in one thing and in several at once, – a view which might be thought to be the most impossible of all?" … A theory that kept universals in a separate realm from particulars would at least avoid this difficulty![73]

According to the accounts of metaphysical realism that involve spatially located universals (such as Armstrongian physicalism, and typical accounts of Aristotelian realism), a single entity (property or relation) can simultaneously exist at more than one spatial location: *sphericity*, for *example*, is *one* entity that is at *more than one* spatial place[74]. On this account there is no need to introduce spatially unlocated universals; instead, they are *wholly spatially located.* But many philosophers have found this problematic since it may be troublesome to consider that *one* entity is at *two* (or more) spatial locations[75]. Armstrong, writes:

> One thing that has worried many philosophers, including perhaps Plato, is that on [the Aristotelian view, where universals are in things,] we appear to have multiple location of the same thing. Suppose *a* is F and *b* is also F, with F a property universal. The very same entity has to be part of the structure of two things at two places. *How can the universal be in two places at once*?[76]

It is arguable that, "one entity located at two (spatial) places", is not a description of *one* entity, but of *two* entities. And it is arguable that a spatially located universal, being one entity multiply located, is self-contradictory, in as much as appears to be both *one entity* and *more than one entity* simultaneously. Therefore, a need was felt to solve this prima facie problem by maintaining that an entity that appears to be multiply located is in fact *not* multiply located. This can be done by espousing a metaphysics where (1) universals (such as the relation, *connectivity,* or the relation, *parthood*) are spatially *unlocated*, and (2) are *exemplified by* physical objects (interrelated entities (p_1 and p_2)). A relation can be exemplified without being where a p_1 and p_2 are, explaining the relation's *merely apparent* multiple spatial locatedness in nature. This platonist scenario seems to solve the problem platonists have with multiply spatially located entities, but in doing so, universals, such as the relation, *connectivity* or *parthood*, must be placed outside of space (the relation is *wholly spatially unlocated*). If this is the case, the *exemplification tie*, and not the wholly spatially unlocated relation, *connectivity* or *parthood*, is the realm crosser. This scenario only arises for philosophers who hold that the multiple spatial locatedness of universals is problematic. Philosophers who do not find multiple spatial locatedness problematic have no need to move universals outside of the spatially located realm. And those who deny that universals exist, such as trope nominalists[77], also hold that relations are wholly spatially located, as they have no reason to move them outside of space.[78]

If relations are *wholly* spatially located or *wholly* spatially unlocated, then relations, such as the relation, *connectivity* or *parthood,* are apparently not the ontological entities that cross realms. Rather, *exemplification* appears to be, in some way, responsible for realm crossing.

My basic thesis can now be further refined: the connection of a spatially unlocated entity to a spatially located entity is not a problem about the related entities (p_1 and p_2) or the relation (*connectivity*, *parthood*). Rather, the problem is about the realm crosser – the exemplification tie – and how it is able to tie a spatially *unlocated* entity (relation) to a spatially *located* entity (p_1 or p_2). This is a problem, in part, due to the fact that a description of how exactly exemplification connects a spatially unlocated entity and a spatially located entity across these two realms is presently unavailable, since any description or analysis of the nature of exemplification is nearly absent in the philosophical literature. It is likely that one reason for the absence of analysis or description of exemplification is due to the widespread view that *exemplification is primitive*.[79] The supposed primitivism of exemplification might consequently lead one to inadvertently pass over this remarkable capacity that exemplification has to tie two kinds of ontological entities across the ontological realms of the spatially unlocated and the spatially located, and yet be an unbroken and uniform tie from one realm to the other.

3.4. *Realm crossing relations and unmediated attachments*

In this section, I discuss realm crossers, which appear to be exemplification ties. I will also discuss realm crossing unmediated attachments, and in doing so I will come to problems with them – problems that will also give rise to problems for realm crossers. This is because realm crossers involve unmediated attachments between spatially located entities and spatially unlocated entities, for the following reasons.

1. If a realm crossing exemplification tie is partless (simple), and is either wholly spatially located or wholly spatially unlocated,[80] then the realm crossing exemplification tie is an intermediary that connects a wholly spatially located entity and a wholly spatially unlocated entity, and the realm crossing exemplification tie involves an unmediated attachment to *both* a wholly spatially located entity (p_1 or p_2) *and* a platonistic wholly spatially unlocated entity (such as, *connectivity* or *parthood*).[81]
2. If a realm crossing exemplification tie is both spatially located and spatially unlocated, it is composed of two or more parts, where at least one part is wholly spatially located (and involves unmediated attachments with the p_1 and p_2), and where at least one part is wholly spatially unlocated (and involves an unmediated attachment with a platonic universal, such as *connectivity* or *parthood*). In order that the realm crossing relation give rise to a connection between or among wholly spatially located physical particulars and wholly spatially unlocated platonistic universals, the wholly spatially located and wholly spatially unlocated parts of the exemplification tie must involve an unmediated attachment.[82]

Points 1 and 2 above both suggest that platonistic property possession must involve an unmediated attachment of a wholly spatially located entity and a wholly spatially unlocated entity. It is this unmediated attachment that I will be concerned with, and which I will find apparently contradictory. I will next explain why an unmediated attachment between a wholly spatially located entity and a wholly spatially unlocated entity is contradictory.

It is difficult to understand how an unmediated attachment between a wholly spatially located entity and a wholly spatially unlocated entity might take place at all. Such an unmediated attachment, would require either that the wholly spatially unlocated entity "reach across" (to used Armstrong's spatial metaphor[83]) the realms in order to be *at a spatial location* and to thus involve an unmediated attachment to the wholly spatially located entity, or vice versa. Since a wholly spatially located entity cannot fail to be at a spatial location, a spatially unlocated entity then must indeed "reach across" to *the spatial* entity, in order to involve an unmediated attachment to the spatial entity. Since the wholly spatially located entity can only be *spatially located*, the wholly spatially unlocated entity must *become a spatially located entity*, and must somehow be *at a spatial location*, if it is to involve an unmediated attachment to the wholly spatially located entity. Similarly, a wholly spatially located entity would have to "reach across" the realms in order to *become spatially unlocated*, if it is to involve an unmediated attachment to the wholly spatially unlocated entity. However, how this occurs is not only unexplained, it is also apparently contradictory: in order that such an unmediated attachment occur between a wholly spatially located entity and a wholly spatially unlocated entity, either a wholly spatially located entity must *not be spatially located* (*not be at a spatial place*) or a wholly spatially unlocated entity must be spatially located (*be at a spatial place*). But by the definition of "spatially unlocated", what is wholly spatially unlocated cannot be at a spatial place lest it be spatially located; and by the definition of "spatially located", what is wholly spatially located cannot fail to be at a spatial place lest it be spatially unlocated. If the realm crossing exemplification tie is indeed a connection between platonistic n-adic properties (such as *connectivity* or *parthood*) and physical particulars (such as p_1 and P_2), the realm crossing exemplification tie apparently involves such contradictory features.

