

WHOLE AND OBJECT

Groundwork for a New Metaphysics of Objects and the Language of Existence

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International Studies.

By

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Abstract

What it is to be an object and what it is to be a whole are separate enterprises: answering the former is doing ontology, and answering the latter is not. By providing this distinction, a new metaphysics of objects emerges. The positing of a whole is a referential gesture, either by ostension or naming, and the alleged object is postulated without consideration of internal causal operations between its parts. An object, however, requires careful physical explanation. I explicate the concept of object as an ontological function which takes mereological sums as arguments, and by causal operations on the members of that sum as structural relata, returns holistic properties of a singular entity. With the revised notions of whole and object in mind, I consider what implications this bears on existential quantification. Following Meinong, I believe that the existential quantifier does not capture existence. Instead, I argue that the existential quantifier expresses a mereological notion of *countability*; the collecting of things *as one*. The existential status of a counted entity is left unstated until it is explicitly asserted as existing by a speaker, in the mental frame of a *realist* attitude, and this expression of existence is captured by the existence predicate. The existence of the counted entity, the alleged object, is confirmed or denied as an object in light of whether it satisfies the conditions specified by an endorsed theory of causally productive relations; the conditions under which something is an object.

Declaration

This thesis contains no material which has been accepted for the award of any other degree or diploma at any university or equivalent institution and that, to the best of my knowledge and belief, this thesis contains no material previously published or written by any other person, except where due reference is made in the text of the thesis.

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Mereology is an essential part of ontology, but it can easily be overused... it cannot be assumed that because part-relation behaves in one way in one domain... that it must behave similarly elsewhere. All that can be guaranteed *a priori* is that the part-concept has the formal characteristics which are analytic of it. When it comes to the honest toil of investigating the principles governing what objects are parts of others, and what collections compose others, it appears that most ontologies have been following the paradigm of abstract algebra when it would have been better to take a lead from sciences such as geology, botany, anatomy, physiology, engineering, which deal with the real.

PETER SIMONS

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The Philosophical Treatment of Mereology: Proponents and Dissidents

In philosophy we often operate at two levels. At one level we use the language of our community – English, in the present instance – to make assertions about various philosophical topics. At another level we may be thinking about the nature of language, in particular about how linguistic behaviour determines meaning. The interaction between these two levels can become problematic when we find ourselves at the second level disagreeing about the meanings of our assertions at the first level.

ELI HIRSCH**1. INTRODUCTION**

Our language is geared towards a particular structural feature; subjects and predicates. Where the subject position takes objects as its referents, predicates are typically associated with the attribution of properties. It is perhaps by reason of this structure that we are unable to circumvent talk of *objects*, and subsequently questions of existence arise to plague metaphysicians: what does it mean to be an object that exists? We are in much

debt to Frege and Russell for the introduction of existential quantification, which removed the shroud of fog that made mysterious the form of existential claims. With respect to ontology, however, logic is silent on the matter. Quine tells us that what exists, quite simply, is *everything*. Yet what makes metaphysics a particularly attractive area of enquiry is that there are cases of disagreement as to what we ought to count as existing.

Mereology is a sub-discipline of metaphysics. More specifically, it is a field of ontological investigation that enquires into a structural feature of objects; in the language of mereology: the relations that bear between parts that figure in a composite whole. Speaking in more metaphysical terms, mereology investigates what relations must *exist* for there to be a composite entity.

The language of mereology is pervasive in everyday discourse. We might talk of the parts of *natural objects* such as trees, clouds, and animals, or *artefacts* such as tables, books, and laptops. The language of mereology even goes beyond the realm of existent objects to talk of fictional entities; the wings of Pegasus, for example – which might even confuse some into thinking that such things *must* exist (*à la* Meinong and his followers). Given its usefulness, mereological talk is indispensable in ordinary language – meaningful discussion with one’s mechanic exemplifies this point.

Though our language tends to favour talk of mereological entities, there is a further question as to whether there are indeed mereological facts, and if there are indeed facts, what is the metaphysical nature of this facticity. One answer is that mereologists try to *carve nature at the joints*. This is to say that reality contains *mereological structure*, and thus there is something to be *known* about this structure. In other words, there is one mereological theory that is metaphysically privileged. Philosophers have

tended to accept this realist position and subsequently many alternative mereological theories have been proposed. There are those who admit of only the realm of simples (Unger, 1979; Dorr, 2002; Rosen and Dorr, 2002), those who believe in only collections of four-dimensional hunks of matter (Hellar, 1990), those who embrace only those composites that are living (van Inwagen, 1990; Merricks; 2001), and those who accept that all objects compose further objects (Lewis, 1986, 1991; Sider, 1993, 2001; Van Cleve, 2010).

In recent times, the metaphysical investigation of mereology has faced accusations of triviality, superficiality, and, perhaps more severely, meaninglessness. This deflationary sentiment seems to be a product of the metaphysician's inability to resolve disputes between proponents of alternative mereological theories; debates in mereology seem to be perennial. As a result, the ghost of Carnap has been awakened to haunt metaphysics once again. Though Carnap's 'verificationism' has not been summoned with him, some philosophers believe that there is merit in his theory of linguistic frameworks, which allows for a distinction between *internal* existence question – those question that can be answered in accordance with the rules of the framework – and *external* existence questions, which are asked independently of any set of rules. External questions, if they attempt to discern matters of fact, are cognitively meaningless according to Carnap. Thus metaphysics is faced with a pernicious dilemma: either the metaphysician asks an internal question of which the answer is trivial, or else they ask an external question of which there is no answer; it is an empty pursuit.

After the awakening of the ghost of Carnap, it was not long until the ghost of Quine caught wind of this event and was awakened himself. Quine is generally accepted as the great saviour of metaphysics from the positivists. By identifying the deficiencies in the analytic/synthetic distinction, Quine subsequently dismantled the wall that divided internal and external questions that Carnap required for his deflationary campaign; there was no longer analyticity to provide this distinction.

Contemporary metametaphysicians, however, do not appeal to this particular debate to either defend or reject the credibility of metaphysics. Instead, the debate centres around the nature of the existential quantifier. In line with the Carnapian thought, some philosophers have suggested that mereology, or ontology more broadly, is no more than a matter of language, and our decision to pick one language over another is decided on pragmatic grounds; we are under no truth-related constraints. This is called the Principle of Tolerance. With respect to the existential quantifier, some neo-Carnapian philosophers (Hirsch, 1993, 2009) believe that just as any logical constant gets its meaning from the truth-conditions of the sentence in which that constant occurs, so, too, does the quantifier. Accordingly, they argue that the quantifier *varies* in meaning with respect to usage. The implication of this position is that inconsistent sentences that were at the heart of mereological disputes turn out to have distinctly different quantifier meanings. Given that different concepts of existence are being employed, there is no reasonable argument to be had for there is an equivocation in terms; there is no sense in which the sentences in dispute are inconsistent. Questions concerning mereology, then, amount to no more than a decision about what language to choose, and how one can translate one mereological language into another.

Proponents of neo-Quinean philosophy (Sider, 2009, 2011) argue that there is a metaphysically privileged quantifier meaning. As well as there being privileged predicates, neo-Quineans believe there is also a quantifier meaning that carves nature at its logical joints, or in Quine's terms one that *limns the structure of reality*. Thus, there is hope for the substantivity of mereological enquiry yet. For Theodore Sider (2009, 2011), the answer to this problem is two-fold: (1) adopt an extension of the Quinean criterion of ontological commitment, and accept as much structure as is required by science, and (2) if such structure requires a univocal quantifier meaning, then appeal to the Lewisian criteria of naturalness and fit to discern eligibility. This preserves the substantivity of mereological debates, and metaphysics more broadly.

At this point in time there is no clear winner in the debate, and, perhaps, it is for this reason that metaphysics goes on about its business. Thus, I too will engage in metaphysics in this thesis. Though what I hope to achieve will shed some light on mereological debate itself.

2. WHAT IS MEREOLGY?

Mereology, quite simply, is the theory of parts and wholes. More specifically, it is an investigation into the relations of parts to wholes, and parts to parts in the context of a whole. While ontology, at least in the Quinean sense, is typically interested in providing a list of existent objects (what Jonathan Schaffer calls a "flat structure" (2009: 354)) mereology takes things further and asks by virtue of what relations do things exist; what relations are responsible for the existence of composite entities – if there are any. The

fascination of mereology has been present throughout history, from the ancient Greek's curiosity of the atomistic world, to the Trinitarian theories of the medieval period, from the enlightenment's concern for the parts of celestial bodies, to diversity of systematic theories today. However, the richest part of its history lies in the early 20th century. It was Franz Brentano and his pupils who set themselves the goal of establishing a formal mereological theory. The extent of this project is most notable in the work of Brentano's most famous student Edmund Husserl (1901). Yet, it was not until the ground-breaking work of Polish logician Stanislaw Leśniewski (1916, 1927-1931), and subsequently Alfred Tarski, that a theory of parthood relations was given an adequate formulation. Interest from the English-speaking world only came about with the publication of H.S. Leonard and Nelson Goodman's *The Calculus of Individuals* (1940).

For the most part of the early 20th century, mereology was considered predominately a matter of language. It was the project of establishing an axiomatic system of parthood relations; a formal system of composition. When theorists started claiming that mereology was about the object-world, philosophers questioned whether these axiomatic systems truly carved nature at the joints. Subsequently, mereology became a matter of interest for metaphysicians and has remained an unsolved problem to this day.

The metaphysics of mereology can be divided into two fields of enquiry. The first concerns parthood simpliciter, an answer to the question "What is it to be a part of another thing?". The second is a derivative question, typified by a concern for dynamics: "What is the process by which something becomes a part of another thing?". The former I will refer to as The Parthood Question, the latter The Composition

Question. What distinguishes these questions is that The Parthood Question enquires into the nature of a state of being; the state of being a part. It asks for the conditions under which something *is* a part. The Composition Question, on the other hand, is a question about a process¹; the process by which something achieves a state, namely the state of being a part. It was in 1987 that we saw a shift in metaphysical enquiry with the publication of Peter van Inwagen's "When Are Objects Parts?". For van Inwagen, The Composition Question, or what he refers to as the Special Composition Question, is a more fruitful means of enquiry to discern the nature of parthood; by knowing the means by which something *becomes* a part sheds light on *what it is to be* a part, or, in other words, answering The Parthood Question. Thus, a wealth of literature was spawned in an attempt to answer The Composition Question that is still discussed today. I will now explore the most prominent and persuasive answers to The Composition Question that have been proposed.

3. THE COMPOSITION QUESTION: ANSWERS

The Composition Question asks:

“What would one have to do – what could one do – to get the *x*s to compose some *y*?” (van Inwagen, 1987: 23)

¹ One might question whether Nihilism and Universalism should be thought of in terms of processes. We might think of Nihilism as the thesis that no process takes place, and Universalism at the thesis that the process is immediate.

In other words: “how must a collection of objects be organised in order for them to compose a further object?”. How should we go about answering this question? Perhaps the most intuitive methodology one could employ is to analyse everyday objects, as paradigm cases of objecthood, and discern relations that are required between the supposed parts. Metaphysicians of mereology seem to be resistant to this thought, or at least don’t find it to be a useful methodological tactic. The methodology that seems to be preferred is simply to think of some unspecified objects, the *xs*, and postulate relations that the *xs* *could* be in that would non-arbitrarily compose some further object *y*. The product of this thought is a range of philosophical positions spanning from the frugal theorists who delimit their ontological spending to the point of insufficient explanation, to those unburdened by the extravagance of spending too much.

The minimal ontologists are referred to as Mereological Nihilists (Unger 1979; Dorr 2002; Dorr and Rosen 2002). There are a number of ways that we can characterise the Nihilist position, yet the most useful definition is perhaps the simplest: composition *never* occurs. According to the tenants of Mereological Nihilism, the only objects in existence are *simples* and such simples only compose themselves – there are no proper parts. The objects that we take as existing are no more than simples arranged in an *F*-wise fashion, where *F* is some objectival predicate. Yet, this arrangement is not metaphysically substantive. Nihilism has its benefits theoretically, yet deficiencies intuitively. Theoretically, it is advantageous to embrace the tenants of Nihilism as an answer to The Composition Question as it is an ontologically parsimonious and logically clean thesis. Further, there are no problems of vagueness or arbitrary postulations of metaphysical relations. Thus, there is no requirement to give justification for the

relations that we stipulate as being necessary for composition. However, justification is required elsewhere. Namely, why we should commit ourselves to a theory that doesn't give us the putative objects that we could not reasonably deny? Despite the Nihilist's frugality, the theory is quite simply too expensive in this sense. For the Nihilist, the response is easy: you get to keep all the talk of objecthood without the commitment. Ordinary objects are just the arrangement of simples in a complex fashion and our commitment goes no further than this. The plausibility of this position remains in doubt; we don't just want *talk* of objects, we *want* objects.

The maximal ontologists are the Mereological Universalists. Mereological Universalism is a fascinating metaphysical position. Where Nihilism pushes one side of our intuitions to a crisis point, Universalism pushes the other side with an interesting effect. The Universalist accepts that our ontology consists of the objects we wish to commit ourselves to, albeit with the questionable addition of an infinite amount more. However, what is remarkable about Universalism is that it is a widely accepted thesis, including very prominent and important thinkers, and has philosophical credibility that is lacking in Nihilism – it has been subject to less scrutiny than its metaphysical counterpart. The Universalist believes that if you have some objects, composition *always* occurs. In other words, composition is unrestricted; it happens so long as there are some distinct objects. In the words of Bigelow and Pargetter, unrestricted composition is defined accordingly:

“Given any two distinct things, a and b , where ($a \neq b$), and where neither a nor b is a part of each other, there always exists at least one further thing c , ($c \neq a$) and

($c \neq b$); and c contains a as one of its parts and contains b as another of its parts”

(2006: 2).

This is known as the *principle of unrestricted composition*; the conditions under which fusions occur are just when distinct objects exist. Given this definition, the Universalist makes no distinction between a mereological whole and an object. A whole is sufficient for being an object. What is it to be a whole according to the Universalist? To be an *aggregate*; a delineation of objects, no matter how scattered or near, *taken as one*. This commits one to a realm of both bizarre and uninteresting objects. According to the Universalist, the sorts of objects that we do have interest in are only privileged insofar as they serve some purpose, be it for the practice of science or reference to everyday phenomena. However, there is nothing *metaphysically* interesting about them that separates them from boring aggregates, such as the fingers of my left glove and the keys on my laptop. The Universalist believes that no matter how dispersed or close objects are, if they are distinct then composition will have occurred – the realm of objects is vastly more expansive than common-sense would reveal.

In the middle of the extreme ontologies are a group of theories referred to as moderate positions, and as such I will refer to these theories as Mereological Moderatism. Where the Nihilist denies that composition occurs, and the Universalist accepts that composition occurs always, the Moderate believes that composition occurs *sometimes*. In other words, given any two distinct things, a and b , there is *not* always a further thing c . Precisely why composition occurs sometimes and not others requires *careful* explanation on the part of the Moderate. This explains part of the reason why

Universalism and Nihilism have gained so much attention; if there was a simple, and perfectly consistent, Moderate mereological theory with a clean logic, you would be hard pressed to give a reason why one shouldn't accept it over Universalism or Nihilism. However, the elusive Moderate theory has been a grand prize long forgotten by most – our hope seems to rest in either the two extreme theories. Yet, there is a dangling Moderate theory that has gained some popularity: Organicism.

Organicists argue that the only objects that have proper-parts are living things. In other words, Organicism holds that simples compose an object if and only if they are involved in the existence of a living organism. This theory eases the pressure on our intuitions; Organicism allows for objects such as plants, dogs, and humans, without admitting objects such as the one composed of the Eiffel Tower and David Lewis' nose. Although, it does not capture our intuitions completely. For Organicists do not commit themselves to the existence of tables, chairs, buildings, and the like. However, this is the least of the Organicist's worries. Precisely what 'living' amounts to requires careful explanation, as vagueness will creep in at borderline cases. That is, often we won't know when something participates in the activity of an organism:

“[C]onsider some simples that would ordinarily be taken to compose a carbon atom. Suppose those simples get ingested by a woman drinking tea, so that they are eventually absorbed into her bloodstream. At precisely what instant does it come to be the case that simples are caught up in that woman's life?”
(Markosian, 2005: 14).

Moderate theories all seem to face the same problem: vagueness. Where philosophers tend to shudder at the thought of a vague object, it seems that a vague relation is utterly contemptible. David Lewis writes,

“Therefore it cannot have a vague answer... No restriction on composition can be vague. But unless it is vague, it cannot fit the intuitive *desiderata*. So no restriction of composition can serve the intuitions that motivate it. So restriction would be gratuitous. Composition is unrestricted” (Lewis, 1986: 212-13).

Given that Moderatism is the clearly intuitive position, it is odd to think that it is the hardest to justify. Why is this? I believe that what is lacking in the positions given above is a sufficient account of objecthood. That is, mereology’s association with objecthood has been overstated, or as Peter Simon suggests, “[m]ereology is essential to ontology, but it can easily be overused” (2006:613). What it is to be an object requires more than mereological investigation, though mereology is necessary. In accordance with the Moderate position, I do indeed believe that a commitment to certain relations can provide a reasonable means of discrimination between objects and non-objects that aggregation simply cannot provide.

Precisely what relations provides the grounds for discrimination won’t be given by an enquiry into composition itself, perhaps much to the dismay of contemporary mereologists. Why? If composition is a process by which something achieves the state of parthood, we should question why we ought to believe that it will tell us anything about parthood itself. Parthood should tell us whether composition occurs, and not the other

way around. If we knew that for an object x to be a part of another y it must satisfy parthood condition Φ , then an answer to the question of the process by which x *becomes* a part of y must work within the constraints of Φ , for if it did not then x would not be said to be a part of y . However, what this entails is that an investigation into composition independent of a theory of parthood is methodologically blind. Epistemically speaking, we should not expect it to tell us anything interesting for it amounts to no more than unwarranted speculation – unless each compositional theory comes with an implicit theory of parthood; The Parthood Question is more primitive than The Composition Question.

The consequence of this thought is a methodological hierarchy of metaphysical enquiry; certain questions must be answered before others. This is not a new idea in philosophy generally speaking. In much the same way answers to questions of ethics rely upon answers to questions of meta-ethics, so too do questions of mereology rely upon foundational metaphysics. In my mind, mereology, or at least composition, is dependent on answering an age old question: what is it to be an object? It will be my endeavour to provide an answer to this question.

4. WHY HAS MEREOLGY COME UNDER FIRE?

Disputes in mereology have fallen on hard times of recent. Meta-ontology, the field of enquiry that questions the nature of ontology, has become fashionable once again, with theorists arguing that certain disputes in metaphysics, if not all, are either trivial,

superficial, or meaningless. The question of whether composition occurs – The Composition Question – is one area of concern. David Manley writes:

“If we have some objects, what does it take for there to be a further object that has those objects as parts? On Cian Dorr’s view, composition never takes place. There may be partless particles (simples) arranged in the shape of teacups and turkeys, but there are no tea-cups or turkeys. On David Lewis’s view, composition always takes place. So, not only are there teacups and turkeys, but also teacup-turkeys: spatially scattered objects consisting of one-part dishware and one-part bird. And on Peter van Inwagen’s view, simples compose a larger object only when their activity constitutes a life. This gets us turkeys but not teacups. Faced with this kind of dispute, many philosophers claim to detect a whiff of superficiality. Everyone agrees that there are bits arranged ‘teacup-wise’; so do we not agree on the relevant facts? It can seem that this is only a disagreement about how to *describe* certain situations, rather than about how things really *are*.” (Manley, 2009: 2)

Manley’s passage captures the deflationary sentiment. Whether or not composition occurs is not a question for metaphysics, but merely a matter of linguistic choice; the choice of either adopting a ‘composition’ language or not. This kind concern results in what is called a verbal dispute. A verbal dispute involves the appearance of disagreement yet involves a variance in what is meant by certain terms, or as Chalmers puts it, a dispute is terminological when “an apparent first-order dispute arises in virtue

of a meta-linguistic difference...” (Chalmers, 2009: 13). To elucidate this thought, consider the following dispute between two ontologists – a Universalist named DKL and a Nihilist named PVI. Say they are arguing over the sentence ‘There are tables’:

PVI: “There are no table that *really* exist, there are just fundamental objects – simples – that arrange themselves in a unique, table-like fashion that we simply *declare* as being metaphysically substantive.”

DKL: “Of course there are tables! When you say that there are simples in a table-like fashion, there is something metaphysically substantive that exists – all there is to being an object is to be an aggregate of this sort!”

Where is the supposed equivocation? The dispute between DKL and PVI is about tables, accordingly we can say that it is a dispute about whether or not to accept the sentence ‘there are tables’; DKL say yes, and PVI says no. We now have two options. Either we argue that there is an equivocation in the predicate ‘..is a table’ or else admit there is variance in the quantifier (‘there are’) – the concept of existence. Sider writes:

“...if the alleged equivocation is merely over a predicate then PVI and DKL’s dispute is in one respect like a dispute over whether geese live by ‘the bank’, in which one disputant means river bank and the other means a financial bank. That kind of verbal dispute is familiar, but it’s not what’s going on in ontology. PVI and DKL are not tacitly employing different standards for what it takes to

be a table. They agree on the condition Φ that a thing must meet in order to count as a table; their disagreement is over whether there exists anything that meets that condition.” (Sider, 2009: 388)

If the disputants agree to the conditions under which something is a table, yet disagree as to whether anything meets those conditions, then their dispute is about *existence*. The difference between the disputants lies in their respective uses of ‘exists’. Since, under the Quinean programme, the quantifier is the logical form of existence, the equivocation, then, must lie in the quantifier. That is, the participants *mean* different things by expressions such as ‘there are’, ‘there is’, and cognate terms. This position is known as *quantifier variance*.

This does not yet spell the end for metaphysics as both disputants could be using alternative, albeit *wrong* quantifier meanings. In this sense the debate is not worth having since *both* PVI and DKL express false propositions. However, the quantifier variantist suggests an additional criterion: *there is no metaphysically privileged quantifier meaning*. Sider gives the following account:

“There is a class, C, containing many inferentially adequate quantifier meanings, including two that we may call $\text{existence}_{\text{PVI}}$ and $\text{existence}_{\text{DKL}}$. PVI’s claims are true when ‘exists’ means $\text{existence}_{\text{PVI}}$ and DKL’s claims are true when ‘exists’ means $\text{existence}_{\text{DKL}}$. Further, no member of C carves the world at the joints as well as an other member of C – either because there is no such notion

of carving nature at the joints that applies to candidate meanings, or because there is such a notion and C is maximal with respect to it.” (2009: 393).

This thought has been most notably propounded by Eli Hirsch, who credits his work as an extension of Putnam’s ‘conceptual relativity’ (1987) and has its roots in Carnap’s *Principle of Tolerance* (1950). Hirsch writes:

“...such expression as ‘thing’, ‘object’, ‘something’ or ‘exists’ has a certain variability or plasticity. There is no necessity to use their expression in one way rather than various other ways, for the world can be correctly described using a variety of concepts of “the existence of something.” (Hirsch, 2002: 51)

There are three essential features of quantifier variance. The first, there are many quantifier meanings. Second, the truth-value of a sentence can change the meaning of the quantifier. Third, no quantifier meaning carves nature at the joints better than any other, or there is no such notion as carving nature at the joints.

The implication that quantifier variance has on metaphysics is devastating. Any difference in metaphysics can be reduced to a mere difference in the concept of existence being employed. As we have seen, mereology has been the prime suspect of superficiality. For the quantifier variantist, there is no question of fact. Mereology involves no more than language choice, where the only substantive question is whether one language can be translated into another, and the choice to pick a language is decided on pragmatic grounds. I am sceptical of this conclusion. Not insofar as I think

mereology can be saved in the way it is typically understood. Mereology plays a certain role in metaphysics, though the extent to which it meaningfully contributes to ontology has been overstated. In the following section I will state why I think this, and further elaborate on the project that I will undertake to find the substantivity in mereological enquiry.

5. THE PROJECT: REVISING ONTOLOGICAL ENQUIRY

I believe that quantifier variantism plays on a shallow understanding of ontological disputes. If one wants to accuse ontological disputes of being defective in some way, then it only seems fair that it is done in the most rigorous manner. Hence, we must give ontological disputes the best chance of being substantive.

What is the nature of an ontological dispute? First and foremost, I do not believe that it is an argument over sentences. It seems entirely plausible to me that the disputants in an ontological dispute could agree to the *same* meaning of the sentence ‘There exists tables’, and still have a profound disagreement. Why? The dispute is about *whether there are tables* not whether to accept the sentence ‘There exist tables’. Furthermore, it seems odd that ontological disputes would even concern specific objects such as tables. In other words, an argument over tables is not sufficiently general enough for ontology. It seems more appropriate that an ontological debate concerns something of a much broader category, namely something like the existence of artefacts of which the existence of tables might be inferred. Given that we have established that the disputants already agree to the standards for what it takes to be a table, it seems that the

debate, following the points above, centres around the following question: what are the standards for what it takes to *exist*?

Following Quine, I take being to be the same as existence, and I take this as saying that what it is to exist is just to be an object. Accordingly, though this might upset Quine's extensionalism, what it *takes* to exist is no different from what it *takes* to be an object. Thus, we can say that ontological disputes centre around what it takes to be an object; the standards for objecthood.

There has been temptation to define objecthood in very simple terms: something countable as *one*. This sense of objecthood is meant to capture the structure of ordinary language, specifically, as Strawson puts it, "...anything whatever that can be identifyingly referred to; anything whatever can appear as a logical subject, an 'individual'" (Strawson, 1959: 227). However, we should be wary that ordinary language could convey the genuine structure of reality; and this is consistent with the spirit of ordinary language philosophy of which Strawson himself was involved. This formal emphasis on oneness is not unique to contemporary philosophy. Aquinas observes, "Being and one are convertible terms", further Leibniz argues, "I do not conceive of any reality at all as without genuine unity" and Locke writes,

"Amongst all the ideas we have... there is none more simple, than that of unity, or one... every idea in our understanding, every thought in our minds, brings this along with it... For numbers applies itself to... everything that either does exist or can be imagined." (1924, 121-2)

It is this attention to *oneness* that I believe mereology has been of significant interest to philosophers. Mereology is no more than the study of *oneness*, an investigation into the formal properties of *being* one. It is the attempt to discern the nature of objecthood through an analysis of parthood relations. Accordingly, we should expect ontological debates to be about oneness. Each of the major mereological theses (i.e. Universalism, Nihilism, or Moderatism) provide alternative accounts of what it is *to be* one. The Universalist equate oneness with aggregation, the Nihilist specifies oneness with being partless, and the Moderatist demands some relational requirements.

By thinking of ontological debates in this way, are mereological disputes preserved as substantive? Heavens, no. In what I will suggest in the following is that the quantifier *only* expresses the notion of oneness. However, being one, as I will argue, is not sufficient for objecthood, existence, and thus the quantifier as interpreted this way is inadequate to express ontological commitment. And for this reason, I do not feel the wrath of quantifier variantism, for the meaning of the quantifier is univocal, where differences between theorists are located elsewhere: in the existence predicate – the expression that the conditions under which something is an object has been, or is believed to be, satisfied.

The project that I will undertake will go as follows. First of all, I believe there is something fundamentally mistaken with equating objects with wholes – or, at a methodological level, object-theory with mereology. That is, objects are more than just a matter of simples and aggregates. To be clear, my interest is in *physical* or *material* objects, that are natural, bearing natural properties. However, what I will say is comfortably applicable to other areas of ontology. In the 2nd chapter I will argue that

while all objects are wholes, not all wholes are objects. It is this equivalence that has caused trouble for mereology that has meant that a sufficient answer has not, and cannot be given under this way of thinking. And, moreover, why mereological debates look suspicious. This will require propounding an alternative object-theory, one that separates wholes from objects in both a logical and metaphysical sense: objects require the production of holistic properties in virtue of their structure. How are these properties produced? In the 3rd chapter I will discuss causation. I distinguish between three types of causal interactions: *collision*, *catastrophe*, and *coalescence*, where only coalescence is a causally productive relation. Hence, objects require the production of holistic properties in virtue of a *causally-based* structure. In the 4th chapter, I give a theory of kinds and universals based on the theory of objects that I proffer: the structure of an object determines its category. That is, the causally-based structure of the object that produces properties determines its membership in a kind, and a property is a universal when it is the ontological product of an ontological structure. In the 5th chapter I will discuss what my proposed object-theory means for the language of existence. I argue that the existential quantifier, despite its name, is best understood as ontological neutral. Accordingly, this leaves meaningful work for the existence predicate. No doubt many will be disgruntled by the theory that I will have proposed, thus chapter 6 is dedicated to responding to the most prominent mereological theories of today: Universalism, Nihilism, and Organicism. I will undertake a comparative analysis, and respond to the possible arguments that could be proposed by each position.

A Theory of Objects

All, or almost all, of the antinomies and paradoxes that the philosophical study of material objects is heir to involve the notion of parthood. I believe... that most of the great, intractable metaphysical puzzles about material objects could be seen to have quite obvious solutions by one who had a clear understanding of what it was for one material object to be a part of another.

PETER VAN INWAGEN

1. WHOLES AND OBJECTS

To frame the discussion, let me state my position clearly from the start: I believe that all objects are wholes, but I do not believe all wholes are objects. Hence, I do not believe that ontology can be reduced to a question of what counts as a whole and what doesn't. The concept of a whole is fundamentally quantificational. We posit, recognize or acknowledge a whole by simply counting a collection, aggregation or group of things² as *one*. It is not required that anything should justify, or warrant me doing so. If I want to

² The notion of 'thing' is intentionally left unspecified at this point.

count an aggregate made up of say, my thumb and the Tower of London, as one, that seems to be my privilege. You might question, out of curiosity, why I would want to do it, but I don't think you can simply declare it mistaken.

This notion of a whole should not be particularly halting or novel to philosophers – it is Cantor's original notion of a set. As you are probably aware modern mereology was borne out of Leśniewski's dissatisfaction with Cantor's naïve set theory as a formal mereological system. As a mereological system, successful or not, we might interpret the braces of set-theory as asserting the membership to comprise a whole, *something to be counted as one*. Putting aside any constraints that avoidance of Russell's Paradox might demand, we do not demand anything of sets as wholes except that they possess well-defined memberships, or parts. It is not necessary that those parts should possess certain relations with each other. Any relation that might happen to obtain between my thumb and the Tower of London does not bear on their *admissibility* as members or parts of a set unless that relation is deemed a membership condition *for* the set. In this sense, sets and thus wholes are essentially *delineations* of things; and it is such delineations that we naturally speak of as “containing” members. It is this delineation which provides perhaps otherwise unrelated things with the relation of being members of a whole or set. It renders individuals as parts of *one* thing, a whole or mereological sum.

The elements comprising a whole are themselves wholes which *become parts* simply by virtue of no longer being individually counted as one; to be a part is simply to be a *part* of something which is counted as one. Accordingly, wholes designate mereological frames of reference; any part ceases to be a whole *in the same mereological*

frame of reference as the whole of which it is a part. Our intuitive feeling for the countability of parts is purely a function of a natural disposition to change mereological frames of reference according to the demands imposed by interaction with the world. In this process, wholes can be dissolved into their parts which each assume the status of a whole in a different, lower-order mereological frame of reference. In an ascending process, existing wholes become parts of a larger, higher-order frame of reference and are no longer counted as one.

A mereological frame of reference is not, and cannot be determined by parthood considerations. The very act of considering the parthood of a whole entails a change of mereological frame of reference in which the parts are being considered as wholes. It is for this reason that the notion of a whole is mereologically primary and prior to that of parthood. A more detailed analysis of this account of parthood will be undertaken in a later section.

Wholes can therefore be rather arbitrary things. But as much as they might be arbitrary, they are rather rigid. Their identity conditions are rigidly fixed by their membership – their membership, as sets, *is* their identity conditions. You cannot take, add or replace an element of a whole without affecting the identity of that whole. *Ipsa facto*, wholes can come and go quite easily; they are not the sort of thing you should get too attached to. Objects seem to differ importantly in this respect; many of the problems we associate with the identity of objects are grounded in a conflation of the identity of something *as a whole*, and its identity *as an object*. We can allow that objects *might* well have parts that are identity-affective, but beyond those parts, should any exist, the identity of objects seem to survive changes in parthood – at least to some degree. But

what exactly allows tolerance in identity conditions when we move from consideration of wholes or sets, to objects?

2. OBJECTS

In keeping in line with Quine's way of thinking, an object is something that exists. However I will make an additional claim: an object is a mereological whole which is accorded the ontological status of an existent. All objects are mereological wholes. This I take to be both an intuitively and analytically good assumption. However, it is not clear that all mereological wholes are objects. It is notable that some wholes possess properties as a whole, while others have no properties apart from those of their parts. This marks a distinction between existence and non-existence.

The most obvious change in a move from a consideration of just a delineation of parts – the specification of a whole – to that of an object is a matter of morphology. We generally demand that an object should conform to a morphological profile; a profile that specifies, for a specified degree of generality, the composition and properties of the object. The profile provides an account of parts that determines an object with specific properties. Accordingly, the profile can, at a higher level define a kind, and at a lower level a specific individual. Under such a profile, parts are brought into a union, an ontological fusion, where they assume what looks like *structural* identities. This represents a significant change. Most significantly, this seeming structural identity is *relational* – parthood is determined by satisfaction of relations required by the morphological profile. Under the notion of such structural identity, a part can, it seems, be replaced

without affecting the identity of the object *when it preserves the relevant part-to-part relations required to produce properties prescribed by the morphological profile of the object*; when it is *structurally equivalent* to the part it replaces. A part is *structurally equivalent* to another when, if put in identical relations with all other parts, the properties of the object as a whole are preserved.

When considering structural relations of an object, it is important that we do not use the concept of that object as *part of something else*, such as an event, because of the transitive characteristics of the parthood relation. The concept of the first SS100 Jaguar produced in 1936 is the concept of a car *as part of an event* – the production of the first car of its model in a certain factory in Coventry, England in 1936. The parts related to the composition of *that* car are rigidly prescribed by the hard facts about that event in 1936. While there can be structural equivalents for any part of any SS100 Jaguar as an object in its own right, those parts will not be parts of the *historical* object; the first car of its kind produced by the SS Cars company in 1936.

Structural equivalence is identity preserving when the object does not carry any external contextual relations bearing on its identity as part of a greater whole or object. Indeed, for our old Jag to accommodate parthood structural identity which would allow substitution by structural equivalence, the very connection with the SS Cars company, the factory in Coventry, and any similar external relations must also be obviated. We are purely concerned with the object in its own right, *in vacuo*; its history and all other contextual facts cannot be brought into consideration.

Any collector of objects like veteran or classic cars, musical instruments etc. will be familiar with the often tedious debates that can go on about whether the replacement

of certain parts affect the identity of the object – even if the replacement part in fact enhances the quality of the object in some respect. Such debates I believe to be usually a product of a confusion between the structural equivalence of a part, and the object's identity as part of a greater whole such as being produced in a certain place, at a certain time, and perhaps by a certain person.

The mystique of a Stradivarius violin encapsulates this issue well. For centuries, violin makers have striven to produce structural equivalents of the instruments made in the workshop of Antonio Stradivari in the 18th century. The use of the same wood, production techniques, varnish, strings etc. has led to close physical *copies* of a “Strad”, but they are not considered *equivalent* because they do not, under subjective assessment, replicate the same sound. The object must exhibit this property as a product of the internal relations of parts. Accordingly, whatever the relation of parts is responsible for the sound of a Strad, such a relation of parts is required for structural equivalence. Even the production of exactly the same sound, perhaps by some form of discretely embedded digital transducer will not do the job; it must be done the same way as Antonio Stradivari produced the sound in his instruments. The relations of parts, strings, bridge, wooden body and sound-post etc. must be *causally* responsible for the relevant property.

I believe that there are recent copies of Strads with tonal qualities which, under comparative test conditions *including* a genuine Strad, are mistaken for the sound of a genuine Strad. While it is difficult to grasp the notion of a violin sounding more like a Strad than a Strad itself, I believe that if those copies are eventually found, under extensive physical analysis, to produce their characteristic sound by a slightly different causal chain or methodology to authentic Strads they cannot be regarded as structurally

equivalent. They will of course nevertheless command extraordinary prices, but not to the same degree as a real Strad. If, on the other hand, they are eventually found to use the *same* causal chain or methodology as a real Strad then they can be hailed as true structural equivalents; the Stradivarius enigma will no longer exist. Whether they will command the same prices as an original is dependent on whether we regard *being a part of the historical event* of construction in the workshop of Antonio Stradivari, as valuable. And I am sure it will.

There are numerous issues that complicate this sort of debate, especially in relation to enhancements and repairs. I am not sure that they critically bear on the idea of structural equivalence to the point where they demand attention here. What I want to extract out of these observations is simply this: parthood identity for objects is a *structural* concept. The structural relation between parts, at least for physical objects, is causal, and provides for properties of the object as an ontological singularity³. The causal structural constraints on *parthood identity* allows for the possible substitution of parts without affecting *object identity*. Accordingly, objects when regarded independently of their contextual relations to external events and historical states of affairs, do not exhibit the identity conditions of sets. More interestingly, they *do* seem to exhibit the characteristics of functions.

Objects, under this structural perspective behave like a function from parts to properties – properties of a singular entity. As a function, a given object takes structurally equivalent parts and returns the properties of the singular entity defined by its morphological profile. The notion of a part for any given object thereby assumes the

³ I am of course not here using that term “singularity” in any mathematical or quantum physical sense. I simply intend the sense of a discrete, single entity or individual.

function of *a variable which can take any structural equivalent as a value*. The structural relations of parts can then be seen as causal operations on the values assigned to those variables.

If we define an object, a Stradivarius (S) without referral to any mereologically inclusive external relations, as a composition of violin parts in specific causal relations (C) with each other such that they produce a specific tonal or acoustic output (K), then to be a part of a S is to be a part that will preserve K when put into relation C with all other parts of S. Accordingly, any parthood variable in this structure of causal relations, say a bridge, will then be definable as the class of all structurally equivalent bridges – all bridges that when put into relation C with all other parts of S produce acoustic output K.

If we are to think of the conceptual shift from wholes to objects as a shift from mereological sums to ontological functions based on a structuralist perspective of objecthood, then we must accept the idea that such structure is more than just a system of relations. It is a system of relations generating *an output which defines the system as an individual* by the production of holistic properties; properties which cannot be attributed to the additive, common or individual properties of any one or more parts. Perhaps these might be more accurately referred to as emergent or supervenient properties. If the heliotropism of plants is supervenient, or the production of energy by the combustion of fuel is supervenient then I am happy to concede that nomenclature. I am nevertheless wary of the significant philosophical complexities that emergentism and supervenience have developed in recent times in the philosophy of mind, complexities which need not bear upon or benefit this analysis. I am interested purely and simply in the properties which are the *physical effect of causal transactions occurring between parts within the*

structure of objects. On that understanding, I will call them “holistic” properties and allow that such properties might well include supervenient, emergent or any other denomination of properties that apply specifically to an object as a whole.

Why should we expect these structures to exhibit property-productive *causal* structures? Because we are considering *physical* objects, and causal relations are a defining signature of physical reality. Of course, we should allow that physical objects can come into causal relations with other physical objects without thereby comprising a distinct object. Where causal relations between putative parts are not productive of holistic properties, the case for regarding that whole as a physical object is I believe dubious. There is no ontological pathology to suggest that the posited whole is operating as an ontological unit in the structure of the world. Hence, there is a strong sense in which all objects can be regarded as causal events without all causal events qualifying as objects. The causal relations involved in one billiard ball hitting another, as an event, lacks even intuitive objecthood; it is nothing like the continuous atomic and molecular events which make up my coffee cup, or my mantle clock. The event occurs once, exhibits certain properties, and is finished. If we were to suppose such a billiard ball event to be an object it would be difficult to even spatially define or delineate the putative object. We typically expect the causal interactions going on within an object to be temporally extended; a nesting or spatial containment of temporally extended sequential or contemporaneous events. But what is most important in this event-based concept of an object is that containment or nesting is defined and exhibited when it, the nesting of events, is itself *acted upon* by other objects as a singularity, and when it *acts upon* other objects as a singularity. We can and should allow that non-objectival wholes such

as a bag of groceries may exhibit the characteristics of a causal singularity. However, such wholes lack the internal relations required of objecthood; they do not produce properties by virtue of a causally-based structure. I will explore the notion of causally productive relations in the next chapter.

Now, this is a potentially confusing picture. We have numerous causal relations going on *inside* objects, and now causal relations going on *externally*; all playing a part in the attribution of objecthood. But notice that the external causal relations that define the object A as a causal unit acting upon, and being acted upon by other causal units, similarly define it as a possible part of some greater object B. Just as *internal* causal relations of A produce holistic properties of A as an object, so the *external* causal relations of A are part of possible *internal* structural relations producing holistic properties for a greater object B. In other words, by defining A as an object in its own right we seem to similarly define it as a possible part of other objects. This is an important characteristic for what I will later refer to as “existential inheritance”.

Before going on further to explicate these ideas, let me briefly summarise. I have tried to explicate the concept of object as being not that of a mereological sum or a basic cantorinan set, but as an ontological function which takes a mereological sum as an argument⁴, and by causal operations on the members of that sum as structural relations, returns the holistic properties of a singularity. I have argued that these structures are not sums because their identity conditions are not equivalent to their membership. Within the view I have suggested parthood identity is provided by structural equivalence, which effectively constrains and preserves object identity under substitution of parts.

⁴ One might worry that this precludes the notion of a simple object. I will say more on this in a later chapter.