3.5. *Objections to the concept of realm crossing*

An objection to the argumentation in the previous subsection is treated next, and is given as follows. Armstrong's phrase "crossing realms" is a spatial metaphor, but the concept of the *exemplification* of a relation, need not correspond to any spatial "crossing" concept. The interrelatedness involved between or among a relation and a physical particular only exists in the spatially located and spatially unlocated domains, not *across* them, or "in-between" them. The notion of *realm crossing* is misguided: the *exemplification tie* need not do any "crossing of realms". The exemplifying (and relating) *only* exists at the spatial location of the entities of the universe (only where p_1 and p_2 are), and *only* non-spatially in the platonic realm (where there relations *connectivity* or *parthood* are); and there need not be any sort of concept of connecting *from* one *to* the other.

Next I argue that this objection fails. Considering a platonistic relation R, (*parthood*) between wholly spatially located entities, p_1 and p_2, but only considering the wholly spatially located entities as platonistic thin particulars.[84] Since p_1 cannot *fail* to be at a spatial location, *x*, this implies that p_1 only involves an unmediated attachment to the exemplification tie at *x* and nowhere else, since p_1 is nowhere else *but* at *x*. This attachment must be spatially *located* since p_1, which is at *x*, is wholly spatially located; the unmediated attachment, if not at *x* (spatial location), is not an attachment that can involve p_1 since p_1 is a *wholly spatially located* object, only at *x*. An unmediated attachment to the exemplification tie *not* at *x* is an unmediated attachment that does not have anything to do with p_1 (whereby, the exemplification tie would not involve an unmediated attachment with p_1). Since a platonistic relation, R (*parthood*), cannot *fail* to be spatially *unlocated* – call this being at *z* – this implies that R only involves an unmediated attachment to the exemplification tie at *z*, since R is nowhere else *but* at *z* (in the platonic realm). An unmediated attachment to the exemplification tie *not* at *z* is an unmediated attachment that does not have anything to do with R (whereby, the exemplification tie would not involve an unmediated attachment with R).

This implies that p_1 and R could not be tied by the tie of exemplification: if R only involves an unmediated attachment to the exemplification tie at *z*, and if p_1 only involves an unmediated attachment to the exemplification tie at *x*, and if the exemplifying is not considered as "crossing realms", since $x \neq y$, then p_1 and R apparently cannot have any sort of dealings with one another, such as being tied by the tie of exemplification. It appears that in order for R to be tied by exemplification, R, which is wholly at *z* (in the platonic realm), must also be at *x* (at a *spatial* location), and thus must apparently take on characteristics that are self-contradictory. The same argument applies to the tying of p_2 and R by the exemplification tie. Also, a similar line of reasoning could be given for the scenario where p_1 and p_2 are non-identical, interconnected, basic units of space. (The contradiction discussed in this paragraph ensues *regardless* of whether or not exemplification is considered primitive and unanalyzable).

One may object to my argumentation in this subsection since *z*, the "location" of the platonic universal, might be considered an incorrect description of the non-spatial nature of a platonic universal. One may assert that it is accurate to instead consider a platonic universal to be "nowhere". This objection fails because, regardless of what "nowhere" could be defined as, it is *not equal* to *x* or *y* (or to any other spatial location), and to have dealings of any sort with a spatially located entity (such as p_1 or p_2), something that is *nowhere* could not be *where* a spatial entity is, and if it is not *where* a spatial entity is, it does not have dealings of any sort with the spatial entity (such as unmediated attachment).

If one objects that the reasoning of this section is unsound since words, such as "is", "are", and so on, denoting predicating ties (such as the exemplification the) are *primitive terms*, this is also of no avail, since the arguments of this subsection are *independent of any alleged primitivism of exemplification*. In this subsection, I have only discussed that if a wholly spatially unlocated entity (such as a platonic universal) cannot have any dealings of any sort with spatial entities (such as a platonistic thin particular), and this account does not even involve *analysis* of exemplification. Lastly, this paper is not primarily about issues to do with the philosophy of language, but rather is about issues in metaphysics.

4. AN OBJECTION: STATEMENTS, SUCH AS "P_1 IS TALLER THAN P_2", CANNOT BE NECESSARILY FALSE

Many objections to the reasoning of this paper can be considered. In this section I discuss a few.

One objection might be given as follows. If there is no relation such as the relation, *taller than*, as the reasoning of this paper apparently suggests, then it is never true that *x is taller than y*, if, as was argued above, there are no connections between any entities in space. For example the statement, "the elephant is taller than the lion", can never be true. Some might claim that this paper supports an extreme doctrine that appears to destroy the unity of the world, since a world without relations or interrelatedness is arguably no world at all.[85]

This paper is not directly about issues in epistemology or the philosophy of language, and since this paper is specifically about metaphysical issues, I do not feel a strong need to explain any problems with epistemology and the philosophy of language that this paper presents. However, since some might assert that metaphysics, the philosophy of language, and epistemology are not entirely separated domains of philosophy, I will give a few comments in reply to this objection. I will, however, not discuss issues about what metaphysics would be like if the reasoning of this paper is correct. I will not address this issue since paper is not about any sort of *explanation* of what the world is like if my argumentation is correct, and if relations do not exist. I do not offer a "*replacement* metaphysics" in this paper. Rather, this paper is only about apparently overlooked problems to do with relations. On that note, and following the objections given in the previous paragraph, I will instead only address a few very general issues to do with epistemology and the philosophy of language.

The metaphysical realist claims that relations are real constituents of the world. In this paper I argue that they are not. If the argumentation of this paper is correct, and in considering statements such as, "the elephant is *taller* than the lion", might there still be an entity denoted by "taller", so as to make the statement true? I will next argue there *is*, but following my thesis in this paper, it is not a relations that is a real constituent of nature, independent of the mind. I will discuss this after a comment about the history behind these ideas.

Statements such as, "the elephant is *taller* than the lion", might be the result of the *comparing of* two entities in the mind. "Taller than" need not denote a real constituent of nature outside of the mental *conception* of, or a mental *comparison* of, an elephant and a lion. "Taller than" may merely be a *mind-dependent idea* of what the world is like when a comparing mind experiences two objects (elephant and lion) next to one another. Reasons similar to these are why many philosophers before Russell told us why it might be (falsely) believed by some that there are relations, rather than only monadic relatedness. Campbell discusses this:

> The attempt to dispense with relations is by no means new or unpopular. Aristotle called relations 'the least of the things that are'. Averroes, William of Ockham, Hobbes, Spinoza, and Leibniz all agreed with the Stoics that all real properties reside in objects taken singly. Relationality involving both terms together, is a contribution of the apprehending and comparing mind, in its activity of making a relational judgement.[86]

(Note that if the reasoning of this paper is correct, in disagreement with the philosophers listed in Campbell's passage, it is apparently the case that monadic relatedness is also impossible, as I argued in Subsection 2.5.[87])