3. OBJECT HIERARCHY AND CARDINALITY SHIFTING

Now every object has a mereological aspect and an ontological aspect. Mereology is a matter of *form*, ontology is a matter of *content*. The mereological dimension of an object is that object considered purely in terms of a whole, a sum. The ontological aspect of an object is that whole considered as a causal structural entity generating properties that make it part of the causal wash of the world. Just as we do not expect first order logic to tell us which propositions are true and which are false, so mereology as a formal structure should not propose to tell us about what exists and what doesn't. Accordingly, although the ontological status of any whole is not, in my view, the business of mereology, it nevertheless forms a metaphysical substratum from which ontology emerges. Objects are wholes, and it is within that form as wholes that ontology must find accommodation. If mereology provides the formal basis for the relationship between parts and wholes, then ontology should assume the task of describing and telling us about what goes on in that relation, it should fill in the content of that relation. With that end in mind, let me briefly return to mereological considerations.

We regard parts, even those as controversial as fundamental particles, as wholes in their own right. Indeed, when we discuss the mysterious denizens of the quantum world, we might just as well be discussing tea-pots. Quanta seem to intrigue us *because* they behave so enigmatically *as objects*. At the everyday level, parthood is not at all particularly distinctive; a car spare-parts shop doesn't need special shelves or any other peculiar infrastructure just because it stocks *parts*.

Of course, if parthood is a purely relational matter why should parts be any different to wholes? Parthood is, it seems, just a matter of how certain wholes relate to, or specifically comprise, other wholes. But this is not as clear as it might seem. All objects are wholes, and a whole is something *we count as one, inclusive of parts*. When something is regarded as part of a whole it is *not* counted as one; it is *part of something which is counted as one*. If a whole is any aggregate we count as one, then how can parthood be construed as a matter of multiple wholes? Why would we count only one whole where there is more than one? What is it that happens when we cross the whole/part boundary and start considering a whole *in terms* of its parts?

It is a commonplace observation that there is something distinctly *hierarchical* about our grasp of wholes and parts. Wholes have parts which become wholes themselves with parts; and so on it seems down to fundamental particles. The hierarchy seems to be a conceptual downward movement *of what we count as one*. We are, in effect, doing *cardinality shifting*⁵ that render parts, the entities of lower levels in the hierarchy, countable as one, and not just *parts of something we count as one*. Under cardinality shifting the world of wholes becomes more and more populous as we move down the hierarchy. If we turn around and move upward in the hierarchy, we inversely diminish the number of things we count as one until we reach a single whole, the world, of which all else is a part. Cardinality shifts are then clearly movements to and from frames of reference within which we do a sort of mereological accounting – the counting of wholes.

⁵ ‘Cardinality’ is not intended to be used in a set-theoretic sense, but just the counting of elements.

When we simply *consider or entertain the idea* of a part of a whole, we engage in downward cardinality shifting. As we move downward we conceptually dismantle a whole at a given level, *and its parts are then regarded as wholes*. Accordingly, we lose the distinctive *inclusive* relation between the whole we counted as one, and its parts *which were not individually counted as one* in the prior frame of reference. In a downward cardinality shift every entity in the active frame of reference is counted as one and becomes a whole; the prior whole is undone into its constituents. Now, as bland as this process might seem, it is nevertheless problematic. How is the idea of parthood preserved in cardinality shifting if these *inclusive* parthood relations are undone? That is, *when the inclusive parthood relation has been effectively destroyed*.

It is at this point that classical mereology takes up the baton and offers partial ordering as the core of the required relation *between wholes* which captures the original parthood relations – or at least provides us with something *like* it. I contend that the partial ordering proposed by mereology, under cardinality shifting, must be essentially *genealogical*. When we simply *consider* the parts of a whole, those parts are themselves conceptually rendered as wholes and assume a child-to-parent relationship with the initial whole, and a sibling-to-sibling relationship with other parts. The idea of a whole with parts has been turned into a family-tree structure of wholes. The *family-tree* structure is distinguishable from an *inclusive parthood* structure of the whole because each member of the family is countable as one, rather than just the prior whole being countable as one. This I take to be the structure that classical mereology proposes; it is not the inclusive model of parthood, it is the structure of parthood *post cardinality shifting*.

And for that reason I do not believe it provides a complete account of part/whole relations.

As already noted, in cardinality shifting from one level to the next lower level, the earlier whole is undone – it is lost, mereologically it no longer exists, its parts which are now counted as wholes have only a genealogical relation to a mereologically deceased ancestor. So if you thought that this is all pretty much reductionism in mereological clothing – then perhaps not. If reductionism is taken to imply an identity relation between different levels of wholes in a family tree then an existing lower mereological level cannot be identical to its higher level ancestor, because that ancestor no longer mereologically exists. But that is another debate.

Now, there is nothing anomalous about this process; families are good things. In the context of a cardinality shift this process has a very well defined purpose. A downward cardinality shift requires the rendering of parts as wholes in order to obtain a movement to the next lower frame of reference. The wholes at that next lower level will maintain a normal *inclusive* parthood relation with their parts, but now everything above that level will be wholes *in genealogical family-tree relationships*. In other words, cardinality shifts maintain or preserve *inclusive* parthood relations *at or below* the active mereological frame of reference, and create genealogical relations *above* it. This process is predictably reversed in an upward cardinality shift. Families of wholes disappear as they are gathered into a parent-whole and reassume inclusive parthood relations with that whole. Ultimately all wholes are gathered into the one parent whole, the world, and assume inclusive parthood relations with the world as a single whole.

I believe that any account of mereology, formal or informal, that does not observe the dynamics of this ebb and flow of parthood and genealogical relations in the process of cardinality shifting, omits a very significant feature of our instinctive mereological interaction with the world. It is a simple and familiar process, no different in principle to disassembling something on a workshop bench or perhaps the kitchen table. We start off with a whole and as you remove bits and put them aside, eventually you have a pile of wholes on one side, and the remainder of the original whole on the other. The remainder of the original whole still has its parts in an inclusive parthood relation, but the removed bits are now wholes in their own right with an ancestral relation to the original whole. You started off with *one* thing on the table, now the number of things on the table you *count as one* has increased by the number of bits you have removed. On a purely conceptual level, this is analogous to the effect of cardinality shifting.

I know there are some obstinate metaphysicians who would insist that their car still exists when it lies in a completely dismantled state on the garage floor. I think this is a matter of confusing the existence of the original car with the existence of a genealogical relation between those parts and the original car. Genealogically it can be rightly said I have a great grandfather – *even though he no longer exists*. Perhaps we think of the original car, which no longer exists, in just this sense. Comprehensively dismantled cars are I think much like marriages. There is no sense in which a marriages still exists after it has been dismantled by divorce. Try completely dismantling your partner's car; you will probably come to see the close similarity between the two.

4. EXISTENTIAL INHERITANCE

Cardinality shifting has clear ontological implications when we move to considerations of this hierarchy in terms of objects, the wholes which we take to comprise the physical world. A cardinality shift from wholes, to parts *as* wholes, carries with it a transfer of the ontological status of the object to its parts, which allows those parts to shift down and become objects in the next lower level of the object hierarchy.

If the world is *assumed* to be an objectival whole, an object – and that seems a fair assumption given the pursuit of unified field theory or a “theory of everything” – then cardinality shifting will presumably carry objecthood from the highest level, the world as an object, down through each lower level of objects to fundamental particles. We might call this transfer carried by cardinality shifting, *existential inheritance*. It is the inheritance of existence through the bequeathing of *objecthood*, the passing-on of object status, from parent-wholes to child-wholes in the genealogical family-tree structure forced by cardinality shifting.

Now, cardinality shifting, as you might now be aware, is not a metaphysical notion. It is the imposition of a *mereological* structure onto the world of objects. It allows one to interact with a section of reality, to give character to an object in terms of composition and decomposition. What might then be perplexing to some is how existential inheritance fits with cardinality shifting given that it seems plainly metaphysical. The answer is that ‘objecthood’ isn’t passed down the line in a metaphysical sense, but only in a mereological sense of establishing, or defining a mereological frame of reference; a domain of wholes that serve as the values of bound

variables in quantified statements. That is, the passing down of ‘object-status’ doesn’t determine what things are objects *per se*, but instead what things are to be *counted* as objects in a given frame of reference. In other words, under the conceptual framework of cardinality shifting, the notion of existence operates as a means of defining a domain of object-wholes that explains the relation between levels of cardinality shifts: the genealogical relations that bear between child-wholes to parent-wholes, and sibling-wholes to sibling-wholes.

The parts of an object – prior to cardinality shifting – subsist as purely structural relata in the form of non-objectival wholes. The properties of that structure as a single entity are the holistic properties generated by the causal relations *between* those relata. On a downward cardinality shift, those relations of parts are conceptually undone, dismantled; the newly acquired object status of any part now depends on it possessing the *internal* properties required of an object: *its* parts must now produce the holistic properties of an object. If a part cannot satisfy that requirement then the process of cardinality shifting stops. Existential inheritance does not proceed. The parts in question fail to achieve objecthood, existence.

Now how does this connect with our old 1936 Jaguar and Stradivarius violins? It is this: downward cardinality shifting is the process of parts, *as object variables*, taking values – ontological values. In an inclusive parthood relation, the notion of a part is that of an *object variable* which under the constraints of structural equivalence can take one or more values. In taking a value, by downward cardinality shifting, the object variable assumes the status of a physical object by forfeiting a purely relational parthood relation to its object-whole and assuming internal structure. It is now countable as one; as an

object it exists in its own right with its own object-variables as inclusive parts. Parts are mereological *wholes* acting as ontological place-holders for *objects* under the constraints of structural equivalence.

Parts in this structural sense are purely mereological entities. Unless a part is *essentially* a part, it is objectively an object which is *mereologically* functioning as a non-objective whole. That is, the only properties relevant to its parthood are extrinsic, relational. Let's say I ask you about the parts that make up your university⁶ you might typically tell me about the functional elements of the university, administration, academic departments, the student body etc., and how they relate to each other so as to comprise the university. If you assiduously stick to that level of generality, you will not venture into the internal machinations of administration or any other section, but rather describe how administration functionally relates to those other parts. Accordingly, administration and the other parts, *qua* parts, are given as purely structural *relata*. They are object variables that could be filled with anything that satisfies their structural functions. If you then go on to tell me about the internal workings of administration in your university, you will have done a cardinality shift that isolates administration as a whole and endows it with characteristic internal relations of parts. Administration as a structural object variable will have assumed a value by the endowment of its own internal structural relations in the manner of an object. Now let me quickly add that I don't regard universities, in these terms, as *physical* objects, they might be better described as *institutional* objects, but because they are structural entities their parts,

⁶ If you did not know, the etymological origin of the word 'university' is the Latin term *universitas*, meaning "a whole".

within any given frame of reference, take on structural identities until cardinality shifting reduces them to objecthood at a lower frame of reference.

Are there entities which are essentially parts? Well, consider the lowest mereological level, the realm of fundamental partless entities or particles. Hopefully you can sense a problem with the concept of these particles as objects. The fundamental particles of theoretical physics have no parts and therefore no internal causal relational structure; their properties are entirely extrinsic. Ladyman and Ross express just this point:

“Both [quantum mechanics] and relativity theory teach us that the nature of space, time, and matter raises profound challenges for a metaphysics that describes the world as composed of self-subsistent individuals. In so far as quantum particles and space-time points are individuals, facts about their identity and diversity are not intrinsic to them but rather are determined by the relational structures into which they enter... [A]ll the properties of fundamental physics seem to be extrinsic to the individual objects (Ladyman and Ross, 2007, p. 151)

Their lack of pathology required of objecthood *is more than functional – it is actual*. They are *essentially* parts *because* they are *not reducible to objects* by cardinality shifting. If objecthood is an ontological function which takes a mereological sum as an argument, and by *causal* operations on the members of that sum as structural relata, returns the holistic properties of an ontological singularity, then fundamental particles cannot be

objects. As counter-intuitive as it seems, this presents us with, I think, a potentially appealing view of the mereological hierarchy of physical reality; at the bottom we have fundamental parts as *essential* parts, at the top we have an *essential whole* – the world, and in between, wholes which can assume parthood *or* objecthood depending on our mereological frame of reference. The world is *essentially a whole* because as the totality of parts it cannot itself be a part. In saying that, I am of course denying the highly questionable concept of improper parthood, where a part counts as a part of itself.

You might say “Ok, why not just accept these kinds of particles as a limiting case of objecthood? We all know and accept that many limiting cases lack the properties of their typical instances. Just look at the concept of a geometric point as a mathematically degenerative limiting case of a circle – it doesn’t even have a radius. Perhaps fundamental particles could also be regarded as degenerative limiting cases.”

Being the charitable person that I am, or would like to be, I will concede that option – but it comes at a cost. If fundamental particles are allowed the status of objects without internal causal structure, then how are we to account for their holistic properties as an object, as an ontological singularity? Do we really want things in the physical world for which we have to say *that there is no causal story behind their properties?* Do we surrender causal closure of the physical world for the sake of allowing fundamental particles in as limiting cases for objects? I’m not sure that is such a terrific deal. Perhaps as good and faithful physicalists we really should accept purely structural non-objectival entities at that bottom of the object hierarchy if only to preserve causal closure. I will have more to say on the notion of a fundamental object in my discussion of Mereological Nihilism.

5. PROTO-OBJECTS, EXISTENCE AND REFERENCE

What is the ontological status of wholes that lack objectival properties? The short answer is they must be denied existence. That is not to say that such wholes somehow blink in and out of existence for lack of properties, or take on a shadowy Meinongian quasi-existence. It is to simply say that the ontology of a non-objectival whole is merely the ontology of its parts, the things of which it is an aggregation. Non-objectival wholes, let us call then “proto-objects” for convenience, do not impact on the ontology of the world. There are no more or less existents in the physical world with the positing of a proto-object. Indeed, why should there be? After all, the positing of a proto-object is nothing more than a delineation, by one means or another, of a group of things in the world. We can *refer* to such proto-objects, we can even name them, but in so doing we do not imply the physical existence of anything but the constituents of the proto-object.

With a certain degree of perhaps melodramatic spin, proto-objects are literally things that don’t exist. While I hesitate to venture that all attributions of non-existence relate to proto-objects, I am nevertheless sceptical that we have a fully articulated alternative concept of non-existence. The null or empty set *should* do that job, but set theory is typically silent on the nature of sets minus members; so to explicate the non-existence of any membership as an empty “we-know-no-what” seems to indicate an explanatory shortfall. This is not to dispute a need for the concept of the empty set; set theoretic closure under intersection where there is a lack of a common member demands the empty set – but it does not explain it, it does not tell us *what* is empty or null.

If we suppose that a set, at least in a naive cantorian form, is nothing more than the concept of a whole, then the intersection of say, the set of all equine creatures, and the set of all winged creatures yields a proto-object, a non-objectival whole. That whole, an aggregation of parts comprised of the corpus of a horse and a set of wings, fails to achieve physical objecthood through the requisite causal relations. What set-theory prescribes as a set devoid of any physical member is a non-objectival whole possessing the *parts* required of an object to satisfy membership of the intersection of the two sets. It is in just this sense that we can agree that the null set is *ontologically* empty, but in specifying the *parthood* conditions required of any object in that intersection, we specify and posit a purely mereological, non-objectival whole.

What should be noted here is that the proto-object is logically independent of a morphological profile. We can apply a cardinality shift without applying a profile. This is what I take formal mereology to be about; the relations between parts to a whole *independent of a morphological profile*. That is, the necessary and sufficient conditions for wholes or proto-objects. We might say that a cardinality shift produces a proto-object which the morphological profile *completes* as an *object*. This is not an entirely baseless distinction. There are things which do have parts, but lack any concept that prescribes the relations of those parts to form an object. A simple cantorian set might thus be such an entity. Indeed I would venture that the very notion of a set, as standardly accepted, itself is nothing other than a proto-object. We do not produce an object by giving the product of cardinality shift, the proto-object, a name or ascribing it a type/kind. Claiming that sets are objects because they have a concept, namely that of a set, to define their objecthood is a questionable enterprise. The cantorian definition of a set

assures us that we are dealing with the concept of a proto-object. Defining a proto-object – a product of cardinality shift – as being of this or that kind is purely a *referential gesture* – a way of linguistically distinguishing entities produced by ontological cardinality shifting. There are considerable consequences that flow from this analysis.

Proto-objects are incomplete business. They are the genetic seeding of an object. To posit a proto-object without an object-concept is to produce ontological residue of an (intentionally or otherwise) incomplete process. Objects are a function of morphological profile and proto-object, if either of these are lacking, an object fails to realise – it does not exist.

6. OBJECTS OF REFERENCE

We can and do refer to proto-objects. Whenever we refer to the parthood of an object we refer to it in terms of a proto-object. Whenever we refer to a simple collection of things like the contents of a desk drawer, we refer to a proto-object. Indeed the mechanics of reference seem indifferent to whether we are using language at a purely mereological level or an ontological level. It is then no surprise that we have predicates like “exists” which serve to make the distinction when required.

Quine gives us a very compelling account of existence claims in terms of the quantifier ‘ \exists ’ as a logical operator, which lifts much fog that had settled around “exists” as a logical predicate (viz. the Wymann and McX discourses). But “exists” is a perfectly good, if maligned, logical predicate. In any assertion where existence is predicated of a logical subject or singular term, the objectival status of the logical subject *qua* proto-

object is flagged. In this sense, it is correctly interpreted in logical form by the existential quantifier.

Quine's slogan "to exist is to be the value of a bound variable" is correct, if only because the domain of the existential quantifier is, for Quine, the universe of objects – everything that exists. But the job of the quantifier is not to adjudicate on what exists, that has already been decided on by the particular metaphysics which defines the quantifier's domain; it is to assert the existence of something which satisfies an associated predicate. To be the value of a bound variable is to be something *amongst everything that exists*, which satisfies the predicate associated with the quantified expression.

The existence predicate, like any predicate, partitions the things which do and do not satisfy it. Accordingly, the existence predicate will separate objectival wholes into its positive extension and non-objectival wholes into its negative extension; it is the partition of the positive extension which existential quantification presupposes in order to define its domain of existing things. The partition of wholes provided by the existential predicate thereby follows the distinction between purely mereological wholes and ontological wholes. By negation the predicate enables the singular term to secure reference to non-objectival wholes in expressions like "Pegasus does not exist" by picking out proto-objects in its negative extension. Pegasus, in the negative extension of the existence predicate is that aggregation of parts which fail to achieve requisite causal relations to yield the flying horse as an object – in Quine's terms, it fails to yield something which pegasizes. I will say more on this in chapter 6.

7. GENEALOGICAL RELATIONS AND REDUCTIONISM

There is something slippery about the notion of proto-object parthood that I have presented here. This notion of parthood, and *not* the genealogical relations that are formed by cardinality shifting, seems almost too elusive to grasp. Indeed it is; you cannot consider the parts of a whole without a cardinality shift – and that transduces the parthood relation into a genealogical form. It is perhaps a little like trying to work with the concept of energy without converting it into kinetic, thermal or electrical units. The nagging question is of course: why not? The short answer is that when we define a proto-object we decide, determine or simply deem that it will be counted as one. The act of considering a part as an entity in its own right breaks that covenant and dissolves the proto-object into wholes. Parts of the proto-object each become countable as one in familial relations.

As indicated above this process does not get rid of proto-objects *en mass*. It transduces the proto-object into wholes at one level and above in the hierarchy. A wooden table is a simple example of a proto-object. If we consider the parthood of the table in terms of lengths of wood, the whole proto-object is dismantled into wholes comprised of lengths of wood – each length of wood a proto-object in its own right. If we consider the parthood of the lengths of wood in terms of wood-fibres, each proto-object is dismantled into fibre-wholes – each fibre a proto-object in its own right, which like the previous lengths of wood which were dismantled by a cardinality shifting down to fibres, can be further dismantled by cardinality shifting down to say, molecules. At every level, the wholes created by cardinality shifting assume a sibling relation with each

other, and a child-relation with the previous level. The original table thus becomes the mereological progenitor, or original parent of all subsequent levels of cardinality shifting.

This is probably so obvious as to be barely worth discussion. We are all more than familiar with the standard conceptual mechanics of reductionism. The point I want to reiterate here is that the parthood provided in genealogical relations is not the parthood relation that underlies the notion of a whole assumed in existential quantification or predication. When we consider parts in terms of wholes we break the original covenant which was used to define the proto-object. The resulting dismantling of the proto-object means that we lose the framework for objecthood, for existence. Therefore, if that proto-object had attained objecthood, it is lost under cardinality shifting and passed on to its parts. It is in just this sense that the familial relations approach to parthood must be genealogical; the parts are always orphans. They are parts of a whole that no longer exists. And by my lights, if a whole no longer exists it seems rather perverse to speak of it having parts. Hence any notion of parts in the genealogical sense is about wholes that have only an ancestral relation to another whole which does not exist.

Is this really just a storm in a tea-cup? Perhaps. Our propensity to constant and almost instantaneous upward and downward cardinality shifting in our considerations of parthood relations for an object make the mechanics of the process quite inconspicuous, if not invisible. However, it doesn't matter how quickly or naturally we undertake upward and downward cardinality shifting, the point remains that our intuitive, and I believe correct notion of parthood is embodied in the unshifted parthood that exists in

any proto-object, and not in the genealogical relations of wholes that ensues from a shifting. This is not an entirely inconsequential perspective. Any reductionist who wants to claim that an object *is* just its parts, usually its fundamental parts, and who implies an identity relation between those parts and the whole in question, is asserting the unlikely thesis that there is an identity relation between certain existing wholes and the non-existent parent whole. If an identity relation can hold between things which exist and something which does not, then well and good. Otherwise the idea is patently false.

8. MEREOLGY AS A CONCEPTUAL EXERCISE

Non-objectival proto-objects are purely mereological and not ontological. Mereology is a conceptual exercise which intersects with reality only in cases of the successful anticipation of objects. There is much time and energy wasted in the search for mereological relations in reality. The real world, the physical world, does not have mereological relations; it has *physical* relations e.g. spatial, causal etc. That is, objects in the world stand in physical, not mereological relations to each other. The idea that we can somehow discover a distinction between parts and wholes in some objective sense is simply misguided.

There is no physical relation which corresponds to the mereological relation of parthood. There are objects which are joined to, or connected with, or contiguous with, or interior to, or external to other physical objects; but none of these physical relations are necessary and sufficient for a parthood relation.

Consider the parts of a non-objectival proto-object. Any relation of those parts to each other can be purely accidental because their relation to the proto-object whole might be just a matter of arbitrary delineation. Parthood for these objects cannot be any more than possible ways of dividing the whole into other wholes. Accordingly, parts are *possible* and not actual wholes through decomposition. I say *decomposition* because the notion of part makes little if any sense in the absence of a whole, therefore any consideration of parthood implies the *possible* decomposition of an existing whole, not into parts, but into wholes (viz. cardinality shifting).

The alternative compositional view of parthood is difficult. To posit wholes as parts in a compositional process seems to necessitate a conceptual whole; a whole that until physically completed does not actually exist. The only way of making sense of this actual-part-to-conceptual-whole-relation is to render it counterfactually. That is, if the whole *were* to exist (be completed) then the compositing wholes would stand in a part relation to it. However, once again we have moved into possible worlds. This time, rather than parts being wholes in a possible world by decomposition of an actual whole, we have wholes in the actual world as parts of a whole in a possible world.

Is parthood then a physical relation? The fact that it involves modal relations counts against that. To be a physical relation is to be a relation between physical things. I can think of no physical relation which is not a relation *within* the actual world. I will further discuss physical relations, or more specifically *types* of causal interactions, in the next chapter; these interactions gives us an understanding of composition and decomposition without the notion of parthood.

9. NATURAL AND ARTIFICIAL OBJECTS

To this point, proto-objects and morphological profiles have been the product of human invention; artificial objects. The alternative notion of “natural” objects is more elusive. Initial perceptual prompts seem to present us with a ready-made proto-object. The perceptual grounding of the proto-object may or may not include the attribution of parts, and almost certainly does not provide a morphological profile. The proto-object is not an intellectual construction (e.g. a chess set or a car); it is something which is countable as one purely on *perceptual* or *observational* grounds; and it is here that we enter the realm of ontological commitment.

Ontological commitment is a belief about a phenomenal individual; it is the belief that the individual provided by the phenomenal proto-object is more than a phenomenal entity, that there is an morphological profile that completes the requirements of objecthood for the individual. Science attempts to “discover” this profile in the form of physical theory, namely in the form of *natural kinds* (i.e. atoms, molecules, and the like). Science thereby validates or invalidates our ontological commitments. The question that arises in this scientific enterprise is precisely which relations should hold between elements of any proto-object in order to comprise a natural object? After all, there are relations which hold between any two things in the universe. This is in line with what Quine tells us about the movement from phenomenalism to physicalism or objecthood.

“[a] physicalistic conceptual scheme, purporting to talk about external objects, offers great advantages in simplifying our over-all reports. By bringing together scattered sense events and treating them as perceptions of the one object, we reduce the complexity of our stream of experience into a manageable conceptual simplicity” (1948:17)

Science is involved in the practice of developing ‘natural’ concepts. These are morphological profiles that explain the physical relations and objects required to produce a natural object with natural holistic properties. I will now discuss such relations.

Causal Interactions

There is something to observe here, that lies under our noses. It is little attended to, and yet still so obvious as to seem trite. It is this: causality consists in the derivativeness of an effect from its causes. This is the core, the common feature, of causality in its various kinds. Effects derive from, arise out of, come of, their causes.

G.E.M. ANSCOMBE

1. OPENING REMARKS

In what I have proposed so far, my account takes objects as the basics of existence; functions from parts to a singular entity defined by a morphological profile. However, being interested in the physical world, I take the Wittgensteinian view that the world is the totality of facts and not of things, and to this extent an account of relations must be given. I have suggested that parts of a mereological sum must bear causally-productive relations to bring about the assembly of novel object. What is unclear is the nature of this relation. This chapter investigates this curiosity.

2. CAUSAL RELATIONS AND FORCES

Metaphysicians of causation concern themselves with two questions: In virtue of what relation does something produce an effect? And, what should be said to be the things that bear this relation? The former question aims to provide the nature of a causal relation, where the latter attempts to discern causal relata. It is fair to say that theorists standardly accept that *events* best serve as causal relata. This has, of course, been met with resistance, with some theorists opting for other types: facts, features, tropes, states of affairs, situations, and aspects. While it might be unfair of me to forego the vast literature on causation, I can only be apologetic, for the stalemate between theories creates an air of suspicion concerning the concepts involved.

Consistent with the *biff*-theorists, I believe that causation is a concrete relation, a physical *interaction*, and the nature of such a relation, or interaction, will be the subject of this essay; I will not venture counterfactual accounts. Where I part ways is that I do not seek to explain this relation by appealing to conserved quantities. According to this view, causation occurs at the intersection of two casual processes – the world-line of an object which possesses a conserved quantity – involving an exchange of such quantities (i.e. mass-energy, linear momentum, and charge) (Fair, 1979; Salmon, 1984; and Dowe, 2000). A world-line tracks the points on a space-time diagram which represents the history of an object, and it is this 4-dimensionalist spin that I wish to avoid committing myself to. This not because I wish pledge my allegiances to endurantism. Whether causal relata is best served as events, in particular temporal events, is not my concern. What I take as a non-controversial point, as a matter of intuition, is that we cannot get

away from discussion of *objects* in our accounts of causal interactions, whether objects serve as causal relata or else figure in the details of events.

If this is right, that causation has some bearing on ontological issues, the composition of reality, seems hardly surprising. For the physical world, causation is the engine of all change; and despite what seems to be a matter of intractable conceptual opacity for metaphysicians, the notion of causality represents a watermark of physical reality in a conceptual scheme or world-view grounded in empirical sciences. My interest in objects as the subjects of causal relations is because as a physical phenomenon, causation is fuelled by forces (i.e. gravity, electromagnetism, strong and weak nuclear force) and forces act on objects according to salient properties such as mass or charge. It seems to me that if anything at all has a claim to objective existence it is those things subject to natural forces; those things which are amenable to causal relations.

I take it as simply uncontroversial that physical forces only operate on things that exist. But having said that, one must be careful to recognise that a relatum of any causal relation, if composite, will have causal forces operating within it that render it causally monadic. Any stray atoms of oxygen and hydrogen do not comprise a molecule of water; we require bonding forces to produce a molecule that can enter the causal wash of the physical world as a causal monad, a singular entity. H₂O molecules can be bumped around in various causal interactions because they have internal causal interactions holding atoms in the typical H₂O configuration. Accordingly, there is a great deal of difference between any random oxygen atom and any two stray hydrogen

atoms being individually subject to causal forces, and a water molecule being causally related. I take the idea of a natural object to be causally monadic in just this manner.

By virtue of having certain properties, such as mass and charge, forces act on objects to produce change in properties. Insofar as identity is properly related, we should therefore expect that objects under the influence of forces in the theatre of causation may have identity-affective changes brought upon them. Indeed we can broadly partition causal relations as identity-preserving, identity-destructive, and identity-productive, and I will have more to say on this later on.

On the basis of these partitions, and I call them partitions because they are not merely linguistic distinctions, I hope it is evident that the causal theatre of the world is not always simply a matter of things bumping into each other and then continuing on their merry-ological way. The natural forces inherent in causation can have ontological ramifications. A counterfactual change in the laws of nature is not something we can always confine to how things behave, it can change the very things that make up the world. A counterfactual change in the rate of universal attraction does not just mean that things will weigh less or more; it may mean that things that owe their existence to the actual rate of gravitational attractive may no longer exist. I am not simply suggesting that things would physically fall apart under a lesser rate of gravity, even though there might well be such cases, I am suggesting that the possible failure of subtle and life-critical biochemical processes that, by the machinery of evolution, have come to depend on a rate of gravity. No doubt many zero-gravity space-station experiments are designed around this kind of concern. In short, nomologically divergent possible worlds cannot be assumed to be ontologically consistent with the actual world; if forces that are

responsible for the composition of objects varies across worlds, then with such variance brings different kinds of objects.

Natural objects as causal monads are functional structures, systems. They are not causally isolated from the world around them, they interact with that world as units, singularities, just so long as their internal systematic integrity is not compromised by the external forces of the world around them. It is in this sense that our concept of natural objects represent, to borrow Leibnizian terminology, the ebb and flow of a causal monadology that we call *ontology*.

If the question of what exist is in the main part about compound entities, and natural composition is taken to be a product of physical processes, then it seems to me that we should expect to find evidence of an interesting intersection of identity and causality in the interactions of individuals.

Let us understand a causal *relation* to be any relation holding between two or more objects *just in case that relation is expressible in terms of a measurable physical force*. The concept of a physical force need not be abstractly or generally defined; it can be any one or more instances of the following types: electromagnetism, gravitation, strong and weak nuclear force.

Intuitively, force is inextricably linked to the concept of causation, because causation is a matter of change, and physical change is always a function of one force or another. Billiard balls hitting each other, an apple falling on Newton's head, or simply the misfortune of you or I catching a cold are all instances of causal interactions, and all instances of natural forces working between objects. Without forces there is no causation, and without causation there can be no physical change in objects. Indeed our

very notion of force, at least point source forces, is given in terms of a rate of *change* usually expressed in a form of the inverse square law.

But if causal relations *are* just the operation of forces on objects, it then seems perverse to say that gravity itself was the cause of the apple falling on Newton's head. We are naturally inclined to say that gravity must in some sense be a cause because we regard the falling apple as an effect, and causes precede effects. But notice that we have now subtly moved from a consideration of a causal relation to the notion of a cause. Causal relations are an *incorporation* of causes and effects; accordingly we have to distinguish *within* causal relations, effects – the operation of forces on objects, and the idea of something which precedes that operation – the cause.

There is only one candidate within the causal relation – the mere connection of the objects within the causal relation. In other words, a cause can be nothing more than the *relating* of objects in a causal relation by a specific force, the effect is the event or physical *product* of that relation. For Isaac Newton, the relationship between the earth and the apple, provided by gravity given the property of mass possessed by both objects, is the cause of the apple falling.

This does not tell us why some relations are object-forming and others are not. An apple descending towards the earth is a distinctly different type of causal interaction than the bond that holds atoms together, though both are nevertheless products of forces – the cause, in both instances, is the relationship between the object's involved provided by some force. If the cause is the relating of objects in a causal relation by a specific force, it does not seem so unlikely that there are different ways objects can relate to each other, under the bounds of some force.

This is to say that, for any theorist interested in a full description of causation, an adequate theory will explain all the relevant facts. The apple and the Earth, related by gravity operating on the masses of each object, causes the apple to fall, yet the *interaction* does not constitute the formation of a new object. The electrons of two hydrogen atoms, when in a specific spatial proximity, bond in an object-forming relation, provided by electromagnetism. What explains the differences between these two instances of causation? It might be appropriate to separate the question of causation into three sub-questions:

- (1) What causes objects to interact?
- (2) What kinds of interactions are there?
- (3) What effects are produced?

To question (1), I have stated explicitly that it is the work of forces that cause objects to interact, and I believe that, metaphysically speaking, the answer to (1) determines the answer to (2); the forces operating on objects will determine what kind of interaction is occurring in a given instance. Further, I believe that an answer to (2) determines an answer to (3); the kind of interaction that occurs in a given instance determines what effects are produced. However, from an epistemic point of view, it seems that the properties of a causal interaction are only known to us by observing its effects. That is, there is something that we cannot know about a causal interaction until its effects are known. Thus, it seems to me, by partitioning effects we in turn learn something about causal interactions, namely, what *kinds* of causal interactions there are. This chapter will

focus on the partitioning of effects by the criterion of identity, specifically the identity of the objects involved in a causal interaction. By tracking the objects, we can observe the effects on the identity of the objects to see whether they have been *preserved*, *destroyed*, or else a new object has been *produced*.

I will introduce new causal categories to the conceptual terrain. Objects involved in a causal interaction where identity is preserved I call a *collision*; objects involved in a causal interaction where identity is destroyed I call a *catastrophe*; and lastly, objects involved in a causal interaction where a new identity is produced I call *coalescence*. To some, it may come to no great surprise that bivalence figures in the causal theatre of the world – a causal interaction either preserves or destroys an object. However, it is coalescence that is the metaphysically interesting relation. It sits in a middle ground between the polarities, where it is neither identity-preserving, nor identity-destructive. Instead, it is identity-productive, it is compositional; mereological.

A caveat before I begin. My concern for causation is restricted to the relations that bear between objects in the physical world, and as such I believe there to be no greater means of carving nature at the joints than the natural sciences. Thus, in order to partition effects, I will take a Quinean stance: just as Quine tells us to take our objectual ontological commitments from the sciences, so too should the same be expected for relations. Accordingly, I will utilise examples from the sciences to give justification for the general causal relations that I propose. Under this way of thinking, my investigation of causation can be said to be naturalistic. However, the relations that I propose are not spoken about by scientists, or at least not discussed in the way that I have explicated

them. My aim is to identify cases of causation and distinguish them according to the effects that are produced.

3. COLLISION

A collisional interaction, as ordinarily understood, involves a short term exertion of force by two bodies. It is perhaps the most ubiquitous interaction in physical reality. Paradigm cases of such events extend from colliding billiard balls to crashing cars. A scientific account of collision characterises a collisional event as a short duration interaction that involves a change of motion in the participating bodies due to the forces acting upon them. Collisional events, as given by the sciences, are divided into those interactions that are either elastic or inelastic. An elastic collision between two objects involves the conservation of both momentum and kinetic energy, where an inelastic collision conserves only momentum. Elastic collisions do not occur at the level of macroscopic reality. A collisional interaction between two macroscopic objects will convert kinetic energy to internal energy, and energy of other forms; collisions are typically inelastic at the level of interactions between medium-sized dry objects.

Given this basic understanding of a collisional interaction, we can deduce certain requirements for an interaction to be deemed ‘collisional’. Salmon (1984) characterises a causal interaction as requiring a spatio-temporal intersection between two causal processes which alters the structure of both, and that such processes gain properties that they otherwise wouldn’t have had in the absence of interaction (Dowe, 2008). The kind of interaction Salmon is alluding to, albeit a 4-dimensionalist account, is collision, which

might either be elastic or inelastic, so long as some quantity has been conserved. Though Salmon indicates that there must be a change in the structure of both objects involved in the collision, I believe what is particularly important about a collisional interaction is that it is *identity-preserving*. Accordingly, to amend Salmon's explication, a collisional interaction, at least at the level of macroscopic objects, will involve a spatio-temporal intersection between two causal processes which modifies the structure of both *without affecting the identity of either object*. This does not entail that such interactions cannot change some aspect of the objects, or 'processes', involved, but that such changes aren't so significant so as to affect either object's identity.

Our general familiarity with collisional interactions makes it hardly worth surveying examples. Consider just the common example of two billiard balls colliding with each other; though there might be superficial changes to the qualities of either billiard ball, the impact does not cause either ball to lose their identity as a billiard ball, despite any cosmetic damage that might be inflicted by the collision in an over-zealous application of force. In a more technical example, consider the density of hot air. When, say, the molecules that makes up a body of air interact with a hot ocean surface, the particles start to vibrate and bump into each other, in effect increasing the space between each particle. By virtue of this interaction, the number of particles take up a larger space, decreasing the density of the air as a result. Particles 'bumping' into each are just collisional interactions that have a causal effect but the identity of each of the particles involved in the collision is not compromised by the interaction.

One might respond that there are cases, especially at the lower rungs of reality, where 'collisions' do happen to change the identity of, or at least one of, the objects

involved. It must be noted that I am using the term ‘collision’ in a specific way. Where the term ‘collision’ might be typically thought of as no more than an interaction between two distinct objects, I am using it to define an interaction with an identity preserving effect. However, this does not exhaust all types of interactions by observing effects. When particles interact with sufficiently high kinetic energy, they can be broken into their constitutive components. Further, quarks can interact in such a way so as to produce new objects of different kinds, namely protons and neutrons. These examples are evidence of different types of causal interactions which I believe justify certain distinctions. The former example I will call a *catastrophic interaction*, and the latter, a *coalescent interaction*. Let us first consider the nature of catastrophic interactions.

4. CATASTROPHE

A catastrophic interaction is *identity-destructive*; it is an event involving sudden and significant damage. Though the word ‘damage’ here might seem to be a use of subjective value terminology, my intention is only to convey a sense of the event being identity-affective. Two objects participate in a catastrophic event when the interaction results in the loss of identity in one or more of the objects involved. If we were to consider a shoal of fish as a unit with identity conditions, then the complete dispersal of that unit by the invasion of predator sharks might be considered destructive of that unit through the loss of its identity conditions; this then will constitute a catastrophic causal interaction. Perhaps a clearer case is the shattering of a ceramic mug; the identity of the mug *qua* mug is destroyed in its catastrophic causal interaction with the tiled floor.

Catastrophic interactions typically result in loss of identity through *scattering*. The process of scattering involves an interaction whereby an object loses its identity in such a way that constitutive parts take on a status of independent units, causal monads, in their own right; the composite object is lost. The Large Hadron Collider (LHC) might help our intuitions here. A hadron refers to a composite particle such as a proton or neutron, composed of quarks bound by strong nuclear force. The function of the LHC is to accelerate hadrons to extremely high levels of kinetic energy to facilitate head-on impacts with particles of equivalent kinetic energy travelling in the opposite direction. The by-products of this kind of event are sub-atomic particles with peculiar properties. The aim of this interaction is to identify the properties of sub-atomic particles at high-energies, though this has proven to be particularly difficult given that such levels of energy last for only miniscule periods of time. Though in cases of high-energy interaction a reaction occurs – specifically the transformation of a particle to another – most cases of lower-energy interactions involve the decomposition of particles into its constituents – a proton is broken up into its constitutive quarks. The interaction between the particles is strong enough to break the binding relations provided by the nuclear force. It is in this sense that we might say that a catastrophic interaction is naturally *decompositional*; it involves disengaging the compositional relations that hold composite entities together that subsequently allows an entity's constitutive parts to become causally monadic in their own right.

So far we have discussed causal interactions that are *acompositional* (collision), and *decompositional* (catastrophe), the third type of causal interaction is *compositional*, what I will call *coalescence*.

5. COALESCENCE

At both the microscopic and macroscopic levels of reality, the fundamental forces provide the physical basis of compositional relations for natural objects. Quarks, required as compositional components for protons and neutrons, are bound by strong nuclear force; electrons, which orbit a nucleus are bound by electromagnetism; and gravity is responsible for large celestial bodies such as planets, stars, and galaxies. What is unique in these instances of interactions, is that they do not fit either category of causality as collisional or catastrophic. Collisional interactions fail to provide for composition, and catastrophes are inherently decompositional. Yet, we have a family of interactions that are inherently *compositional*; they mark a kind of causal relation that is notably *property-productive*. This property-productive relation I will call coalescence.

A coalescent interaction is *identity-productive*. Where collisional interactions are identity-preserving, and catastrophic interactions are identity-destructive, a coalescent relation provides the means by which objects come together in a unified fashion, a natural fusion, to produce an object with an identity that is more than just a conjunction of the objects of which compose it. To understand why coalescence requires more than just conjunction, other than the obvious point that conjunction is *not* standardly perceived as an object-relation, consider an example of the properties of water. According to elementary chemistry, we are told that the chemical components of water are H₂O. We are also told that the relational requirement for a H₂O molecule is a covalent bond that holds between two hydrogen atoms and an oxygen atom. A covalent bond is typified by electron sharing, which involves the stable balance of attractive and

repulsive forces between atoms – the specifics of which needn't concern us. The mere conjunction of two hydrogen atoms and an oxygen atom is not sufficient to provide this object-forming interaction. In particular, the matter of stability which is required for bonding pairs, only becomes a factor when electromagnetism comes into play. Conjunction simply fails to capture this requirement.

A particularly interesting example of coalescence is a nuclear reaction. Atoms are either stable or unstable. An atom is stable if the forces binding the particles of a nucleus are balanced, and it is unstable when the nucleus has an excess of internal energy. Particles of like charge repel each other, and those of unlike charge attract each other. In a more complex, stable atom, where there are multiple protons or neutrons, strong force overcomes the force of repulsion between the particles of like charge, and binds the nucleus together. This is called its 'binding energy'. However, when the binding energy is not strong enough to hold a nucleus together, it is said to be unstable. Such unstable atoms are called 'radionuclides', where the instability of a radionuclide's nucleus is a product of an excess of either protons or neutrons. An unstable nucleus will try to reach stability by, *inter alia*, ejecting protons and neutrons. The ejection of these particles is the emission of radiation, which is the disintegration of the nucleus that transforms the radionuclide into different nuclides. This process is called radioactive decay. The decay process will continue until the forces of the nucleus are balanced. In a nuclear reaction between lithium-6 and deuterium, the interaction involves the production of a highly excited, albeit existentially intermediate, nucleus. This interaction is coalescence; it is object-forming, albeit for a short duration. The nucleus then decays immediately into two alpha particles – helium-4.