Perhaps humans, in experiencing physical objects, have certain experiences of the objects, such as seeing p_1 at x, and seeing p_2 at y, and in comparing them mentally, *invent* concepts, such as that there are real, mind-independent relations in nature (such as many of the relations I have discussed in this paper: *taller than*, *brotherhood*, *distance*, and so on) *between* entities, where we imagine a *real* connection between them, and we do not recognize that we might only behold *just* the non-collocated spatial objects. In other words, it is arguable that what is experienced are two objects, p_1 and p_2, and the mind *adds on*, from concepts to do with spatial issues (such as size and location), *ideas* of relations or relatedness between spatially separated objects. It may be the case that a perceiver experiences objects p_1 at x and p_2 at y, but *only in the mind is there any sort of connection between them*. For these reasons, the sentence, "the elephant is taller than the lion", need not be false, for it corresponds to three specific entities: *the statement describes three experiences:* (i) the experience of a lion, (ii) the experience of a elephant, and (iii) the experience of comparing the of (i) and (ii), where, unlike the experiences of (i) and (ii), the item denoted by "taller than" is a *concept* that does not represent anything outside of that experience. (Each of (i)–(iii) are experiences a perceiver has, but (iii), unlike (i) and (ii), is an experience of something not in the world outside the mind.

One might object that this reasoning is seriously troubled, since it may depend on the existence of a relation, namely, the relation of *mind-dependence*. One might object that the experiences of (i) and (ii), when perceived and compared by an experiencer involve a *relation* between the experiencer (call the experiencer *relatum$_1$*) and the elephant and lion (call these *relatum$_2$*). Relatum$_1$ and relatum$_2$ might be the relata of the complex polyadic property, *experiences the mind-dependent comparison* (as in the statement, "x experiences the mind-dependent comparison of the elephant and lion"). This may appear to be the espousal of the very item (a relation) that in above sections I am attempting to show the nonexistence of. I will next suggest that I am not assuming the existence of a relation since: (1) given my reasoning in Sections 2 and 3 there cannot be such a relation, and for that reason, there must be some *other* sort of explanation to account for (iii). And this brings me to my second concern in this section: (2) there is no need for such a relation, since perhaps a *better* description of the experience of the mental invention of relations is found in physics, and which need not involve a relation, *experiences the mind-dependent comparison*.

Scientists tell us that when an experiencer experiences an elephant and lion, there is a steam of particles (photons) reflecting off the experienced objects (lion and elephant), and into the eyes of the experiencer, whereby the information from the photons is processed by the nervous system of the experiencer,[88] whereupon the experiencer could invent the idea of a relation. On this scenario, the experience of the mind-depenence of relations can be described entirely in terms of *particles* (which are apparently *unconnected particles*[89]) streaming between the experiencer and the experienced objects – if, that is, scientists are correct about their analysis of what is going on with light particles, nervous system mechanics, and so forth. The experiencer cannot co-exemplify the relation, *experiences the mind-dependent comparison*, with the observed objects, without the aforementioned problems of Sections 2 and 3 ensuing, and for that reason, perhaps this uncontroversial scientific explanation is more coherent than the purely ontological explanation of the situation in terms of relations.

Some might complain that while my arguments in Sections 2 and 3 attack the topological structure of space discussed by physicists, I have however just made use of an explanation from physics, which involves the topological structure of space discussed by physicists. I assert that this might not be a problem, and would be solved by merely making use of a different topology than physicist have made use of, in order to explain the topological nature of space, and, as I have just discussed, the physics of photons. For reasons given in Section 2, I suggest that only mereotopology could perhaps account for such a topological model of space or perhaps another topology that has not been invented, or which has been invented but is not yet widely discussed.

This explanation I have just given perhaps recalls philosophers such as Hume, Locke, Hobbes, and Galileo, who were very concerned with the distinction between what is subjective and objective. Barry Stroud, in a particularly elegant passage, where he is discussing these philosophers, and where he discusses Quine, has commented on this issue:

> Although… the project of separating the "subjective" form the "objective" is a very old idea, it is by no means a thing of the past. It is to be found, for example, in any philosophy which would distinguish in general between the "given" that we receive from the world and the "interpretation" we put upon it, or between the "flux of experience" and the "conceptual scheme" we impose upon it to make sense of our experience and learn from it…
>
> The idea is that if human beings come to think or act or experience in certain ways only because of their interaction with the world around them, there must be some-

thing about what human beings are like, and something about what the world is like, which combine to produce those ways of thinking or acting or experiencing. It therefore seems legitimate to ask how much of what we think and feel is due to the way the world is – the "objective" factor – and how much is due to features of us, the "subjective" factor. If the contribution of the world is meager in relation to our elaborate conception of the world, our own minds or sensibilities must be playing a large role. If certain ways of thinking or experiencing could be fully explained by "subjective" factors alone, those ways of thinking would be seen to have a purely "subjective" source. The world would not have to contain anything corresponding to them for us quite naturally to think that it does. But those ways of thinking would give us, at best, "appearance", not reality.[90]

5. CONCLUSION

If my preceding arguments are sound, relations between regions larger than a basic building block of space are impossible, and there are no relations between non-identical basic building blocks of space. It appears that if this is the case, then all basic building blocks in nature are apparently *unrelated* to one another, and theorists who makes use of such relations between non-identical basic building blocks of space or non-collocated basic building blocks of matter, must explain how they are coherent.

These conclusions would apparently hold for causal connections between objects or events: object or event p_1 at spatial location x cannot be the cause of object or event p_2 at spatial location y if $y \neq x$. This would apparently mean that many statements we utter are just about our way of seeing the world or space, and do not denote real constituents of nature, as when we say, "the *cause* of x is y" ($y \neq x$).

As for other areas, the quantum entanglement could not be described as a relation on entangled particles.[91] Mereological theories that involve part-whole relations apparently, for reasons discussed, are impossible. Further, since the position of atomless gunk, is also apparently impossible since it relies on impossible relations between non-identical spaces or non-collocated spatial objects via part-whole relations. Any part-whole where the part and whole do not perfectly collocate apparently do not exist, if my reasoning in this paper is correct.

The conclusions of this paper, if correct, may have significant repercussions on our understanding of reality in the fields of philosophy, physics, and mathematics, and on our common sense understanding of reality.[92]

NOTES

[1] I use "basic building block of space" rather than "spatial point" since there is currently much discussion among philosophers (such as, Hudson (2001), Markosian (1998), McDaniel (2002, 2003), Pyle (1995), and Zimmerman (1996a, b), to name just a few) over whether or not space is continuous or discrete: whether or not space is composed of spatial *points*, or of spatially *extended* basic building blocks of space (such as the widely accepted "Planck lengths" or "Planck cells" discussed by physicists). I will discuss this more in sections below. I will also discuss that my argumentation in this paper is unaffected by whichever is the correct account, and it is unaffected if it were the case that there are no basic building blocks of space at all.

The word "topology" may imply that I am only discussing interrelated point-sized basic building blocks of space, since the field of topology is often considered to deal primarily with interconnected *points* (for example, see Esfeld, 2003; Grünbaum, 1952, 1955, 1967; Roeper, 1997). But in this paper I do not mean the word "topology" to denote *only* "interconnected points". I mean "topology" to denote any of the various models of the structure of space, including discrete or continuous space, or gunky space, where the last one consists of space that is composed of interconnected parts and wholes with no basic level.