I have singled out this particular instance of coalescence because it clearly indicates the specificity of relations required for object-formation. The mark of physical coalescence is that it provides identity by virtue of structure – the specific relations which provide the unity of parts. However, not any old relation will do, certainly not conjunction. We cannot simply put objects together and expect that the world will oblige us with a novel entity – the interaction involved is not coalescent. This is particularly evident in the case of nuclear reaction; by putting together protons and neutrons, the binding force that allows for the composition of atoms is disturbed by the repulsive forces of particles with like charge – coalescence requires the admission of binding relations, and in the realm of physical objects this is given by the fundamental forces; strong and weak nuclear force, electromagnetism, and gravitation. That is, coalescence for physical objects is restricted to these fundamental interactions, and it is these relations that are responsible for composition in the physical world.

Now this is not to deny other forms of coalescent interactions. We might consider the binding force of *social objects*, such as marriage, or friendship; and such binding forces might be ‘love’ or ‘affection’, to even the binding force of a legal contract. We might even consider the binding force of *logical* and *mathematical objects*, such as numbers and sentences and these might amount to the logical connectives or mathematical operations. What is important in an understanding of the nature of coalescence is that the relation in its most general form, untethered to any particular domain of entities, is typically identity-productive; where a coalescent interaction occurs it produces an object. However, in the physical world, coalescence takes its form as causation, a causal interaction, and it is to be discussed in terms of *cause* and *effect*. What

distinguishes coalescence in physical reality, as well as collision and catastrophe for that matter, is that it is *dynamic* in its nature. Collisional and catastrophic relations are dynamic because they require movement in order for interaction; there are forces producing motion in bodies that allows the possibility of causal interactions to occur. Moreover, as well as the requirement of the motion of objects to reach a state of spatial proximity for the binding force of a coalescent relation to occur, a physical object will be comprised of objects in motion; from the orbital properties of an electron to a functioning respiratory system in animals; no physical object is entirely static. As previously alluded to, this gives us further reason to believe that conjunction *isn't* a coalescent object interactional relation – it is a static relation, that if it were an object-relation, it would produce mysterious static objects, and the same can be said for any other logical relation; we cannot take logical principles and simply declare them as object-relations, for this would be to make a category mistake, and fails to capture the requirement of physicalism.

6. COALESCENCE AND IDENTITY

Does coalescence reduce to either collision or catastrophe? In the formation of a novel object, do the objects involved lose their identity, or preserve it despite being *parts* of the new whole? In one sense, the objects lose their identity as causally monadic objects and obtain new identities as *parts*; objects, in this sense, obtain *structural identity*. In another sense, the objects maintain their *intrinsic properties* required for the formation and continuity of the novel object of which they contribute to. It seems to me that

coalescence is neither identity-preserving, nor identity-destructive. Instead, it sits in an awkward middle-ground, and seemingly disturbs bivalence that we typically take to characterise the physical world.

Why believe that objects maintain their intrinsic properties in a coalescent interaction? In any instance of chemical bonding, a paradigm case of coalescence, it is the intrinsic properties of objects that enables them to interact under some force. Without these properties (viz. positive charge, mass etc.), objects will not bond. Thus, the identity of objects involved in coalescence are preserved with the properties that are responsible for the formation of a novel object. However, in the formation of a novel object, the objects involved take on new identities that are structural; they are parts of a larger whole.

As was stated before, the mark of physical coalescence is that it provides identity by virtue of structure. That is, objects are not just brought together *arbitrarily*. They are unified under the description of a natural kind, a joint of the natural world. In what I have suggested, objects must conform to morphological profile, and to reiterate, this is a profile that specifies the composition and properties of an object. In other words, the profile provides an account of parts that determines an object with specific properties. Morphological profiles are not prescriptions, but natural descriptions of genuine carvings in reality. And as a further reminder, under a morphological profile, parts are brought into a union where they assume *structural* identities.

If physical coalescence operates under the instruction of a morphological profile, where an object, bound by a coalescent force, loses its independent status as a causal monad, does this entail that the identity of the object is lost? Or, can we say that the

identity of the object is maintained so long as its intrinsic properties are preserved? Answering these questions requires switching in-and-out of objectival strata – mereological frames of reference. The identity of the objects that become parts *do* lose their identity as causally monadic objects and obtain identity as parts, or structural identity. However, by considering an object *independent* of the relations that it bears in the context of a larger whole, we might rightly say that the object has *not* lost its identity – it is *still* the object it once was. This movement between objectival strata I have called *cardinality shifting*. Though, what is important to note is that this flow of upward and downward shifting is a conceptual exercise. The face of an object changes when we consider it in terms of the external relations it bears to other objects, namely parthood relations, and when we consider it in terms of its intrinsic properties – an object. Yet, this is just the way we spell out the conceptual details of an object, and there are different ways of giving character to an object. From a metaphysical point of view, objects *do* bear external relations to other objects under a coalescent force and a morphological profile, and this relation is indeed compositional, yet our *consideration* of an object in terms of *purely* external relations strips the metaphysical substance of an object and leaves only formal properties – object variables. This is what I believe contemporary mereology has fallen into, a conceptual mistake between the metaphysics of objects and a formal investigation into wholes.

It seems to me that the question of whether the object's involved in a coalescent interaction maintain their identity is a red-herring. From a metaphysical stand-point, the only interesting question about identity concerning coalescence is that an identity has been *produced*. Hence, coalescence does not reduce to either collision nor

catastrophe, since neither collision nor catastrophe concern the production, or identity, of *novel* entities.

Structural Identity and Natural Kinds

The notion of kind and the notion of similarity or resemblance seem to be variants of adaptations of a single notion. Similarity is immediately definable in terms of kind; for things are similar when they are two of a kind. The very words for “kind” and “similar” tend to run in etymologically cognate pairs. Cognate with “kind” we have “akin” and “kindred”. Cognate with “like” we have “ilk”. Cognate with “similar” and “same” and “resemble” there are “*sammeln*” and “assemble”, suggesting a gathering into kinds.

WILLARD VAN ORMAN QUINE

1. A THEORY OF UNIVERSALS AND NATURAL KINDS

What has become custom in metaphysics, consistent with descriptive philosophy, is the general view that a fully detailed and exhaustive account of the contents of the world will be given in terms *objects*, and moreover objects that bear *properties*. In the terms of metaphysicians, there are *particulars* and features of particulars called *attributes*. This picture is reasonably clear and, perhaps to most, intuitive. Some of these objects are *natural* insofar as they are not products of human, or social, convention contingent on

mentality – they are part of the genuine furniture of the world. And, what’s more, these natural objects have *natural properties*; an object is natural insofar as it bears *only* natural properties. Again, the picture, as it stands, seems clear: amongst the things that exist are those objects that are mind-independent, that possess mind-independent properties. Now, amidst the assortment of existents are distinct objects that bear *similar* natural properties. From this, we can infer that there are natural groupings, collections of objects with similar natural properties – right? It is this movement that unsettles some philosophers.

A commitment to the similarity of properties can lead one down a metaphysically extravagant path. According to the proponents of a theory of universals, numerically distinct objects can be qualitatively similar by being instances of the same universal property. There are disagreements, understandably, as to how we should characterise a *universal*. One way follows Plato; universals are *abstract entities*, untethered to the causal laws of physical reality, as well as distinct from the fabric of space-time. This is typically referred to as *ante rem* universalism, literally meaning ‘prior to the existence of particulars’. Accordingly, the universal property of redness is existentially separate from all instances of redness instantiated in objects.

An alternative picture follows Aristotle, who responds to Plato by arguing that the extravagance of *ante rem* universalism can be given up in favour of *in re* universalism, which means ‘in the matter of’; a universal property is *entirely* where that property is instantiated. Perhaps the most discussed proponent of this view is David Armstrong (1978, 1989). For Armstrong, universals are concrete entities that figure in the causal wash of the world, and located amongst the litany of physical existents. According to

Armstrong, a universal property is not *sparse* insofar as it is disparately located, instead it is a robust particular that occupies more than one location at the same time.

In what will come in this chapter is broadly in line with Armstrong's picture of the world. Universals, I will argue, are concrete, however their instances are products of structure so far as they are natural. This focus on structure shifts the question of universals from *what properties an object bears* to *how an object bears a property*. Interrogating the former concern, talk of universals presuppose, to some extent, that properties *are* similar. That is, it is taken as a fact that properties are similar and following this the substantive question is where this similarity is located. The latter question will give an account of how a property is produced, and explains similarity in virtue of this property production; distinct objects are said to have similar properties just when they produce a property *in the same way*. That is, objects have similar properties when they are *structurally identical*. Under this way of thinking, universals become a little less mysterious. A property is universal in any instance it is produced by virtue of *the structure of an object*.

By giving an account of universals in terms of property-productive structure, I believe that I also give an alternative story of *natural kinds*. What is it to be natural? I take it that *causation* is the watermark of reality, and accordingly to be natural is to be bound by the forces of causal law. This relates to the notion of kind in the following way: distinct objects belong to the same kind when they produce similar properties in virtue of their causally-based structure. Hence, I do not believe that an adequate account of natural kind-hood is just membership by property similarity; *belonging* to a kind tells us very little about the *nature* of kinds, much to the dissatisfaction of extensionalists. Where a universal is a property produced by virtue of an object's structure, a kind captures the

guiding relations that forms a structure; a kind *prescribes* the relations required to produce a certain property – it is informational, not a static class. This shows the intimate link between kinds and universals: a universal has its attention on outputs, where a kind gives importance to structure. It is for this reason that I will equate kind-hood with morphological profiles: a profile that specifies the requisite causal relations that must bear between parts of an object to produce certain properties.

2. NATURAL KINDS

Naturalism is the thesis that there are classifications that are genuinely natural, non-arbitrary groupings that are part of the working, mind-independent world. Theorists who embrace naturalism have a predilection to accept that the natural sciences performs the role of categorisation better than any other methodology. In other words, naturalists tend to believe that successful scientific theories describe theory-independent phenomena, and in this sense it is in accordance with scientific realism. For the naturalist, there are demands that must be met for a sufficient theory of natural kinds: members of natural kinds should have natural properties in common, and be bound by the laws of nature, where such members must *form* a kind under specified conditions, and this will shape a kind-hierarchy. (Bird and Tobin, 2015).

Contrary to naturalism is the thesis that classification of objects by similar properties is a product of convention, which has been conferred the appropriately labelled *conventionalism*. For the conventionalist, natural kinds do not exist independently of the way theorists talk about them; natural kinds are not naturally privileged.

The contrast between naturalism and conventionalism seems to lie in a difference in attitude. Where the naturalist believes that our theories describe the mind-independent world, and the concepts involved in such a description are reflections of reality's genuine character, the conventionalist holds a pragmatic attitude towards the employed concepts, and views them as only a means to serve a mind-dependent purpose. In what will follow presupposes naturalism; I hold a realist attitude. I will not have anything critical to say about conventionalism, nor will I provide much reason to believe that naturalism is the better theory. Much philosophy depends on presupposition to proceed, and it seems that I have found my threshold, at least in this chapter.

Beyond the question of classification by similar properties is a further metaphysical curiosity about the nature of the classification itself: are we required to quantify over entities we call *kinds*? An answer to this goes in two directions: realism and nominalism. The realist responds to the question affirmatively, and argues that in order to account for classification on the grounds of property similarity, we must also quantify over the class that delineates the objects of classification; the difference between natural kinds goes beyond the mere groupings of objects. The nominalist rejects this ontological bloat. While the nominalist agrees with the realist that there are natural groupings, they deny the requirement to posit the existence of additional entities that are over-and-above the objects that are grouped.

While I reject the realist position, what I will proffer is only approximately nominalist, or at least in the way it is typically understood. I do not believe that all that is required to account for kinds are the objects of classification; there is a story telling us

why they are grouped in this way that goes beyond property similarity. Accordingly, in what will come, I will try to provide this story in terms of property production of a causally-based structure. Hence, I don't think there are entities that are, strictly speaking, natural kinds. The tendency of philosophers interested in kinds seems to be directed towards solely identifying the monadic properties of an object i.e. a table is ascribed the property of being a table independent of the structural aspects responsible for the production of that property. This I take to be a mistake. By focusing only on monadic properties it is no wonder that realism has come to be a viable option on the table. Instead of making the requirements of a kind structural, property similarity invokes additional entities to explain how such groupings come to be.

It seems to me that we can drop classification by property similarity in favour of structural identity: objects belong to the same kind just when they are structurally identical. But how far does this get us? The realist can respond that additional entities are still required: the class of all structurally identical objects. We can avoid this ontological mess by invoking the notion of *interchangeability* as determined by natural laws. The natural laws governing the relations that bear between objects are responsible for an object's structure, *coalescent relations*, and this is a recurring theme throughout physical reality. If these same laws are responsible for objects with similar properties⁷, then objects belong to the same kind if and only if they produce such properties in the same way. Objects produce properties in the same way just when the structure of object A and the structure of object B is such that part *a* of A can be substituted for part *b* of B,

⁷ Under my way of thinking, 'similarity' of properties *does not* determine kind-hood, where structure does. Thus, I can utilise the notion of similarity without the threat of circularity.

and *vice-versa*, without affecting the identity of either A or B. If this is right, then it seems gratuitous to then posit an additional entity that groups objects together as a kind. Objects belong to the same kind when they are structurally identical, and objects are structurally identical when they have structurally equivalent parts. Anything in addition to this seems superfluous. I will come back to this later in the chapter.

3. ESSENCE AND KINDS

This section concerns *essence*; the necessary and sufficient properties for an object to belong to a certain kind. Saul Kripke's (1980) story of essence makes use of ostensive definition in his case for the essential properties of objects. He claims that *this* wooden table could not conceivably be made of ice, or it would not be *this* table. Further, *this* table could not conceivably have had its origin in a different block of wood or it would not be *this* table.

Ostensive definition is an appeal to strict identity unless qualified; it holds all properties to account identity-wise. I cannot conceive of *this* table which has a pin hole in the bottom left corner of its writing surface not having that hole; to do so is to not conceive of *this* table, simply because *this* table *does* have such a hole. If one can so conceive of this table without the hole, then you have already made up your mind about the accidental and essential properties of this table – ostensive definition has not done that job for you; it is a *trivial* essentialism akin to that proposed by Salmon (1982: 166), who suggests that deriving essentialism from a theory of reference is question-begging. If

left unqualified, any ostensive definition of this table will capture all properties of the table for its entire history and wrap them up in a four dimensional concept of *this* table.

To break out of this Leibnizian stranglehold on properties we need to release the concept of *this* table from events of which the table comprises a part. We need to distinguish between the things which are true of the object, and physical properties of the physical object. History is not a physical property of anything even though it is a matter of truths about the object. There is nothing in the physical composition of the table that is its history. There is simply wood and perhaps a variety of metal joining devices such as nails or screws. That's it.

Nevertheless we can still say that *this* table is made of *this* wood and not other wood. Of course, *this* wood is nothing more than wood with certain properties – properties that historically but irrelevantly associated it with a certain original block. *This* wood, for the main part, is comprised of long strings of certain sugar molecules making up the cellulose structures we associate with wood fibres. So *this* wood is just a certain set of sugar molecules in a certain configuration. Kripke's point can thus be made without reference to the history of the material comprising the table. But why should we count this property as essential? Why should we allow that being made of *this* wood is more significant identity-wise than having *this* pin-hole in a corner?

We regard the wood comprising the table as essential because any other properties pertaining to the table at any point of time are attributable to the wood. The pin-hole is a property of the wood, the shape of the table is a property of the wood. It is essential properties that bear the non-essential properties of the object – and that is what it is to be an essential property.

I suggest that the necessity of certain properties advanced by Kripke is the result of an inversion of properties. We invert the relationship between the consignment of wood and its tabular form, the table, by deeming the wood a property of the table. In a very real sense the wood becomes a property of itself; and that is just another way of expressing the necessary relation of self-identity. The table *is* the wood, regardless of whatever we might want to say about its form, so to say it has the property of the wood is to simply assert a necessary relation it has with itself.

The same case can be made for water and its necessary property H₂O. Water, as we have seen, is a property of the bonding of oxygen and hydrogen atoms – a property generated by the causal relations between the atoms. To say that H₂O is a property of water is to take this property of H₂O and make H₂O a property of it. H₂O has become a property of itself. Accordingly, necessity is attributed to the relation.

It is for this general reason that the necessity of certain properties claimed by Kripke is contestable. Intuitively, necessity is always matter of form, not substance. We might argue that a certain structural schema of causal relations between parts is a necessary characteristic of certain kinds or objects, however there is no necessity governing which entities comprise relata in that structure.

Accordingly, the essential properties of an object will not just be a monadic property, or set of monadic properties, and further it is not monadic properties that is responsible for the classification of objects into kinds. The essence of an object which determines its classification is given by its relational properties in the manner of a structure. That is, it is not the monadic properties that we typically take to define a

object that determines its place in a kind, but the structure responsible for the production of those monadic properties.

The benefit of this account of essence is that it avoids begging the question seen when given in semantic terms, i.e. a theory of reference (viz. Salmon (1982)), and further avoids misplacing the burden of essence on the substance of an entity and rightly finds its home in relations; the wood is *not* an essential property of the table (or, gold and the atomic properties, light and a stream of photons, lightning and electrical discharge), the inversion of properties makes necessity a matter of identity, which is a necessary relation, rendering essence trivially true.

4. ESSENCE AND SUBSTANCE

If a given substance takes a given form then that form necessarily is of that substance. Substance cannot be separated from its given form, simply because it is the form *of that* substance. Thus when we speak of a table we are speaking of the wood. Its form as a table is simply a contingent configuration of substance. In possible worlds talk, in whatever world that form of that substance exists, so does that substance. And that seems straightforwardly right. But it is not right by virtue of some strange necessity which attends certain properties – essential properties. It is right by virtue of the table and the wood being the same thing. In other words, as was suggested above, it is simply self-identity with respect to substance that links the wood and the table across possible worlds.

The notion of an essential property construed in this way proceeds rather directly from Aristotle:

“...a given thing seems to be nothing other than its own substance, and something’s substance is said to be its essence.” (2011: 821, 1031a16)

Of course, the concept of substance is a rather generalised, if not a downright murky idea. I am not here concerned with the details of Aristotle’s concept; but rather our usual understanding of the term. As we all know, you won’t discover substance in a reductionist analysis of matter; we simply move through strata of smaller and smaller objects. Perhaps then the idea of substance can be construed as simply *all* that which underlies a given stratum of objecthood. In other words, substance might be considered the totality of structure underlying any given thing. It is in that case a highly homogenised notion of objects, relations and properties. But when we conceive it as such, we can no longer maintain the conceptual priority of substance over objects. We require objects to provide the notion of substance. Objecthood is not an aspect of substance.

Clearly Kripke observes this revised notion of substance by admitting specific substructure as essential properties. H_2O is an essential property of water as a kind, and presumably a particular set of H_2O molecules is the essential property for any given mass of water. In the same way a particular mass of wood comprising a table will have a certain molecular signature as a member of a kind, and a particular set of those

molecules will represent the essential property of the wood that comprises that particular table.

I would conjecture that the further we descend into the ontological strata of substance the less ability we have to make kind distinctions – the more similar things become. If we allow the notion of logically fundamental particles, objects which have no essential properties because they have no substructure to provided parts and their relations as essential properties, variation in kind disappears; there is only one kind – material objects. Kind is therefore a function of substructural complexity in the sense that the greater the possibility of different combinations of parts and relations between them, the greater the possibility of variation in kinds. What is notable here is that a kind imposes a restriction on permissible objects and relations. H_2O is the *covalent bonding* of two atoms of hydrogen and one atom of oxygen. There is no kind which is any two atoms of hydrogen and any one atom of oxygen. And if there is no such kind, there is of course, no such object.

Now this is not simply a matter of there being no name for such a kind. A natural kind requires distinct and identifiable individuals. So out of all the possible couplings of random oxygen and hydrogen atoms, which couplings do we specify as members of the kind? You might say that is an arbitrary matter – it really doesn't matter. Well, I think it does matter because as soon as you make identity conditions arbitrary (with respect to couplings of oxygen and hydrogen atoms) for members of a kind you have denied the notion of a natural kind. Natural kinds are typically couplings (of parts) which are determined by natural forces, through coalescence, which can produce multiple individuals with the same relations between parts – structurally

equivalence. We recognize such couplings by their production of properties; a characteristic that random specification of couplings fails to achieve because random couplings may in fact, and probably will (given the ratio of unbonded to bonded oxygen and hydrogen atoms in the universe), fail to produce any properties.

In this sense, the idea of substance is very much a matter of the individuals which make it up. It is not feasible to extract objecthood from the concept of substance except where substance is explicated as a substructure of objects. Is it then correct to designate substructure as a property of an object? It is clear that parts of something are properties in the sense of that parthood being true of them; they are accordingly *mereological* properties. If we attribute relations between the parts which are sufficient for objecthood, then the property is structural or *ontological*. If we attribute a property which is the causal product of relations between the parts, then the property is a *natural* property.

What Kripke declares as an identity relation between H₂O and water is then the relation between ontological and natural properties. This is possibly mistaken. An ontological property is a purely structural property; it does nothing more than posit parts and their relations. In the case of H₂O this is the covalent bonding and hydrogen and oxygen atoms. Water is the *causal* product of atoms coming into this relation *and producing properties*. To classify this as identity is equivalent to identifying the striking of a billiard ball with the subsequent movement of the ball. In other words, it is the identifying of a cause with its effect.

So why does Kripke's Aristotelian concept of essential properties seem so obviously right in the case of the table, but ultimately wrong in the case of H₂O? First,

the table is not a natural property of its wood; the table is obviously a superstructural fabrication. No one should deny that the table is made of a certain mass of wood that links its identity to that wood. What is important here is that, as a fabrication or manufactured *form of the wood*, it is not a causal product of the structural/ontological properties of the wood. Accordingly, the table's identity relation with the wood – *à la* Aristotle – is unaffected by any confusion of cause and effect relations between ontological and natural properties. What is problematic is the idea that the table/wood relation is the same as the H₂O/water relation.

5. STRUCTURAL EQUIVALENCE

Any natural object has a mereological aspect insofar as it is at base an aggregation of parts, however that aggregation can be distinguished from a purely mereological whole because the aggregation is driven by causal relations.

As was suggested above, we might take any set of natural objects to form a natural kind where the aggregation of substitutable parts is driven by the same causal relations between those parts to produce like properties.

As much as we take natural objects to belong to kinds, any object seeds a kind. That is, the very concept of an object allows that there can be other objects with like parts driven by the same causal relations between those parts to produce like properties. To satisfy the requirements of objecthood is to satisfy the requirements of a kind, simply because the notion of parthood requires only structural equivalence and not strict parthood identity. Object-kind is the tolerance implicit in structural equivalence.

But what is structural equivalence? First consider a simpler concept of functional equivalence. Let's say that a jet engine and a piston engine are functionally equivalent insofar as they both can produce power by the burning of fuel. An electric oven and open fire might be considered functionally equivalent insofar as they both can heat food. Given a defined criterion of function, and a metric for satisfaction of that function, two things are functionally equivalent if they satisfy that criterion to the same degree.

Two things are structurally and functionally equivalent if such a criterion is satisfied in the same way. That is, the way in which they satisfy the criteria by their composition and relations between parts is equivalent. The concept of equivalence can here be explicated as the possibility of interchangeability of parts without affecting the satisfaction of functional criteria to the same degree. (Clearly this does not apply to obsolete parts; any part is obsolete if its omission or absence as a part does not affect the satisfaction of the functional criteria to the same degree.) Accordingly, jet engines are not structurally equivalent to piston engines, and open fires are not structurally equivalent to electric ovens despite their functional equivalence.

Structural equivalence, like functional equivalence is dependent on the satisfaction of certain criteria – as should be expected in any relation of equivalence. For objects generally, structural equivalence can be defined in terms of the production of like properties by the same causal relation of parts. If the same causal relation of parts in two or more objects provides for the same properties then those objects can be regarded as structurally equivalent, at least with respect to those properties.

Now, as was discussed above, this does not gel with Kripkean essentialism. For us, any molecule which exhibits the properties of water and for which the causal

relations between atoms is such that if replaced by hydrogen and oxygen atoms would produce water, we will count as of the kind water. The fact that that structural relation produces water in the actual world by the bonding of oxygen and hydrogen atoms does not preclude the same causal relations with different atoms producing the same properties in worlds with sufficiently variant natural laws. This flies in the face of Putnam's semantic externalism, captured by his 'Twin Earth' thought experiment. Putnam (1975a) imagines a planet, 'Twin Earth', which is observably similar to Earth, where every thing on Earth has a twin equivalent on Twin Earth. Unlike Earth, however, the chemical composition of water on Twin Earth is 'XYZ'. For Putnam, despite the similar observational qualities of the objects, XYZ is not water. The reason for this is because, according to Putnam, water *is* H₂O; the chemical components are distinctly different. Hence, being composed of the molecules of H₂O is *necessary* for being water.

I contest this view. Allowing that structure accounts for the notion of kind entails that if the laws of nature are sufficiently variant, it is possible that water can have alternative chemical compositions *so long as the structure of water is preserved*; so long as all instances of water are structurally equivalent. If what is essential to an object is form and not substance, then preservation of form maintains an object's essence, but only when the natural laws, that dictate causation, are accordingly compatible and produce the requisite property or properties.

However, what are the 'requisite' properties of water? For many, water *just is* H₂O, and that if something fails to have the property of a specific chemical composition then *it is not water*. In other words, water has the property of H₂O *essentially*, thus water is

necessarily H₂O. But, as we have seen, this is to make a trivial claim about the self-identity of water; we invert certain properties to obtain an ‘essential’ property. Structural identity and equivalence does not entail this triviality. This is because the structure of water does not produce the property of H₂O; H₂O is *what it is*. What are the relevant properties of water? Given my interest in physical object means I am only interested in physical properties, why not go to who knows best about water? We are given an extensive list from the sciences: physical state, dissolving ability, density, surface tension, conduction of heat, heat capacity, latent heat of fusion, latent heat of vaporization, refractive index, transparency, sound transmission, compressibility, boiling and melting points. Thus, if these are the relevant holistic properties of which we assess whether something is water or not, then it follows that so long as the laws of nature, responsible for coalescence, that is the life blood that moves objects, are sufficiently variant as well as the salient properties of which forces act upon, then the molecular make-up of water can vary across worlds so long as the relevant properties are produced by virtue of a specific structure. Hence, H₂O is *structurally* equivalent to anything that can produce the relevant properties of water *in the same way* i.e. XYZ of Twin Earth.

An immediate response to this point is that I am confusing *logical* properties and *physical* properties. H₂O is a logical property of water, which is capture by logical identity: all things have the property of being identical with themselves. This concern leaves me unfettered. My interest is in natural kinds, and I take this to be robustly physicalist⁸: physical objects that bear physical properties. Thus, categorization is determined on the grounds of physicalistic concerns. That is, it might be a holistic

⁸ Perhaps notwithstanding consciousness, but that Pandora’s box is something I will steer clear away from in this essay.

property of an object that it is identical to itself, but this is a formal concern, where my interest lies in physicalism: structure and causally-based property-production.

6. NATURALNESS

A benefit of structural equivalence is that we can safely arrive at a notion of *naturalness*: those properties that are perfectly natural – those that carve nature at the joints. Perhaps the most familiar account of naturalness is given by David Lewis in his celebrated paper “New Work for a Theory of Universals” (1983b).

For Lewis, the demand for naturalness is imperative to serve a variety of purposes in his systematic philosophy, none more important than his formative work on possible worlds. Lewis argues that for any actual and possible objects, whether they are fundamental or not, there is a property that such objects have that determines its membership in a given set. Lewis does very little to convince us that there are indeed such things as properties and relations, yet the work that Lewis requires is an account of *degrees* of naturalness which is ultimately employed to serve as semantic values in formal linguistics and moreover the content of mental states.

For Lewis, properties are more or less natural. The *perfectly* natural properties are those that carve nature at the joints, and make for objective similarity, or resemblance, between objects that bear them. Moreover, they are relevant to the “causal power of things”. How do we spell out the details of objective similarity? Lewis gives us the following passage:

“...physics discovers which things and classes are the most elite of all; but others are elite also, though to a lesser degree. The less elite are so because they are connected to the most elite by chains of definability. Long chains, by the time we reach moderately elite classes of cats and pencils and puddles; but the chains required to reach the utterly ineligible would be far longer still” (1999:66)

According to Ned Hall, this suggests the following: A property F is more natural than a property G when a predicate that expresses F can be defined, in terms of predicates expressing perfectly natural properties, more simply than can any predicate that expresses G . (2012).

If this is right, the honest toil of metaphysics is displaced for the mechanistic labour of language. While I am indifferent to Lewis’ suggestion of definability, what I will proffer as an alternative explanation to perfect naturalness is robustly metaphysical: structural equivalence. I agree with Lewis that perfectly natural properties must be relevant to the causal power of things. However, for Lewis, “[a]most all properties are causally irrelevant, and there is nothing to make the relevant ones stand from the crowd” (1999:13). This is where we parts ways. I believe there is a way to make the relevant properties ‘stand from the crowd’. That is, when an object’s properties *are a product of the causal relations operating between its parts*. In other words, the structure of an object, and the causal powers forcing themselves upon parts, generate properties that are defining of that object.

Now, this might not serve the purposes of David Lewis – all well and good. By hijacking Lewis’ notion of perfect similarity, the benefit of this analysis is that we can

define objective similarity, or resemblance, by appeal to purely metaphysical considerations. As was suggested above, if the same causal relations of parts in two or more objects provides for the same properties, then those objects can be regarded as structurally equivalent, and further, those properties are perfectly natural; it is not similarity of properties, but similarity of property-production.

7. MORPHOLOGICAL PROFILES AND UNIVERSALS

What guides the relations that bond objects to form a structure and produce a property or properties? My answer to this is reasonably innocuous: the laws of the nature, forces which dictate causal relations; coalescence. For the physical world, causation is the engine of change, and accordingly there are causal relations that are responsible for object-formation and causal relations that are not. The difference between the two are contingent on the salient properties of an object i.e. mass and charge, that natural forces act upon.

How do the laws of nature, causation, and the production of properties relate to the notion of kind? It is all capture by a morphological profile – the specification of the structural identity of an object that is responsible for the production of novel properties.

My rejection of kinds as entities in their own right means I must tread carefully. From a metaphysical point of view, my commitment goes no further than objects, properties, and causal relations. That being the case, a morphological profile is not something that is ‘out there’, as it were. Profiles are informational descriptions about the physical states of affairs of objects. A profile isolates a section of reality to explain the

metaphysical story of an object's composition and produced monadic properties, and this involves only causation and the salient properties of objects that allows natural forces to do their business. In other words, a morphological profile takes an object as a *world*, an independent individual in which we cease to recognise it as functioning amidst other objects under the bounds of causal law. By doing this, we can explain the internal machinations of the object by analysing the causal relations operating between parts within the object to produce monadic properties; a fully detailed structural description of an object, given by a profile, lays the conditions of a natural kind.

A profile captures the internal machinations of objects, and in a scientific physical system is organised into a conceptual framework, which are written into privileged predicates (kinds) that are subject for scrutiny in light of recalcitrant experience; we might modify the informational description of a profile, which attempts to carve nature at the joints, when experience dictates so.

Given that similar properties pop-up throughout reality, we cannot help but venture discussion on universals. Talk of universals takes for granted a way of thinking of objects that is non-structuralist. That is, we view an object only as bearing a property, or properties, and not the structure of the object that is responsible for such properties. By turning our attention to the structure of a physical object, the shroud of fog that made mysterious the notion of a kind is uncovered also to demystify the notion of a universal – at least for natural properties. Let's contrast alternative explanations.

Take two objects, X and Y , both bearing some natural property Φ . The universalist says, on any account, that the property Φ is instantiated two times. Accordingly, says the universalist, there is something in common between X and Y –

they both bear the property Φ ; how do we explain this similarity? The *ante rem* universalist gives a rather mysterious story of a causally unrelated entity that instantiates itself in reality, and has many instances. The *in re* universalist tells us a more plausible story that the universal property is an object that occupies more than one location at the same time, but this is still a difficult pill to swallow.

This seems to me to be extraneous and cumbersome philosophy. Someone fond of structure, while also keen on outputs, can appeal to structural equivalence to explain similarity, and enjoy the benefit of simplicity and parsimony. That is, objects X and Y that bear the property Φ are similar just in case the parts of X can be interchanged by the parts of Y , where each part maintains its structural placing, and both produce Φ . The structure of the object that produces Φ determines its kind, and Φ is a universal property when it is the ontological product of an ontological structure. In other words, Φ is a universal property because it is *always* produced by virtue of a specific structure.

8. OBJECT AND KIND HIERARCHY

In the criteria for a naturalistic theory of kinds given above, Bird and Tobin state that natural kinds must form a hierarchy. This is not unfamiliar to common thought, and is particularly prominent in the sciences. In the classical Linnean taxonomic system of biological classification, there is a distinct hierarchy: two distinct organisms from different species-kinds belong to the same kind if they are from the same genus. This hierarchical structure is also seen in fundamental physics: quarks and leptons belong to

the higher-order kind fermion, where both have the property of a half-integer spin, and only quarks are bound by strong nuclear force.

An exception to this requirement is found in chemistry, and is potentially devastating, creating an uncomfortable division in the sciences between employed concepts: some carve nature at the joints, others are pragmatic categorisations intended only for abstract and useful groupings, detached from the working world. Bird and Tobin give the example of compounds classified according to functional groups. A functional group is classified on the basis of atomic combinations within a molecule that is responsible for chemical reactions that produce physical and chemical properties characteristic of that group. An example of this is the organic compound *alcohol*, containing a hydroxyl group -OH bound to a carbon atom of an alkyl group or derivative of an alkyl group (Bird and Tobin, 2015). All alcohols go through reactions called esterification: two reactants form an ester; chemical compounds derived from an acid. As a result, for example, hydrogen atoms in an alcohol molecule may be substituted by another functional group, producing a molecule with properties characteristic of *both* functional groups, and classified accordingly: Benzyl alcohol, $\text{C}_6\text{H}_5\text{CH}_2\text{OH}$, is obtained from methane, CH_4 , by replacing one hydrogen atom by an alcohol-forming, -OH , and another by the phenyl group $\text{-C}_6\text{H}_5$ (Ph) (2015). Accordingly, benzyl alcohol is in the position of category ambivalence, but is treated as either an alcohol, or as an aromatic benzene derivative. Thus, “if the hierarchy requirement on a system of natural kinds is correct, then not all these cross-cutting classifications pick out natural kinds” (2015).

This is a complex case, but it is nevertheless problematic for the hierarchy requirement for natural kinds. One way to deal with this problem is to say that cases such as this do not carve nature at the joints. However, it stands to reason why category hierarchy ought to take theoretical priority. A hint of arbitrary division between the concepts that do form category hierarchy and those that don't creep into our minds and provoke suspicion. In the absence of a unified theory of kinds across the strata of the scientific enquiries, it becomes a plausible option to disregard kind hierarchy altogether. Some theorists who have opted out of the hierarchy thesis claim that such a requirement is too stringent for scientific kinds; Khalidi (1998) and Tobin (2010b). I, too, will adopt this sentiment.

Can we preserve the intuitive idea that the world *does* contain a hierarchy? A commitment to structure, and a marriage to property-output, can serve as an alternative account of kinds while preserving hierarchical form, so long as we take on board the notion of objectival hierarchy. This is not a hierarchy of kinds, but an ordering of objects based on mereological considerations.

As was suggested in an earlier chapter, there is something distinctly hierarchical about the relationship between wholes and parts: wholes have parts, of which such parts become wholes in their own right – so on and so forth until fundamental particles, unless the world is gunky in which such movement goes on *ad infinitum*. The conceptual movement downwards is what I have referred to as *cardinality shift*: our attention to a stratum of what we count as one. This involves rendering parts, the entities of lower levels in the hierarchy, countable as one, and not just parts of something *we* count as one. Accordingly, the world becomes more populous the further we go down, and

diminishes when we move up the hierarchy, until we reach the world as a whole. This is a movement between different mereological frames of reference of which we are performing mereological accounting: the counting wholes.

How does this help us? In what I have suggested as a theory of kinds, what is important about a kind is not *just* property-similarity but structural identity responsible for property-production; kinds require structural equivalence. For objectival hierarchy, the structure of objects is imperative. The structure of objects is responsible for the production of salient properties such as mass and charge, of which the fundamental forces act upon for bonding; causation in the form of coalescence. This allows that objects can assume parthood relations and obtain structural properties *as a part* of the structure of an object higher in the hierarchy. The ebb and flow of cardinality shifting relies on the idea that objects can be parts of other objects, and have parts themselves – and this seems an intuitive picture of the world.

The Language of Existence

It is the existential quantifier... that carries existential import. It is the logically regimented rendering of the 'there is' idiom. The bound variable 'x' ranges over the universe, and existential quantification says that at least one of the objects in the universe satisfies the appended condition...

WILLARD VAN ORMAN QUINE

1. MEINONG AND QUINE

Don't let the name fool you, existential quantification is tricky business. Since the formative work of Russell and Quine philosophers have standardly, and fairly, assumed that the role of existential quantification is reasonably clear: it expresses ontological, or existential, commitment – and this has been, for the most part, philosophical convention. In Quine's way of thinking, existential quantification *reveals* ontological commitment. In order to know one's ontology, all we need to investigate are the existentially quantified statements that one affirms. We don't need to look far to convince us that this is right, we can simply look at the form that existentially quantified

statements typically take: *there is some x that is F* or, expressed formally, $\exists x (Fx)$, where ‘is’ expresses *being*. Though, this isn’t as clear as it could be, and we should not let words deceive us. For Quine, it is ordinary usage that serves as partial justification that idioms such as ‘there is’, and cognate terms, are the means that we typically express our affirmations of existence. It is not entirely obvious that this is true, ordinary usage seems to suggest that we quantify over many things we would not want to existentially commit ourselves to, such as fictional entities, unactualised possibilities, certain composite objects, and the like. To discern the nature of quantification, we should instead look at the function, or role, that the quantifier plays in our everyday reference to the external world, and this will determine whether the quantifier is ontologically committing in the way that Quine suggests.

Given that most theorists pledge their allegiances, blindly or not, to the Quinean programme, and assume that usage of the folk idiom ‘there is’ is indeed ontologically committing, it will take some serious work to convince these theorists otherwise. However, it is the task of this chapter to convince these theorists that the role of the quantifier is much more metaphysically modest than was proposed by Quine. I maintain that quantificational expressions such as ‘there is’, and its cognates, can be cashed out in terms of countability; to count something *as one*. This notion of countability is mereological, and is equivalent to the notion of a *mereological whole* as defined by unrestricted composition. That is, a mereological whole requires no more than taking a collection, aggregate, or sum of distinct, non-overlapping objects *as one*, where the conditions of being one is specified under the fusion principle.

In opposition to this thought, I argue that while all objects are wholes, not all wholes are objects, and thus, granted that only objects exist, I do not believe countability is sufficient to determine what exists and what does not. Thus, given that ‘there is’ expresses countability, my interpretation of the quantifier is *purely mereological*, and further logical tools are required to express the existence of something. This is where I believe the existence predicate takes its rightful place in the language of existence; it bifurcates the world into wholes that exist and don’t exist, where the former are objects, and only objects exist.

Though I defend the broadly Quinean line that the concepts of object and existence are intimately linked, most of what I will discuss in this chapter treats existential quantification in much the same way that Meinong does: the notion of existence is not captured by the quantifier. For Meinong, existence is a non-trivial property which features amongst the genuine furniture of the world, where some objects are privileged to be endowed with such a property, and others are not so fortunate. Hence, contrary to the respected tradition most notably defended by Kant, Frege, Russell, and Quine, the existence predicate is required to perform a divisional role – to bifurcate between those wholes that exist and those that don’t. While I do not support the claim that there are objects that don’t exist, it is part of this essay that I embrace the thought that some of our ‘objects’ of reference, individuations of phenomena by ostension or naming, are no more than reference to non-existent wholes. However, contrary to Meinongian thought, despite our ability to successfully refer to non-existent wholes, these wholes nonetheless fail to figure in the domain of entities that *there are*,

ontologically speaking – the Meinongian jungle must be hacked away with Occam’s razor.

2. MEINONG’S JUNGLE AND QUANTIFICATION

Ontology has made its business investigating existence. After Quine, it has been close to philosophical orthodoxy to treat ontology as an enquiry into those objects that exist, where an account of existence is exhaustive with respect to what things there are. Resistant to this thought are those that follow Alexius Meinong (i.e. Routley (1980); Priest (2005); Berto (2012); Crane (2013)). For Meinongians, the field of ontology is not restricted to the set of objects that are endowed with existence, yet our fascination is typically directed towards ‘the actual’; we are prejudice in favour of those entities that share our existential nature. Meinong believed that “the non-real” is not “a mere nothing”, and distinguishes between the existential status of an object (*Sein*), and a set of characteristics an object might have, independent of whether it exists or not (*Sosein*). Hence, the world according to Meinong is vastly occupied by entities that can be distinguished on the basis of their existential status, however non-existence does not preclude entities from bearing certain properties – for Meinong, there are literally objects that don’t exist.