[2] In this paper, some of the relations I am most concerned with are topological relations. In this note, I will briefly discuss a few issues to do with topology for those unfamiliar with basic topological issues.

Topological relations are the relations that contribute to the makeup of space, some of which are relations that stand between non-identical topological regions, or non-identical basic building blocks of space. A topological space that is larger than a basic building block of space can be considered a complex of *interrelated* basic building blocks of topological space. Alexanderoff, in his classic text, writes:

The concept of topological space is only one link in the chain of abstract space constructions which forms an indispensable part of all modern geometric thought. All of these constructions are based on a common conception of space which amounts to considering one or more systems of objects – points, lines, etc.—together with systems of axioms describing the relations between these objects. Moreover, this idea of a space depends only on these relations and not on the nature of the respective objects. (Alexanderoff, 1961, p. 9)

Topology is concerned with *interrelated spaces*. The interrelated spaces might be, for example, non-basic topological regions, or basic topological building blocks, such as points or Planck cells.

My argumentation in this paper, which is concerned with relations between or among basic building blocks of space or non-basic topological regions, applies to topologies that involve interrelated basic building blocks (such as points or Planck cells), and to topologies that do not involve basic building blocks, which has been called a "gunky space", or "gunky topology", where there are no basic building blocks, but rather there are subspaces within subspaces, "all the way down". A "gunky topology" consists of extended spaces, and any extended gunky space, being infinitely divisible, necessarily consists of more fundamental subspaces, and for this reason, my arguments in this paper also apply to relations of gunky topological spaces. In a later note, I will further discuss gunky topology and the relations involved in gunky topology.

The reason I mention these three sorts of topologies, where one contains no basic building blocks, and the other two are continuous or discrete, is because there is some disagreement between philosophers and physicists as to which sort of topology describes nature.

[3] This is often referred to as a relation, but some may object that this is not a relation at all, but rather is a stream of messenger particles between gravitationally connected objects. In that case, then consider the interrelatedness involved in gravitation as an interconnection among or between graviton particles of the gravitational field, where the field is a material phenomena consisting of *interrelated* virtual messenger particles. I will discuss this more in a later note.

[4] I do not discuss spatially *collocated* entities, nor do I take a position on whether or not any exist. And my argumentation in this paper does *not* suggest that collocated spatial entities *cannot* be interrelated. Many philosophers do not deny collocated entities. For example, Gilmore (2003) suggests that non-platonistic universals can be spatially collocated entities, collocated where a physical object is located. Along the same lines, Casati and Varzi discuss many candidates for collocated entities:

The idea that objects are in one-one correspondence with their regions has a respectable pedigree. It was most famously defended by John Locke, who used it as a basis for a criterion of identity.

For we never finding, nor conceiving it possible that the two things of the same kind should exist in the same place at the same time, we rightly conclude that whatever exists anywhere at any time, excludes all of the same kind, and is there itself along. (*Essay*, ll-xxvii-1)

But Locke was thinking of entities *of a kind*, e.g., material objects. This is no guarantee that the same principle can be applied across entities of different kinds. Ceasar's death (an event) took place exactly in the same region where Ceasar's body (a physical object) was located … [Davidson provides another example:] the rotation and the getting warm of a metal ball that is simultaneously rotating and getting warm are two distinct events. Neither is part of the other, Yet they occur exactly in the same spatiotemporal region … (Casati and Varzi, 1999, 16–17)

On another issue, notice that when I discussed Gilmore before the Cohn and Varzi passage in this endnote, I referred to properties as "entities". I mean to use the word "entity" in the broadest possible sense, and in the way that many other metaphysicians refer to n-adic properties as "entities". (For example, Esfeld (2003, 10), Lowe (2002, 16), Moreland (2001, 13), and many others. Also, a passage from Reinhardt

Grossmann at the very start of section 3 below involves Grossman referring to "abstract qualities" as "entities". (Grossman, 1990, 7))

[5] I will also briefly argue in a section below against all varieties of *monadic relatedness* possessed by an object, a topological region, or a basic building block of space. Campbell discusses this position: "Monadists propose to replace the relational *a*R*b* with two monadic propositions, Fa and *Gb,* which attribute qualities to a and *b* individually." (Campbell, 1990, 102) Monadic relatedness is given in terms of monadic facts: p_1's relatedness to p_2, where *relatedness* is a monadic property of p_1, not a shared polyadic property co-exemplified with p_2. Monadic relatedness does not exist spatially *between* p_1 and p_2. And p_1's non-platonistic monadic property, *related to* p_2, is not located where p_2 is, but only where p_1 is.

My arguments in Subsection 2.5 specifically focus on monadic relatedness. I will mainly discuss relations, and not monadic relatedness, in this paper, since monadic relatedness has been discussed far less in the literature since Russell's *Principles of Mathematics,* where relations were argued to be irreducible. (One philosopher who does discuss monadic relatedness at length is Keith Campbell.) I will however refer to both relations and monadic relatedness at various places in the paper, and at specific points I will mention how my argumentation applies to monadic relatedness. But I will mainly mention relations hereafter, only infrequently mentioning monadic relatedness.

[6] For a discussion of this topological relation, see Casati and Varzi, 1999.

[7] It is standard for philosophers who discuss the nature of space to maintain that topological relations (along with basic building blocks of space) *make up* space, rather than *occupy* space. Cohn and Varzi (2003, 358–359) even imply in a recent article that topological relations that contribute to the makeup of space are *not located in space,* since they are constituents, and not occupants of space (this passage is given in 2.2.2 below). In this paper, I will present an argument in 2.2.2 that I have not seen before in the literature where I argue that all relations, even those that are constituents of space, can only be *occupants* of space.

[8] This position is widely held. Ehring writes: "A non-Platonic theory of universals brings universals into the spatio-temporal world. Instantiated physical universals exist in space and stand in spatial relations to each other on this view." (Ehring, 2002, 17)

[9] In this paper, I will use "abstract" to denote entities outside of space, and "concrete" or "physical" to denote entities not outside of space. See Lowe, 2002, chapter 20, or Jubien 1997, p. 39, where Jubien writes: "Platonists see reality (or "the world") as divided into two realms, the spatiotemporal and the nonspatiotemporal or, as we will usually say, the concrete and the abstract."