What motivates Meinong’s theory is a methodological advantage that matches the way we ordinarily talk about non-existent entities, and this is in line with a broadly descriptivist approach to ontology (*à la* Strawson’s *Individuals* (1959)). When we refer to non-existent objects, perhaps through the use of names or descriptive phrases, we do not

have to engage in awkward paraphrases in order to speak meaningfully and truthfully about the alleged entity. For example, Meinongians can make sense of how statements such as ‘Sherlock Holmes lives at 22B Baker Street’ can be, first, meaningful, and subsequently, bear truth-values; there *is* such an entity as Sherlock Holmes that bears the property of living at 22B Baker Street, yet nevertheless fails to meet the criteria for existence. For Meinong, what appears to be the case in ordinary language is *actually* the case in reality; ordinary language does not need to be tampered with in order to make sense of statements in which non-existent entities figure.

For Meinong, the role of the quantifier is not to capture existence, and this thought has its justification in the way folk speakers quantify over objects that lack existence – for example, ‘there are many cases that Sherlock Holmes solved’. The intention of such statements are not meant to express existence, despite the use of the idiom ‘there are’. This might be halting to some readers; if something *is*, then it must have *being*, and if it has being then surely it *exists*? A way of dealing with this thought is by denying that the verb ‘to be’ is relevant to quantification. Theorists such as Francesco Berto (2012) and Timothy Crane (2013) argue that ‘to be’ is accidental to quantification, that “[i]ts showing up in some of the quantification expressions we use lends thin linguistic support to [a] thick metaontological conclusion...” (Berto and Plebani, 2015:102). Nowhere, amongst languages that employ the quantifier, is it found that the verb ‘to be’ is regularly exercised: English uses the term ‘some’, German uses the term ‘es gibt’, and French uses ‘il y a’, where in each language the attribution of *being* would serve as an metaphysically over-generous interpretation, and in many cases the attribution of existence would be nonsensical (2015:102).

If the quantifier is not existentially committing, then what aspect of language performs this role? For Meinongians it is the statement that *something exists*. That is, one is explicitly committed to the existence of something just when they *assert* that it exists, and this is captured by the existence predicate. Hence, the language of existence, according to Meinongians, requires more than just the quantifier, since the quantifier is used instances where the speaker rejects the existence of the objects of which they are quantifying over. The conflation of existence and the idiom ‘there is’ is explained by our ‘prejudice in favour of the actual’, which is due to our ‘lively interest in reality which is part of our nature’, and further explains the ‘exaggeration which finds the non-real a mere nothing’ (Meinong, 1904:79). That is, our quantifier is restricted by virtue of blind partiality to that which is actual, and it is by actuality that we restrict the quantifier. When we say ‘there is’, or ‘for some’, our intention is to restrict this statement to those things that exist, according to Meinong. It might be said that the existence predicate is implicit in our use of the quantifier, and hence is why it is seemingly redundant, where it is observed as an improper predicate. I will have more to say on this later in the chapter.

3. QUINE’S TASTE FOR DESERT LANDSCAPES

It is commonly thought that the ontological bloat of Meinong’s theory is enough to dissuade theorists from taking it as a serious philosophical position, and further that the theoretical benefits that it might have had were shattered with the introduction of Russell’s theory of descriptions. Perhaps the most well-known example of a scathing tirade against the Meinongian position is given by Quine in his paper “On What There

Is” (1948). For Quine, Meinong’s slum of disorderly elements leaves an unpalatable taste for those inclined towards the aesthetic of desert landscapes.

Quine considers a debate between two theorists arguing over the existence of Pegasus. The theorist who affirms the existence of Pegasus takes advantage of ordinary language by claiming that our attribution of non-being to Pegasus entails that it must in some sense *be*, where its being is not caught up in actuality; Pegasus must *be* because there is something of which it is *not*. The difficulty for the theorist denying the existence of Pegasus is the potential to fall into ascribing a property to Pegasus, namely that of non-existence, or non-being. If Pegasus has a property, then it cannot fail to be an object, and becomes a candidate entity that lacks existence.

Quine accuses Meinong (or whom he gives the pseudonym ‘Wyman’ in his 1948 essay) of ruining the word ‘exists’, and this is done by limiting the term ‘existence’ to actuality. For Quine, it is ordinary custom to use the term ‘non-existence’ to assert that there is no such entity at all. However, being wary of the trap laid out by Meinong, Quine gives up the term ‘exist’, and utilises the term ‘is’. The benefit of this is seen in Russell’s theory of descriptions: by translating seeming names, or descriptive phrases, to full descriptions we can avoid committing ourselves to the alleged entities that are named. This is done by shifting objective reference from the descriptive phrase, or name, to words of the kind logicians refer to as bound variables: ‘something’, ‘nothing’, and ‘everything’. According to Quine, such bound variables refer to entities *generally*, ranging over the domain of objects.

Affirming and denying the existence of something becomes an ontological safe haven when using Russell's theory. When we say that '*F*'s exist', we claim that 'there is something that is *F*', and if we wish to deny the existence of something that is *F* by uttering '*F*'s don't exist', we claim that 'there is not at least one thing that is *F*'. The benefit of this analysis is that by dropping the predicate 'exists' for quantification, we do not ascribe any properties to those things we wish to deny, and thus we avoid committing ourselves to a bloated, Meinongian ontology. Quine has wielded the axe of Occam and hacked away Meinong's jungle to be left a cultivated land for prosperous ontology.

4. THE ROLE OF THE QUANTIFIER

In a prescriptivist tone, Quine tells us that we commit ourselves to a certain ontology when we use the expression 'there is', and cognate terms. (Quine, 1948:10). But it isn't clear that the quantifier inherently has this power, nor is it obvious that the quantifier performs this role in natural language, as was suggested by Berto and Crane. Quine showed us a way to avoid Meinong's realm of disorderly elements, yet he nevertheless fails to give us sufficient reason to believe that 'there is' carries ontological import. It is important to note that Quine's fondness for canonical notation, an attempt to serve the sciences with a innocent and well-defined language, is all the reason Quine needs to claim that 'there is' carries ontological import. This is because Quine is making a prescriptive claim about *how language ought to be*, instead of a descriptive enterprise of *how language is*. I am not interested in how language ought to be, and accordingly in an

attempt to explain facts, and to relate such facts back to metaphysics, my interest is in *how the quantifier is used*.

True existentially quantified (EQ) expressions require populated domains. But EQ expressions are not true simply by virtue of something satisfying a bare existential claim in the manner of an existence predicate, they are true by virtue of something in a domain *satisfying* a predicate. In other words the truth of an EQ expression is contingent upon something being true of an individual. At a first order level, existence under EQ seems inextricably bound up with having properties. The reason for this is not hard to discern; a true EQ expression picks something out from its domain. Predicates or properties are the means by which that process is done. EQ always assumes that the matter of what exists is settled; its job is to *find* individuals in that corpus of existing things.

There are a few predicates that make this process problematic: “is a fictional character”, “is imaginary”, some might say “is a possibility”, but certainly “is non-existent”. Now, someone like Quine will say that given that the domain of EQ expressions is the world, the universe – *everything that exists*, and there is no individual within the domain that will satisfy such predicates; they will come out as false. In so doing Quine has already quietly decided on the membership of the domain, and he is simply refusing to let you admit individuals like Sherlock Holmes, or possibilities. So while we might agree with Quine that to exist is to be the value of an existentially bound variable, it is only true when we have agreed on what those values might be. Prior to that point, to exist is to be a member of the domain *over which we take the quantifier to range*.

While it is not my intention here to get involved in the debate about the ontological status of the likes of Sherlock Holmes, imaginary characters or possibilities, let's very reasonably admit that Quine is right in claiming that you cannot get a predicate to contradict the existential claim of the quantifier without rendering the EQ expression false. That is, you cannot assign predicates that implicitly or explicitly deny existence within a true EQ expression. The problem for at least the early Quine is that we *do* allow the existence of things other than the objects his particular brand of empiricism allows. Even later Quine himself was ultimately, if reluctantly, forced to admit sets as abstract objects into the domain of existing things. What is important to recognize at this point is that existential quantification does not resolve the metaphysical issue of what exists in any sense at all; it *presupposes* the question has been resolved in the defining of our domain of quantification. It is here that the important difference between EQ and existential predication lies. Existential predication *posits* objects in the EQ domain by the "attribution" of existence to an individual, EQ simply *picks them out of that domain* by the associated predication in the expression.

So who decides what is in the domain of EQ, Willard Van Orman Quine? Well, no, Quine humbly tells us it is decided by the ontology of the best science. That is why unicorns, spiritual entities of all denominations and the fairies at the bottom of the garden don't get an ontological guernsey – regardless of what you might believe or not believe. And it is why the strange denizens of the quantum world do get a guernsey even if you can't even conceive of anything behaving in the way science tells us they do. Science has this licence because it constructs ontologies better than anyone else, at least according to Quine. The best science presents us with a consistent and economical

system of ontology with the best explanatory and predictive capacities, all based on methodologically rigorous testing, observation and experimentation. If Quine is right, the domain of EQ is a very tidy, highly systematized sector under the protection of the linguistic division of labour adopted in our linguistic community. You and I don't have much, if any, influence on it, but our quantification nevertheless falls under its auspices. But is he right?

Before proceeding let me comment on one of the more tedious elements of discussions of EQ, the persistent question of how to read the well-formed formula ' $\exists x:Fx$ '. Should we say "something exists which is F" or "Fs exist" or "there are Fs" or "there is at least one thing which is F" or "something is F"? We could argue that it is called the "existential quantifier" and therefore it *should* be read as explicitly expressing existence; but then, as far as names are concerned it might just as well have been called the "there-is" quantifier or the "something" quantifier. In the absence of more compelling premises, I don't find arguments based on names especially persuasive. The pertinent issue is not how ' $\exists x$ ' *should* be read, it is exactly which locutions in natural language are correctly translated as ' $\exists x$ ' in canonical notation. That, in turn, is a matter of what we are expressing, the Fregean sense of any natural language candidate for ' $\exists x$ '.

It seems to me that there is really only one thing which captures the correct sense of existential quantification in natural language: *the countability of something as one, and then the attribution of a predicate to that which we have counted as one*. If we want be physicalistic about this characterization, then countability will probably imply something in the form of ostension, if we allow more than physical things then we will need a criterion or

method of individuation of say, cognitive entities. However at this point I am not overly concerned about *how* we achieve such countability.

This characterisation appears consistent with the way Meinongians interpret the quantifier (i.e. Priest's (2005) distinction between "quantifier commitment" and "ontological commitment", where "quantifying over" does not entail ontological commitment). Countability is not ontologically committing. It is an intentional division in reality, by ostension, on the basis of phenomenal individuation, or theoretical necessity, in which the existence of the delineation is left unstated – at least until it is confirmed or denied by some endorsed criteria, such as that provided by the empirical sciences (viz. naturalism). Why is this, broadly speaking, Meinongian? Following the distinction between the existential status of an object, and the attribution of properties to an object independent of its existential status, countability is captured in the latter – or what is referred to as the *Sosein*. That is, the quantifier performs the role of individuating the world for which we then ascribe certain properties, and this is expressed by predication. The question of existence has not crept in at this point. If we are convinced that a particular individuation of the world, a delineation by countability, indeed exists, then the existence predicate is employed.

It is by intentionally employing the existence predicate, by assertion in the mental frame of a particular metaphysical, or realist attitude, that we speak strictly about existence. When speaking strictly about existence, philosophers claim that our locutions are being made inside the *ontology room*. The ontology room is defined by a strong-existential language. That is, we do not speak loosely about the existence of something or rather when we discuss existence inside of the ontology room. This is

typically characterised by distinguishing quantifier meanings. In the ontology room, not only does the quantifier obey the core inferential role of the English-quantifier, but it is stringently used by ontologists to express existential statements that purport to carve nature at the joints.

For Meinongians, and myself, the ontology room is defined by the existence predicate. Statements of the form ‘there are *Fs*’, and the like, are interpreted as expressing existence, not because inherent to the meaning of the quantifier is existence, but because the existence predicate is implicit with any utterance of the quantifier; inside of the ontology room, the existence predicate is redundant, and this is not because it is an improper predicate, but because it is implied in any utterance made by anyone speaking the language of the ontology room – *Ontologese*. In other words, consistent with Meinongianism, in the ontology room, the quantifier is restricted in virtue of our prejudice for the actual.

As we have seen, in natural language, ordinary use of the quantifier is not uttered with strong existential overtones. It seems to me, then, as I have suggested above, that the quantifier, in natural language, operates merely a means of delineating the world into countable entities, where the existence of such entities is left in a state of existential indeterminacy, not insofar as the entities are indeterminate, such as those in quantum reality, but in an epistemological sense that we remain indifferent to their existential status – the countable entities are existentially indeterminate when we hold the attitude of existential indifference. Our reasons for delineating the world into countable entities is for the purposes of pragmatically interacting with external reality – it is not necessary to interact with the world with a realist attitude to serve our purposes.

Dividing language on the basis of attitude is not unlike what has been suggested by David Chalmers in his paper “Ontological Anti-Realism” (2009). For Chalmers, existential expressions bifurcate into *ordinary* existence assertions, which are made independent and indifferent to ontological matters, and *ontological* existence assertions which are sensitive to these metaphysical considerations. Chalmers claims that distinguishing between these two types of existence claims fundamentally comes down to standards of correctness. An ontological assertion is correct when it is subject to ontological matters, where the concept of ‘truth’ might come into play. An ordinary assertion turns a blind eye to the notion of truth, or at least finds refuge in common sense ontology.

While Chalmers and I share the same spirit, we incarnate distinct bodies. What Chalmers claims to be an ‘ordinary existence assertion’ I take to be an expression of countability; existence does not figure in an expression of countability. An expression of countability is insensitive to ontological matters, where its function of rounding up hoards is a referential gesture. In this sense, it is rather indifferent to the standards of common sense, or perhaps common sense ontology is much simpler to discern than first thought. The standards for grouping, aggregating, collecting objects into one is a simple enterprise, the requirements of which are constrained only by aggregation. The difference between communities with alternative common sense ontologies might only reduce to a question of whether the communities has equivalent aggregates. However, this is not a matter of alternative standards, but only a matter of employing those standards – one community might more liberally count things in order to serve their purposes.

It might be argued that this thought is captured by David Rose and Jonathan Schaffer (2015). In their research in experimental philosophy, Rose and Schaffer found that folk people intuit mereological composition occurs when the results serve a purpose. That is, the answer to when composition occurs, according to folk intuition, is *teleological*. For Rose and Schaffer, this entails that metaphysicians ought to dismiss folk intuitions, that “understanding folk mereology should actually lead us to liberate the discussion of when composition really occurs from any demanded conformity with folk intuitions” (2015, 2). This does not seem right to me; ‘liberation’ might come at the cost of wandering blindly around logical space – folk intuition serves as a map to help find our way to an ontological destination. Instead, we might take the results of Rose and Schaffer’s research as partial justification for the thought that the quantifier is mereological and existentially neutral. That is, for folk people, an occurrence of composition is an instance of countability, counting a dispersed plurality as one object. The quantifier captures this activity by expressing this occurrence, i.e. ‘there is *something* that is *F*’. The delineated object is existentially indeterminate given our attitude of existential indifference, and the criterion by which folk people assess an instance of composition is teleological, and this should not be treated as an expression made with a realist attitude.

Summarising these thoughts, I have argued that the quantifier is existentially neutral, and this is contrary to standard thought. However, taking into account the facts about ordinary usage in natural language, the quantifier seems to be used as a tool of delineation; counting a dispersed collection of objects as one. Moreover, this might explain why folk people intuit that composition is teleological. With a purpose in mind,

it is not unreasonable to assume that folk people are not interested in carving nature at the joints. If this is right, then we might suppose that an instance of composition, for folk people, is an instance of countability, and countability is expressed by the quantifier interpreted as mereological.

5. WHOLES AND EXISTENCE

But what about the non-actual? Following Meinong, I agree that the non-real is not a mere nothing, at least in the context of mereological wholes. For a moment let us suppose that the domain of EQ is everything that is countable as one.⁹ Early Quine for one would be unhappy with this: with his noted preference for sparse ontological moonscapes, such a domain is intolerably bloated. Any collection of things that might be rounded-up into something countable as one is in there somewhere. Set theoretically it is the power-set of *at least* all physical entities. There is nothing constraining the aggregations of entities into compound entities we then count as one. In fact you have probably noticed that we have just utilised Cantor's intuitive or naive notion of a set – *a gathering together of distinct objects into a whole*. And ironically it is exactly this ontological bloat, admittedly with axiomatic restrictions to block Russell's Paradox, to which the later Quine was to ultimately surrender under the duress of non-intuitionistic number-theory.

Here then is the connection between the cantorian concept of set and the entities of the EQ domain as things countable as one: each is about *wholes*; it is wholes that we

⁹ Accordingly it might be more appropriately called the *mereological quantifier*.

count as one, it is the concept of a whole that underlies the notion of a set, and it is wholes that form the *mereological foundation* of the *ontological* domain of EQ expressions and which ultimately underpin that which we take to exist. To reiterate what has been said, if we count something as one, we posit, recognize or acknowledge something as a whole; countability is a mereological notion. It is an abstract delineation of entities which comprises a conceptual compound rendering its constituent entities as parts. These are objects in a *primordial* form; what I have referred to as ‘proto-objects’. Not all proto-objects make it to objecthood; the transition from a mere abstract mereological whole that we posit, to an ontological, physical object is a little like an ontological version of natural selection. Yes Virginia, it’s a cruel world even in the metaphysical realms of ontology.

The predicates of EQ expressions are the means by which proto-objects are selected as objects – but not by us. We can posit any proto-object we wish, but something quite independent of us determines whether our proto-object is more than an abstract entity – a physical object. That something is *causation*, in particular *coalescence*.

If a proto-object is *nothing but* a simple collection of things, then any physical properties it might be attributed will probably be just those properties that its parts have in common, and perhaps some that only some parts possess. I can, for instance, posit your thumb and the Tower of London as a proto-object. What physical properties would you attribute this proto-object as a whole? I expect you will nominate common properties of both parts of the proto-object – like having mass, being spatially extended, having gravitational attraction etc. Whatever you come up with I don’t think we would find any physical property that does not apply to at least one of the two parts. In other

words, the physical properties of a proto-object will be a subset of the properties of its parts. There will be no difference between talking about the physical properties of the whole and talking about physical properties of its parts.

If we can successfully attribute a property to a proto-object as a whole, we might still be wary about the nature of that property; how that property is determined. Objects differ from proto-objects (although every object must of course have a proto-object *aspect*) in that they possess causally-based structure. That is, an object is a proto-object whose parts interact or relate to each other in such a way that produce holistic properties from those relations. The concept of a simple proto-object is that of a whole in a static, non-interactional internal state. The proto-object has no unique properties as a whole because its parts are not in any *productive* relation with each other; they are not bound by coalescence. The effects of those causal relations will emerge as unique properties of the proto-object as a whole – an object. In this sense, an object might be regarded as an ontological *event*. Objects can be events that are dynamic or on-going, like the movement of atoms or molecules that make up my coffee-cup; or episodic like the movement of parts on the occasions when a machine is running. And of course they can be combinations of both.

While events might seem an odd way to think of objects, it is just an extension of the concept of a causal effect, and an object is just a proto-object exhibiting the effects of causal relations between its parts in *holistic properties*. But while there are causal events which we seem comfortable to call objects, like the constant myriad of events which comprise my coffee cup, there are also causal events which we do not. What then defines one causal event and not another as an object? By this analysis it is because one

event is occurring within the constraints of a proto-object, the other is not. Causal events that are not subsumed under a proto-object will not be object-yielding *for us*, simply because we have not posited the mereological substratum of a proto-object.

This is the intersection of subjectivity and objectivity for objecthood. Our apprehending of an object depends on our initial positing of a proto-object, typically in response to the observation of certain properties, countability. This is much like the framing of a hypothesis about an instance of objecthood. It is then determined if the observed properties are to be accounted for in terms of causal relations of parts within the confines of the proto-object, or just as the properties of parts. If the former, then we attribute objecthood to the proto-object; reality has vindicated the hypothesis represented by the proto-object.

Quine is correct to claim that science determines, or at least decides for us, what exists. It is physical theory which determines which proto-objects can be attributed the requisite causal relations of parts to account for observed properties. Accordingly, it is physical theory that deems what wholes are to be counted as objects, what wholes are to be admitted into the positive extension of the existence predicate.

I suggested earlier that it is wholes, proto-objects that form the *mereological foundations* of the ontological domain of EQ expressions and which thereby ultimately underpin that which we take to exist. All objects are wholes, but not all wholes are objects. It is the mereological aspect of an object that we first form a hypothesis about its existence. As peculiar as it might seem, these proto-objects could be considered correlates of the “something” which we read for the variable in EQ expressions such as “there is something such that it is a horse”. Of course variables are place holders for

values, and not referential terms. That is why I used the term ‘correlate’. The point is purely hermeneutic: EQ picks something out of its domain as having the necessary parts we attribute to horses, that something is a whole, a proto-object which, if exhibiting horse-related properties in the requisite way, i.e. causal relations on its members, is deemed an object of the required kind and renders the EQ expression true, but only when we affirm its existence by existential predication. Accordingly we could read ‘ $\exists x:Hx$ ’ thus: there is a proto-object, a whole, which has the parts *required* of horses. However, at this point it is not clear the attributed property of ‘being a horse’ is determined by the requisite causal relations between parts that mark physicalism. Notice that the expression does not explicitly assert existence; it lays out the conditions, the required parts, for being a horse, yet fails to capture explicitly the conditions of being a physical object, the required causal relations, of a certain kind. That is, it is *showing* us rather than simply telling us that the conditions for being a horse can be met by associating properties with a proto-object with the satisfaction of specific causal relations. Its existence is affirmed when the standards for being a physical object are met, according to some criteria (i.e. causally productive relations), and we express this by the existence predicate, where inherent to the meaning of the existence predicate are the standards required for being an object.