[10] It is standard to consider platonistic relations as those which are *not* in nature, whereas non-platonistic relations are not outside of nature, as Loux discusses:

What are the issues separating the Aristotelian realists from Platonists? … Aristotelians typically tell us that to endorse Platonic realism is to deny that properties, kinds, and relations, need to be anchored in the spatiotemporal world. As they see it, the Platonist's universals are ontological ''free floaters'' with existence conditions that are independent of the concrete world of space and time. But to adopt this conception of universals, Aristotelians insist, is to embrace a two-worlds'' ontology... On this view, we have a radical bifurcation of reality, with universals and concrete particulars occupying separate and unrelated realms... [T]here [is a] connection between spatiotemporal objects and beings completely outside of space and time. (Loux, 1998, 46)

Another lucid comment about the aspatiality of platonia is also found in Maddy, who is a platonist:

Some platonistically-inclined observers [Maddy cites Resnik, 1985] have argued that [Hartry] Field's spacetime points and regions are as abstract as numbers, and thus as susceptible to epistemological challenge. If numbers are understood traditionally, as causally inert, *non-spatiotemporal,* etc, I think this charge cannot be correct. Physicalistically speaking, ...the main ground for suspicions about mathematical entities... ;s *that they bear no physical relation to us at all*, *causal or otherwise*. (Maddy, 1990, p. 296)

[11] I do not present such a discussion in this paper, since this paper would become far too long if I did. I plan to discuss such issues in later papers.

[12] Simons, 1987, 9–10.

[13] Simons, 1987, 10–11.

[14] Roeper's passage points out the very importance of topological relations:

Since regions are the primary bearers of spatial properties and relations, it should be possible to describe spatial structures in terms of relationships among regions, and it should be possible to identify the points of space by means of its structure, and hence in terms of the regions in which they are located. (Roeper, 1997, 251)

[15] Mereotopologically oriented philosophers common hold that mereology and topology on their own are too restricted, and mereotopology offers a less restrictive model. Casati and Varzi discuss this throughout their lucid 1999, book, *Parts and Places*, and they first introduce it on pages 4 and 5.

[16] Armstrong, 2001, 1997, 1989.

[17] Ehring, 2001.

[18] Price, 2001.

[19] Complex relations (or properties) are relations that have conjunctions of other relations as (simpler) parts. Armstrong writes:

Consider conjunctions of universals. If there are complex universals at all, then conjunctions of universals should qualify... Given that F and G are distinct universals, then F&G can be a universal, provided always that a particular exists at some time which is both F and G... But, it may be objected, if there are complex properties, then they must be complexes of simple properties, or at least complexes of simple properties and relations. If it is also maintained... that all universals are instantiated, then any complex property can then be replaced in each of these instantiations by a conjunction of states of affairs involving simple properties and relations. The alleged conjunctive property, or any other complex property, will supervene on these states of affairs. And then what need to recognize anything but the complex of states of affairs involving nothing but simple universals? (Armstrong, 1997, 31–32)

Some, such as David Mellor (Mellor, 1991, 1992) deny that there are any complex properties. This would not matter to my reasoning in this paper, since I am also going to argue that there are not any. I am considering that there are complex relations here for the sake of argument, and as a way of showing that temporally located, temporally extended, complex properties are problematic.

[20] An example of a complex relation would be, for example, *attracted at a distance,* as in the case of gravitation, since this relation is the conjunction of two non-complex relations, *distance* and *attraction*.

[21] Roeper, 1997.

[22] Many have held the position that the basic building blocks of space are of nonzero size *and* simple (partless), including Democritus (Democritean atoms) (see Hoffman and Rosenkrantz, 1997, 13, 150–151) and perhaps Aristotle (minima), although whether or not Aristotle held this position is controversial, and I take no position on it (see Pyle (1995) for lucid discussion of minima). Many contemporary physicists and philosophers hold the position that so-called Planck cells, or Planck lengths, are fundamental entities which have a non-zero size. And Ned Markosian argues for an interesting variety of spatially extended basic building blocks, called "MaxCon simples". (In a recent article, McDaniel (2003) presents well-written arguments *against* MaxCon simples).

[23] Quantum gravity is a unification of quantum theory and relativity, and is for that reason believed to be the theory that will end the divergence that exists in physics between relativity and quantum mechanics.

[24] Non-commutative geometry is typically called a "geometry", but it can be thought of as a *topological* model of space. See Jones and Moscovici, 1997, especially page 795.

[25] Madore, 2000, 262–264.

Also see Leswniewski, 1997. Points in space are not measurable, as *position no longer has any meaningfulness at this level*. Madore: "...what appears to be a point will, at a sufficiently small length scale, be seen to possess an algebraic structure which can be described by a non-commutative geometry." (Madore, 2000, 313.)

> ... [O]ne could modify the microscopic structure of space-time with the hypothesis that at a sufficiently small fundamental length, the coordinates of a point become non-commuting operators. This means in particular that it would be impossible to measure exactly the position of a particle since the three space coordinates could not be simultaneously diagonalized ... The position of a particle would no longer have a well defined meaning. Since we certainly wish this to be so at macroscopic scales, we must require that the fundamental length be not greater than a typical Compton wavelength. In other words, the fuzziness which the non-commutative

structure gives a point in space-time could not be greater than the quantum uncertainty in the position of a particle. We can think of space as being divided into Planck cells…

Einstein and Bergman (1938) suggested that at sufficiently small scales what appears as a point will in fact be seen as a circle. Later, with the advent of more elaborate gauge fields, it was proposed that this internal manifold could be taken as a compact lie group or even as a general compact manifold… An associated problem is that of localization. We cannot and indeed do not wish to have to, address the question of the exact position of a particle in the extra dimensions any more than we wish to localize it too exactly in ordinary space-time… (Madore, 2000, 3–4)

[26] Hawking, 1996, 4; Stenger, 2000, 76–78, 85. Also see Quentin Smith, 1993, 1995.

[27] Cohn and Varzi, 359, 2003.

[28] Hawking, 1996, 4.

[29] Casati and Varzi, 1999, 48.

[30] Schafer, 2003, 500.

[31] Lewis, 1991, 20.

[32] See Pyle, 1995, 2–4.

[33] Pratt-Hartmann and Schoop, 2002, 469–471.

[34] See Cohn and Varzi, 2003, 362–365. Also, consider what Pratt and Schoop have to say about this:

Mereotopological calculi vary as to which primitives they employ, and the axioms they propose. Clarke's calculus has a single binary relation of "connection" with the gloss that two regions are connected if they share a common point. Randall, Cui and Cohn also use a binary connection relation, but take two regions be connected if their closures share a common point. (Pratt and Schoop, 1998, 622.)

[35] Smith, Barry, 1996, 295.

[36] Smith, Barry, 1997, 524.

[37] Smith, Barry, 1997, 540.

[38] Smith, Barry, 1997, 549.

[39] Smith, Barry, 1997, 551.

[40] If mereotopologists could explain gunky space solely in terms of collocated contacting and collocating of boundaries, my arguments below would not be against such a model of space.

[41] I am surprised that discussion of this sort of relation is not found in the literature. It may seem odd to consider that a relation would be like a material object, but there may be many kinds of matter. At the level of nature physicists study, *connections* between particles are observed, which go by various names: forces, messenger particles, particle exchanges, force carriers, and so on. If nature indeed has matter connections at the tiny level, it does not appear obvious to me why nature

does not involve connections at the macroscopic level. Such "material connections" may be composed of matter that humans do not perceive in the way they perceive ordinary matter, such as rocks and clouds. Perhaps one type of matter is the ordinary matter (electrons, quarks, photons, etc.) studied by physicists, and perhaps *another* type of matter is responsible for connections between entities in nature. Physicists tell us that there are apparently many varieties of matter *different than* "ordinary", familiar matter ("light matter"), such as neutrinos, dark matter (if dark matter is not neutrinos), so-called "exotic matter", and so on, each of which is a type of matter either does not often, we are told, interact much with the familiar, ordinary matter that humans perceive, or if it does interact with ordinary matter, it does so in a way humans cannot detect (this is likely since these are experiments where "ordinary" particles are absent to emit neutrinos, (see Kane, 2000, 25). Indeed, we are now also told by physicists that what we call "ordinary matter" may be actually the *rare stuff in the universe,* vastly less common than other types of matter, such as neutrinos. It is not immediately apparent to me why there could not be a sort of extended matter that gives rise to *extended material connections* between material objects, and which only interacts in a special way with ordinary matter. Perhaps such spatially extended material relations could collocate with and interpenetrate ordinary, familiar matter, so that when, for example, a spatially extended relation, such as the relation, *at a distance from*, stands between the earth and sun (much like a rope between a boat and dock), perhaps Mercury or Venus could pass through, and temporarily collocate with, the extended relation between the earth and sun, since the two types of matter might not interact in that scenario. It is interesting to speculate about such relations, but in this paper, I will argue that if relations are extended and material, they are apparently contradictory entities.

[42] It is this "betweenness", where relations are not merely at the locations of their relata, that monadists often reject about relations.

[43] Cohn and Varzi, 2003, 358–359. Roeper writes: "... a point is a location in space". (Roeper, 1997, 251)

[44] See Loux, 1998, 38–41.

[45] 1 am grateful to John Dilworth for this objection.

[46] Grünbaum, 1952, 1955, and 1962.

[47] In this parenthetical note, my using symbols "$\subset$" and "$\neq$" perhaps provides reason for me to bring up, as an aside, a complaint some readers might have at this point. According to the standardly held ontological accounts of mathematics, the symbols "$\subset$" and "$\neq$" denote relations, and therefore, it is unclear how I can freely use them in this paper, if I am arguing against the existence of all relations, except those between exactly collocated entities. Further, some readers might suggest that language in general involves relations, and if relations do not exist, then language cannot exist. I will discuss such objections as these in Section 5 below.

[48] The arguments in the previous paragraph would apply to a gunky topology, showing that sort of topology to be unrelated by non-platonistic non-complex relations.

[49] Loux, 1998, 38–41.

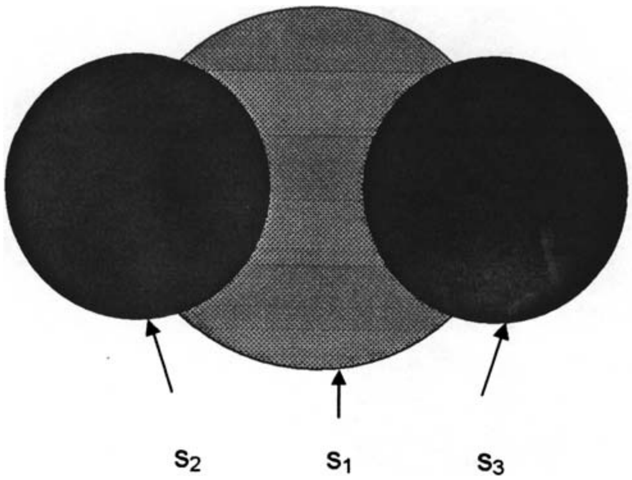
[50] Some accounts of causation are described as this sort of a relation.

[51] Moreland, 2001, 24.

[52] Phillips, 1995, 23.

[53] This is a position discussed extensively by Quentin Smith (1995, 1993).

[54] If mereotopologists could (somehow) describe a relation composed of collocated boundaries, I suspect that my argument in this subsection would not be against such relations. But this task may be difficult, however, since in order for such a "mereotopological relation between p_1, and p_2" to connect across a magnitude, the relation must consist of non-complex sub-relations of non-zero magnitude (lest all the collocating boundaries be the size of a point). If not every sub-relation perfectly collocated with every other sub-relation, we would have a scenario given by the following diagram:



s_2 partially collocates with s_1, and s_3 partially collocates with s_1, but s_2 and s_3 do not partially collocate.

But this appears problematic, since if one such sub-relation, call it s_1, acting as an intermediary of two others, were partially collocated with two others, call them s_2 and s_3, where s_2 and s_3 do not collocate, then s_2 would be describable as "partially collocated with s_2" and "partially collocated with s_3". These statements could be replaced by the statement, "not partially collocated with s_2", or "not partially collocated with s_3", since where s_3 is, for example, s_1 "not partially collocated with s_2." But this means that the non-complex sub-relation is describable by contradictory statements, for example: "partially collocated with s_2 and not partially collocated with s_2".

[55] Grünbaum (1952, 1955, 1967) is one of the philosophers who has argued for this commonly held position.

[56] This is widely held to be the error that Zeno made in his *Measure Paradox* (*unextended* points somehow compose an *extended* line, plane, or volume). See Pyle, 1995, 1–7.

[57] Brown, 1988, 2.

[58] Grossman, 1990, 5.

[59] Grossman, 1990, 7.

[60] Grossman, 1990, 8. Moreland (2001), also a platonist, discusses Grossman's platonism in depth, especially on pages 4, 9, 12–13, 102–103, and many other places.

[61] Some have argued that many quantum physicists (if not nearly all quantum physicists), who in making use of the abstract mathematical concepts of Hilbert space, or imaginary space, are quite literally postulating the existence of a *platonistic* realm. (See Stenger, 2000, 143, chapter 10.)

[62] A thin particular is typically discussed in the context of non-platonistic metaphysics, but I will discuss it as the item in platonistic metaphysics that is the literal exemplifier properties. Moreland discusses thin particulars:

> [Armstrong] distinguish[es] a thick from a thin particular. A thick particular is a state of affairs (e.g., A's being F), and as such it is a particular along with its properties. The particular "enfolds" its properties in the sense that they are spatially located where the thick particular is. In the statement "this is hot", the word "this" refers to a thick particular and says that hotness is among its properties. The thin particular is the particular considered in abstraction from all its properties. It is not a thing *per se,* but amounts to bare numerical difference or thisness, the individuating factor that makes the thick particular more than just a bundle of universals. (Moreland, 2001, 87)

The concept of a *thin particular* is typically considered to be associated with the Aristotelian tradition (Armstrong, 1989, 60) and Armstrongian physicalism. But I see no objection in using it here in the context of platonism with one minor modification: the properties exemplified are platonistic, not Aristotelian. Other philosophers use Armstrongian concepts in a platonistic context. For example, Vallicella (2000), a platonist, discusses Armstongian ontology extensively, accordingly intermixing the two due to Vallicella's platonism, including using the concept of a thin particular.

A "platonistic thin particular" would be different from an Armstrongian thin particular in that, unlike the Armstrongian thin particular, platonistic universals, if they exist, are not *required* to be part of a thick particular since platonic universals can (allegedly) be unexemplified. On Armstrong's account of a thin and thick particular, "[u]niversality and particularity are, he says, inseparable aspects of all existence, they are neither reducible nor related to each other and, although distinct, their union is closer than a relation". (Moreland, 2001, 86) I do not use "thin particular" in a platonistic metaphysics to confuse Aristotelian and platonistic states of affairs, but rather to be clear in what I mean: the platonistic scenario is: a spatially located entity (a *platonistic* thin particular) is tied (exemplification) to spatially unlocated entities (platonic universals). Also, I use "thin particular" here in the context of platonism because I find that platonists very rarely discuss the analogue of the thin particular in platonistic metaphysics.

[63] Armstrong, 1989, 76. Some might object that if a spatially unlocated object is not at any spatial place, then it may not be anywhere at all, contrary to what Armstrong has written about the platonist position. I will discuss this objection more in Section 3.4.1 discuss this other position, that Armstrong discusses, where platonia are considered to be at a place (a spatially unlocated place), since, from what I can tell, this position is discussed more. (I do not know of any philosopher who says that platonia are "nowhere", but regardless I discuss this position below.)

Moreland, 2001, p. 100 also may also refer to a *realm-crossing* exemplification: "For traditional realists, neither the universal nor the exemplification *nexus* are spatiotemporal… [T]he exemplification *nexus* connects an abstract entity with a spatiotemporal one."

Moreland's passage in confusing since, one the one hand, he uses a word, "nexus" (Loux uses the same word), which appears to refer to a bridge-like intermediary tie between entities; but on the other hand, Moreland tells us (as do most philosophers discussing a platonistic exemplification tie) that exemplification is not spatially located, and this implies it is not bridge-like, not a nexus, "reaching" (to use Armstrong's word) from one realm to the other. This leaves open the question of how, exactly, spatially unlocated entity can attach to a spatial entity: if a spatial entity is, by definition, spatially *located,* and if a spatially unlocated entity is, by definition, spatially *unlocated,* one wonders how the two can be involved in an unmediated attachment without the spatial entity becoming spatially unlocated upon such an attachment, or without the spatially unlocated entity becoming spatially located upon such an attachment. I discuss this much more in Section 3.4.

[64] Hereafter, I refer to exemplification as a *tie,* and not a *relation,* for reasons given in a citation below from Loux.

[65] Loux, 1998, 38–41. I have altered Loux's passage to read as if he only discusses platonic realism, rather than metaphysical realism in general. For further lucid discussion on these issues, see Vallicella (2000). Some argue that it is not so certain that Bradley *did not* in fact conclusively argue that relations do not exist, and doubt that exemplification does away with the problems Bradley disclosed.

[66] Moreland, 2001, pp. 99–100, also refers to exemplification as a "nexus", but like Armstrong, he typically also calls it a relation.

[67] Some may object here, and maintain that it is correct to discuss this scenario as if relations *directly attach* to one another, or to particulars, rather than as if relations and their relata are *mediated* by an exemplification tie (or what some call the *instantiation relation,* as Armstrong does in his passage above). This would be to consider the "unmediated attachment of a relation to its relata" as *synonymous with* "exemplification tie" or "instantiation relation", where an unmediated attachment between a relation and its relata is an entity (in the broadest sense of "entity") that is a special "unmediated linkage", to use Loux's terminology, (Loux, 1998, 38–41) that a relation and its relata are involved in. (This is how Strawson describes the exemplification tie.) To my knowledge, this cannot be how the exemplification tie is to be

considered. Strawson's description of the tie does not involve the tie being an *intermediary between* universal and platonistic factor of thin particularity, acting as mediator *between* relation and relata; but rather the tie is a special capacity of direct (non-mediated) attachment that relation and relata can allegedly be involved in. Loux describes the exemplification tie as a "linker", and the word "link" might imply a chain-like connection, where only the pieces of a chain are involved, and a third, *mediating* entity, analogous to a rope between a boat and a dock, that is an entity different from the chain links, is not required for the linking of the chain links to ensue. If this reasoning is correct, and if the reasoning in Grupp 2003 is correct, then it is the *relation,* and not the unmediated attachment (exemplification, instantiation), *that must account for the crossing of realms.*

[68] *Some readers may be concerned that any description* of the exemplification tie is not possible since the tie is alleged to be *primitive*. I suggest that if this is the case, then an inquiry of the nature of the exemplification tie will *reveal* its primitivism. As an aside, I however maintain that the primitivism of the exemplification tie has not been established, perhaps due to the near absence of discussion of the tie. Rather, it appears that it has been *merely asserted* that the exemplification tie is primitive, following Bradley's work. But Bradley's regress only shows a *need* for *a* special *non-relational* tie, not that the special tie is *primitive*.

[69] I do not discuss issues in the debates about which account of relations may or may not be correct.

[70] I will discuss *exemplification* as the realm crasser. I do this because, as I will explain in later paragraphs, the account of relations that metaphysicians have given indicates that relations are not realm crossers. I follow their account, but it in fact does not matter to the argumentation of this paper *which* entities (exemplification ties or relations) are realm crossers, but only that at least one of them is a realm crasser (or that an unmediated attachment of spatially located entities and spatially unlocated entities account for the realm crossing). It does not matter because, in the next subsection, my argument against realm crossing focuses on the general *concept* of realm crossing, rather than on *which* specific entities are realm crossers.

[71] Armstrong, 2001, p. 65.

[72] Price, 2001, p. 23; Armstrong, 1989, p. 77; Armstrong, 2001, p. 66.

[73]Armstrong, 2001, p. 81.

[74] Moreland lucidly discusses this issue, which is known as the *axiom of localization* (Moreland, 2001, 18–19). This passage is given in note 78 below.

[75] For a brief discussion of this, see Loux, 1998, pp. 53–55, and Wolterstorff, 1970, Chapter 4.

[76] Armstrong, 2001, pp. 66–67.

[77] Tropes are typically held to be spatially located n-adic properties that are considered *individuals,* rather than universals. Some tropes, such as mental tropes, have been considered spatially unlocated.

[78] Although he does not discuss realm crossing, Moreland lucidly discusses this issue of the wholly spatial located, or wholly spatially unlocated, nature of relations that I am discussing. (In this paper, I however disagree with Moreland's treatment of

exemplification as wholly spatially located or wholly spatially unlocated, as I will explain in later paragraphs). Moreland writes:

Let us review three realist views of properties and exemplification.

There are three main ways that realists have understood this relationship. The first is the model/copy view, according to which properties are abstract entities that exist outside of space and time… [Properties remain outside space… and do not enter into the particulars that "have" them…

The next two realist views are advocated by impure realists and pure realists. These two schools of thought differ over a principle known as the axiom of localization:

No entity whatsoever can exist at different spatial locations at once or at interrupted time intervals.

Focusing on spatial location, concrete particulars like Socrates are at only one spatial location at one time. They cannot be in more than one place at the same time. Now the axiom of localization says that nothing can be in more than one [spatial] place at the same time. Impure realists like D. M. Armstrong deny that axiom of localization. For them, properties [including polyadic properties (relations)] are spatially contained inside the things that have them. Redness is at the very place Socrates is and redness is also at the very place Plato is [Moreland is referring to two balls, named Plato and Socrates]. Thus, redness violates the axiom of localization… [l]impure realists hold that all entities are, indeed, inside space and time. But they embrace two different kinds of spatial entities: concrete particulars (Socrates) and are in only one place at a time, and universals (properties like redness) that are at different spatial locations at the very same time. For the impure realists, the exemplification relation is *a spatial container* relation. Socrates exemplifies redness in that redness is spatially contained inside of or at the same place as Socrates.

Pure realists such as Grossmann hold to a non-spatial… view of exemplification. Redness is "in" Socrates in the sense that Socrates *has* or *exemplifies* redness within its very being. But neither redness nor the exemplification relation itself is spatial. Properties are not in the concrete particulars that have them like sand is in a bucket. The nexus of exemplification is not a spatial container type of relationship.

Thus, the impure realist accepts properties as universals but rejects them as abstract objects. Moderate nominalists are pure naturalists because they accept the axiom of localization, impure realists are impure naturalists because they reject the axiom of localization but accept the idea that every thing is in space and time in some sense, and pure realists reject naturalism altogether and embrace abstract objects. (Moreland, 2001, 18–19)

In the next section, I will argue against (what Moreland calls) the "pure realist" position, where the exemplification tie is *wholly spatially unlocated,* but still somehow accounts for the tying of spatially located entities and a spatially unlocated entity. The pure realist position is held, for example, by Grossman, in addition to Moreland.

[79] Loux, 1998,48.

[80] A simple platonistic exemplification is *wholly* spatially located, or *wholly* spatially unlocated, for the very reason that it is the platonistic *exemplification tie,* and not, for example, a physical, spatial object that exemplifies spatially unlocated properties. What is regarded as a physical, spatial object, such as a panther, according to some, might be considered by some to *not* be *wholly* spatially located, but rather as an entity that is spatially located *and* spatially unlocated, since it has spatially located and spatially unlocated aspects or constituents: wholly spatially unlocated platonic universals, that are tied to (exemplified by) a wholly spatially located platonistic thin particular (to use Armstrongian terminology). Exemplification is not a spatial, physical object, since it is the special tie that gives rise to spatial, physical objects, on the platonistic account. Unlike a physical, spatially located object, that might be considered by platonists to have spatially unlocated constituents, the exemplification tie, in being a constituent of, or aspect of, those physical objects, is *wholly* spatially located *or wholly* spatially unlocated. These same points would apply to a non-simple exemplification tie, where parts of the tie would be wholly spatially located or wholly spatially unlocated.

[81] Moreland, a pure realist, 2001, appears to hold this position; p. 100: "For traditional realists, neither the universal nor the exemplification nexus are spatiotemporal… [T]he exemplification nexus connects an abstract entity with a spatiotemporal one." On this account, a wholly spatially located entity (the platonistic thin particular) and a wholly spatially unlocated entity (the exemplification tie) would involve an unmediated attachment.

[82] I am not aware of any philosophers who hold this position, but Wolterstorff, 1970, Chapter 4, appears to hold that exemplification is composed of parts.

[83] As I have mentioned, I will discuss problems with unmediated attachment between wholly spatially located entities and wholly spatially unlocated entities without to Armstrong's spatial metaphors in the next subsection.

[84] Some platonists may question why a physical object, such as a lion, is a *wholly* spatially located object, since, according to platonism, physical things have spatially *unlocated* properties. Platonists often neglect to disclose *what* specifically a first-order property ties to, merely claiming it is "the particular" that exemplifies properties. But this is not specific. First-order platonic properties cannot be tied to other properties, lest a platonistic substance be a wholly unlocated *bundle*. Thus, first-order properties must tie to the only remaining element of the substance: the *particularity*. Since this particularity cannot be a property (lest a substance be a bundle), this particularity can only be the *thin particularity* of the substance. Accordingly, a lion is a physical, spatial entity in the sense that it is a thin particular (wholly located) exemplifying (wholly unlocated or wholly located) platonic universals (wholly unlocated). In this way, platonistic metaphysics only involves wholly spatially located or wholly spatially unlocated entities, and in considering a lion as *wholly spatially located*, I am referring to the *thin particular* that is *wholly spatially located*, and which is distinct from, but tied to, wholly spatially unlocated properties, such as, *sublimity*.

[85] I am grateful to Bill Vallicella for these objections. Keith Campbell (See Campbell, 1990, chapter 5) and Peter Simons also discuss these objections. Simons

writes: "The most obvious forma) properties of the part-relation are its transitivity and asymmetry… These principles are partly constitutive of the meaning of 'part', which means that anyone who seriously disagrees with them has failed to understand the world". (Simons, 1987, 11)

[86] Campbell, 1990, 98.

[87] The issues these philosophers discuss also appear to be similar to the way that Berkeley discussed *distance,* as a learning experience, where the comparison of the perceptions in one's mind of the perceived spatial location of objects on the one hand, and the perceived sizes and objects, on the other, where an interrelation or interconnection between the objects need not be espoused. (See Umbaugh, 2000, 20–21)

[88] This position is not entirely unlike the position held by Hobbes (see Lockwood, 1981, 2–5).

[89] Many refer to connections and relations between the particles of physics as *relations*, as if, for example, gravity, or the strong force, might be ontological platonistic or non-platonistic polyadic properties. But the forces of physics are not relations at all; they are streams of particles (where these "streams" are also called "particle exchanges", and where the particles being exchanged are called "messenger particles"), that move back and forth between particles that are bound by a force. For this reason, it is more in line with the findings of physics to hold that the forces of physics that exist between particles (gravity, electromagnetism, color force, and so on) are in fact *not connections* at all, and for that reason, the particles of physics are *unconnected,* since the forces are discrete (discontinuous) particles in motion, moving between the particles they exchange between. (See Kane, 2000, 18–25; Stenger 2000, 80, 232.) (Some might object that what has just been said carries the assumption that the particles of the quantum world are *individuals,* as when I referred to them as "discrete" (as quantum gravity theorists, for example, would argue they are). This is of no concern, however, since even if it were the case that the particles of physics cannot be considered individuals (for information on this issue, see French, 2000), they need not be scattered objects, which require relations between them. Rather, particles would merely be multiply-located spatial entities with no ontological relations between them whatsoever, unless they collocate)

[90]Stroud, 2000, 12–13.

[91] Of course it is not standard to hold that quantum entanglement is a relation when discussing quantum wholeness. But there are many philosophers of physics or physicists that do however seem to imply that quantum entanglement is in fact a relation, or some sort of relational connection. For example, see a passage from Maudlin's recent interesting book (2001, 2).

[92] I am grateful to Quentin Smith, Bill Vallicella, and John Dilworth for presenting interesting objections to the inferences in this paper. I am also grateful to the editor of *Axiomathes* and two anonymous referees at *Axiomathes* for helpful comments on improving this paper.

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