The predicate component of an EQ expression is clearly of the highest ontological significance. While I am not sure that Quine always recognizes its degree of significance, it is certainly attested to by the simple difficulty of parsing “something exists” without some form of non-trivial predication in canonical notation. The meaning of the predicate captures whether the attributed property meets the conditions required

for being an object. Accordingly, entities which cannot be assigned predicates denoting properties as a whole, produced by causal relations, do not pass muster as existing things. Your thumb and the Tower of London exist as individual entities, but not as an object because they lack the requisite holistic properties provided by causal relations between them as parts. And if an entity fails to satisfy the requirements of objecthood that permit such predication, then they fail to exist. They are not in the ontological domain of EQ which is comprised of only existing things – objects.

6. THE EXISTENCE PREDICATE AND NON-EXISTENCE

It is interesting to consider then where in logical space non-objectival proto-objects reside. To answer this we need to shift our focus from EQ to its much maligned cousin, the *existential predicate*.

The existence predicate is maligned because we take it to say no more in an expression than an equivalent EQ expression. Therefore it seems a very poor predicate because it does not differentiate things in the way we expect of a predicate. Any self-respecting predicate should divide the world into two – one part which satisfies the predicate, the other part which does not. But we standardly assume there is nothing in the negative extension of the existence predicate, and everything in its positive extension, so what differentiating work could it ever do?

Well, I contend that it does do differentiating work because its *negative* extension contains all non-objectival proto-objects, and on occasion we can and do refer to those proto-objects. That is exactly what we do when we assert that “Pegasus does not exist”.

Quine correctly observes that we can express the non-existence of Pegasus by creating and deploying the interesting predicate “pegasizes” in the EQ expression “there is nothing which pegasizes”.

As was noted above, Quine’s concern with the existence predicate is that in its negated form attributes a property of non-existence to an object and we are left with a disagreeable ontology. However, in what I have suggested, the predicate’s function is not independent of EQ. When denying existence, the existence predicate can function in two ways. Existence is expressed when we introduced the existence predicate in an EQ statement. When we want to deny the existence of something, it is not necessary to negate the existence predicate and fall into the trap laid out by Meinong. We can still employ Russell’s theory and negate the quantifier. By doing this, we do not deny existence directly, we deny countability which is the mereological foundation of an object. Something cannot exist if it does not have a mereological foundation, the genetic seeding of an object.

Alternatively, we can accept countability and negate the existence predicate in an EQ statement. Given that the EQ is ontologically neutral, this expresses no more than that the standards for being a mereological whole, a proto-object, have been met, without satisfying the criteria of being an object, expressed by the existence predicate. Pegasus, is a proto-object with parts comprised of a horse and wings which never attains objecthood by those parts coming into causal relations with each other in such a way to produce something with the holistic properties of a flying horse. Pegasus, the non-objective proto-object, is simply a delineation of parts which as a whole subsumes the

properties of its parts, the properties of wings, and the properties of a horse, but *not* the properties of a winged flying horse; the relational properties.

This is what I take to be the general form of statements that deny the existence of something; the mereological components of an object are met, without meeting the requisite causal relations between parts so as to produce a holistic property defined by the standards of physicalism. In this sense, the ontology of wholes, if there is one, will be grounded in existing things. Countability requires a delineation in reality that collects objects into parts of a posited whole. Where we might deny the existence of the whole, or at least remain existentially indifferent to it, the parts that comprise the whole will be grounded in reality – somewhere down the ontological line.

Responses: The Other Candidates

Leśniewski's intuitions told him that every collection of individuals forms a mereological sum. Call this position *mereological maximalism*. Other people's intuitions tell them otherwise. The theoretical opposite position, *mereological minimalism*, is the view that only simples exist. Peter van Inwagen comes close to this view: he thinks that the only composites are organisms... Most people's intuitions tell them that minimalism and this near-minimalism are wrong. On the other hand when confronted with bald examples of arbitrary mereological sums... most people's intuitions tell them there is no such object. Clearly intuitions are not going to decide intersubjectively what is correct. If intuitions cannot decide the matter, what of arguments?

PETER SIMONS

1. DIRECTION

The position that I have put forward is novel: the focus of its attention extends beyond the mere consideration of wholes and their parts – ontology is about objects, mereology is about wholes. Hence, it is theoretically contrary to the standardly accepted candidates

for the metaphysics of mereology: Universalism, Nihilism, and Moderatism. No doubt there will be some disgruntled metaphysicians, accordingly there is some work to be done: comparative analysis.

In what will come I will explicate the major candidates of the metaphysics of mereology and assess the merits of each thesis in comparison to my own. I will not appeal to just one measure of assessment. I will take into account assessment criteria that is standard philosophical orthodoxy, such as consistency and coherence, as well as quasi-scientific theoretical considerations such as simplicity, and elegance, and further criteria of pragmatism and intuitiveness. What I hope to show is that at any level of assessment my theory comes out cleaner on the other side. It submits itself to the iron fist of logic, explains scientific enquiry, while also preserving folk ontology and meaningfulness of folk language.

I will take the following strategy. The order of this section will be by addressing each of the candidate mereological theories one by one, starting with Universalism, followed by Nihilism, and finishing with Organicism. This will involve both identifying deficiencies as well as fending off possible objections to the theory that I have proffered. At the beginning of each section I will first provide a brief exposition.

2. UNIVERSALISM: WHOLES AND MORE WHOLES

Universalism can be understood quite simply: when you have wholes, you have more wholes. For any collection of things, no matter how widely scattered, or intimately near, a plurality will always compose something further. Under my way of thinking, it is the

position that *all wholes are objects*. The essence of this position is *the principle of unrestricted mereological composition*. The origin of this principle is formal, though upon investigation into parthood relations of the object-world, theorists extended this principle into the realm of metaphysics:

Unrestricted Mereological Composition:

Given any two distinct things, a and b , where $(a \neq b)$, and where neither a nor b is a part of the other, there always exists at least one further thing c , $(c \neq a)$ and $(c \neq b)$; and c contains a as one of its parts and contains b as another of its parts. (Bigelow and Pargetter, 2006: 2)

Universalism goes by many names: *Conjunctivism* (Van Cleeve, 1986; Chisholm, 1987), *Mereological Maximalism* (Simons, 2006), *Unrestricted Composition* (Lewis, 1991), etc. The Universalist believes that everything is a proper-part of everything else (inclusive or exclusive of simples; depending on whether one believes in gunk). There have been many proponents of this ontologically bloated theory. Its usefulness outweighs its theoretical counterparts, as well as accounting for deficiencies and inconsistencies particular to alternative mereological theories. The weakness of Universalism is clear; it posits entities to absurdity. However, it is by virtue of this feature that it has its strength too. The Universalist does not have to explain arbitrary delineations of objects that plague the Moderate. Furthermore, unlike the Nihilist, Universalists can account for the reputed objects that common-sense reveals to us. Yet, this is at the expense of a commitment to a plethora of objects that seem plainly farcical.

In my mind, Universalism is the most widely embraced and strongest candidate theory. Thus, my time will be predominately dedicated to identifying the deficiencies of, as well as defending my position against, the tenants of Universalism. Onto the arguments. Apart from appeals to simplicity and elegance, Universalism has some strong arguments in favour of it. I will concern myself with three: The Argument from Vagueness, The Argument From Empiricism, and The Argument From Innocence. In my mind, these are the strongest reasons to adopt Universalism, accordingly I will spend time addressing all three. First, I will start with an initial objection of my own.

2.1. FORM AND EXISTENCE

Mereology is the theory of parthood relations. It attempts to give the characteristics of the relations between parts to wholes and parts to parts within the context of a whole. Thus, formal mereology is the logic of wholes. It tells us in symbolic terms, the “*syntactical*” (language-level) or “*structural*” (object-level) nature of parthood relations of a whole. According to James Van Cleve (2010), what is characteristic of all modern axiomatizations of mereology is the acceptance of the fusion principle, or known as a sum, that is:

The Fusion Principle:

x is the sum of a set A if and only if $\forall y (y \text{ is a member of } A \supset Pyx) \ \& \ \forall y (Pyx \supset \exists z (z \text{ is a member of } A \ \& \ Oyz))$. (Van Cleve, 2010)

This definition is difficult to follow and because of this I will use alternative terminology in the way Van Cleve does. Instead of saying that x is a sum of A , we can say, in the language of Peter Van Inwagen (1987), that the various members of A *compose* x . If the members of A have been enumerated (say as a and b) we can use the expression $(a + b)$ as a name for the sum of the members of A : given any non-empty set there is an ‘object’ composed of its members.

Why should we expect a formal system to tell us what exists? We cannot look to formal mereology to tell us *what it is* that exists, for just as syntactical logic is silent with respect to *truth*, so too is it silent with respect to *existence*.

The metaphysical thesis that takes the fusion principle from the realm of formal logic to the object-world is, I believe, Mereological Universalism. Accordingly, I think it is appropriate to describe the Universalist position as a thesis of existence that purports all wholes as objects, in the sense that there is nothing more to being an object than just being a whole; under the specification of the fusion principle. What things are to be counted as a whole, for the Universalist, is given to us by formal mereology. That is, the fusion principle of formal mereology is an object-world principle, almost like a law of nature. According to Van Cleve (2010), all modern axiomatizations of mereology assume the *existence* and *uniqueness* of sums; there exist one and only one sum of every non-empty set: in terms of a delineation of parts, there is no difference between any two sets that have the same members that would compose an object.

It is a curious question as to why Universalists believe that formal mereology can tell us anything about the object-world other than its formal properties. That is, while mereology can tell us that for any object that does exist it will have particular formal

characteristics as a whole, it *cannot* tell us *what* objects exist *as a matter of fact*. While we can infer from what objects exist to certain formal properties, we cannot infer from formal properties to the existence of objects.

In a very real sense the Universalist is committing the fallacy of verbalism. In order to defend fusion as an object relation, and not simply a logical relation, Universalists seem to treat propositional or sentential conjunction as a compositional relation. However, it is a mistake to regard logical conjunction as an object relation. The notion of conjunction we are familiar with in standard first-order logical calculus is a sentential connective. It expresses a specific truth functional relation between propositions, and not a relation that exists between the objects or states of affairs expressed by propositions. Logical conjunction is not temporal conjunction. Temporal conjunction *is* a feature of reality insofar as coincidence in time is regarded as a relation between temporally bound entities. It is therefore quite wrong to use the concept of logical conjunction as any sort of relation that might bear on object relations.

Given an object A, and an object B, there is no sense in which, as the logical conjunction of objects A and B, we therefore have an object C. The idea that there is a valid inference from “an object A exists”, “an object B exists” to “an object A and B (call it object C) exists” is to commit the fallacy of verbalism. For objects A and B, we can only validly infer “objects A and B exist”.

If one is still tempted to persist with the idea that logical conjunction *is* an object relation then a challenge to specify when A and B are, and when they are not, in a logically conjunctive relation, should be sufficiently elusive to put the matter to rest. In other words, when one refers to object A, when are we referring to as a part and when

we are referring to it as a whole? I believe this distinction could only be made with a further concept of objecthood which resolves the apparent ambiguity or indeterminacy. The point is, if there is no material difference between being in a logically conjunctive relation, and not being in one, then the relation is purely propositional, and this is what I have tried to express in chapter 3; the compositional relations of the object-world are given to us by the natural forces; *coalescence*.

If the thesis of Universalism is indeed true, then it is true that the object-world will match the language-world. However, my point is that *we cannot infer from the syntactic structures of language to the physical composition of the object-world*. We know very well that syntax is not a sole determinant of truth. And in the same way mereological structure should not be considered a sole determinant of objecthood and therefore *existence*.

Now, this isn't the only means by which the Universalist arrives at their position. The following arguments provide good reasons for adopting unrestricted composition.

2.2. ARGUMENT: THE ARGUMENT FROM VAGUENESS

As alluded to before, the Universalist's admission of maximal entities has theoretical virtues unseen in its counterparts. Further, these virtues outweigh any benefits of the alternative theories. The pride and joy of the Universalist is that their theory does not suffer from *compositional vagueness*. Universalism provides a non-question begging answer to the Composition Question. Peter Simons gives the following account of the Universalist's argument:

“Assume that some collections compose and others do not. Whatever conditions are sufficient for composition in a given case, we can imagine a sequence of possible circumstances leading smoothly from noncomposition cases to composition cases. For example, if composition requires some spatial proximity of parts, take a sequence of cases where the prospective summands are too far apart to compose, then imagine a continuous sequence of cases where they are closer together until composition takes place. We are faced with a dilemma. Either the conditions for composition have an exact cut-off, or they do not. If there is an exact cut-off, then this cut-off is arbitrary and metaphysically unmotivated: it could just as easily been elsewhere.” (Simons, 2006: 603)

Simon’s passage summarises an argument against restricted composition made famous by David Lewis (1986), and later extended by Theodore Sider (2001). The argument is not about language. It is the denial of a vague metaphysical relation; a restriction on composition.

The way that I will understand this argument is as follows. Take some possible relation R . R is a candidate compositional relation; for some set of objects, either R relates these objects in such a way that composition occurs, or else R does not and composition does not occur. In a series of cases involving some set of objects, under the instruction of R , there is a line that can be drawn between a case where such objects are not in R and thus do not compose a further object, and a case where such objects are in R and thus do compose a further object.

Let us consider a possible relation that is represented by R . Take *contact*; a set of objects compose some further object when these objects are in contact. We should then be able to draw a line at which the objects are in contact and when they are not. However, no such line can be drawn. It is a vague matter whether two objects are indeed in contact. Thus, in Lewis' words, a restriction on composition like this would be 'gratuitous'.

We can plug in any moderate relation into R and have the same result. For Lewis, given that there is nothing vague about the language involved in mereology, in answering the question of whether composition occurs, a restriction on composition must not be vague. However, any attempt to provide a restriction thus far has failed to satisfy this requirement. Moderate theories turn out to be the least plausible mereological accounts given, (a) mereological language is not vague, and (b) our reluctance to admit of vague relations.

2.3. RESPONSE: AGAINST THE ARGUMENT FROM VAGUENESS

Given that my criteria of objecthood admits of only those objects whose parts relate to each other under the instruction of a morphological profile, and further bound by a coalescence, it seems that my theory should be classed as Moderatist; composition occurs *sometimes*. Composition occurs just when objects relate to each other to produce holistic properties, under the bounds of a coalescent relation. Thus, it is precisely the kind of theory that the Universalist is accusing of a commitment to vague relations; a

commitment considered to be metaphysically repugnant. How can my theory overcome this problem?

This is a two-step solution. The first step is to show that the (Special) Composition Question is a red-herring. It asks us to identify when composition occurs between unspecified individuals; I do not believe this to be an intelligible question. The moment composition occurs is sensitive to the identity of the object being composed, and the objects *of* composition – i.e. in chemical composition, the prime-mover is electromagnetism, which is sensitive to the properties of the objects in question, namely charge. Further, as good and faithful physicalists, it seems peculiar not to derive our compositional commitments from the sciences, and this is what I have provided in chapter 3.

The second step is to show how we should treat vagueness when we come across it. What I will argue is that Sorites' paradox type arguments in mereology do not tell us that a restriction on composition is vague, but that the mereological units that one is operating with that results in vagueness, be it parts or relations, *is not the correct mereological level of parthood*.

2.3.1. THE MISLEADING COMPOSITION QUESTION

In order to show why I take the (Special) Composition Question to be a red-herring, let us take an excursion back to Van Inwagen's question that spawned a mass of literature on composition. Van Inwagen asks;

“Suppose we had certain non-overlapping material objects, the *x*s at one’s disposal; what would one have to do – what *could* one do – to get the *x*s to compose something?” (van Inwagen, 1987: 2).

For van Inwagen, any reasonable response should have the general form:

“To get the *x*s to compose something, you must (and need only) get them to stand in multigrade relation R.” (1987: 2)

Precisely the nature of the required multigrade relation has been rigorously disputed amongst metaphysicians over the last few decades. Unfortunately, there has been little progress made in providing a sufficient answer that satisfies both the requirements of coherence and common-sense. I take this to be symptomatic of a deficiency in the question itself. The question asks when distinct objects compose ‘something’. However, it is not clear what standards are being employed when utilizing the concept of *something*. In other words, the concept of something varies according to one’s object-theory, where an object-theory specifies the conditions under which *there is* something. For Van Inwagen, and what motivates Universalism, ‘something’, or an *object*, can be unspecified with respect to its defining and identifying properties. The (Special) Composition Question ignores the identity of the objects of which are involved in composition, and this is apparent in Van Inwagen’s analysis of different monolithic candidate relations for Moderate theories: contact, fastening, cohesion, and fusion. Each of the relations are considered independently of the identity of the object being composed in question. The

methodology that van Inwagen uses to dismiss the plausibility of each individual relation highlights this point. For example, Van Inwagen considers that when two unspecified objects come into contact, composition could occur. Yet contact is dismissed on the grounds that there are cases where distinct objects come into contact yet do not compose a further object, where intuition serves as the arbiter. However, it is quite plausible that *any* of the proposed relations is sufficient for composition, though none are individually necessary. It might well be the case that *sometimes* contact is sufficient for composition, yet other times it may not be – this will depend on some additional criteria. This thought is expressed by Ned Markosian, a partial theory that he calls “The Serial Response”:

“(SERIES) Necessarily, for any non-overlapping x s, there is an object composed of the x s iff either of the x s are $F1$ s related by $R1$, or the x s are $F2$ and related by $R2$, or... the x s are F_n s and related by R_n ” (Markosian, 2008, 254).

An answer to the Composition Question, then, is simple: any instance of SERIES.

The benefits of this view is that (1) it allows that multiple relations are plausible candidates for composition, meaning that we do not have to dismiss a moderate theory based on idea that it is typified by just *one* relation, (2) it produces objects that are consistent with common-sense, and (3) it fits with common-sense on another level; that composition involves different factors in different cases and an answer to the composition question should follow this trend.

According to Markosian, the main deficiency of this view is that no one has yet formulated a plausible position that involves SERIES; yet he holds that one day someone might. I believe that what I have given has provided, or at least come close, to this anticipated theory. The problem with SERIES is that given *any* relation is sufficient for composition, we require something in addition to tell us why a *particular* compositional relation has been instantiated on a case-by-case basis. That is, if $R1$ is sufficient for the composition of some F , why is $R1$ sufficient and not $R2$? The answer will not be given by simply looking at any R , but by understanding the nature of F . For example, if F is a compound chemical, then we know that, according to chemistry, *electromagnetism* is required to bind atoms with *specific* salient properties, namely charge. R , in this instance, is sufficient for composition because the forces acting on the intrinsic properties of a collection of objects is strong enough to bring them together under some binding force; and this is specified by a morphological profile – the required interrelations of parts to produce holistic properties that establishes the identity of the object. It is by ignoring the properties that define an object that the Special Composition Question has gained traction, and further why the extreme answers have been so fruitful; neither Nihilism nor Universalism is constrained by specifying the identity of the object that is being composed, nor the objects of composition.

There is a point that I will say in passing here, though I will bring up later on. The Composition Question asks when x s compose some further object y . Most quickly resort to thinking of possible relations, though it is unclear precisely what the question is asking. Does it ask for when wholes come to compose other wholes? This is non-sensical; wholes are comprised of parts, and not other wholes *in the same mereological frame of*

reference. The question might then be asking when the *xs* turn from being wholes to being parts? This is my idea of upward cardinality shifting. The only appropriate answer I could give is: parts of *what*? Can we ask the Composition Question in a generic sense? Namely, when do some *xs* turn into parts of *something*? I don't think this is possible. An upward cardinality shift requires the informational instructions stated in a morphological profile. Thus, as an extension of the argument above, the *generic* Composition Question dissolves as being unintelligible.

2.3.2. SIDER'S SORITES PARADOX AS A REDUCTIO

We have not yet overcome the argument from vagueness. Even by specifying the properties that are required to be produced by a compositional relation, there is still the problem that any proposed relation will be vague. For example, if contact were sufficient to produce the properties that identify an object, there is still a question of when something is, or is not, in contact. Though, we are part of the way in responding to this concern. When talking about unspecified individuals we have no guide as to *when* composition has taken place. However, from an epistemic point of view, by placing the emphasis on the production of holistic properties we can have some indication of whether composition has occurred: just when those holistic properties are produced.

This looks to be promising, though there is a familiar argument against this: The Sorites Paradox. This paradox is regarded a paradox of predication, vague predication. Though, some metaphysicians have felt it appropriate to move from semantical concerns to metaphysical ones. That is, the Sorites paradox is also a mereological

problem of the object-world, *à la* Theodore Sider (2001), which has been aptly dubbed “Sider’s Sorites”. Here is the argument spelt out by Van Cleve (2010):

(P1) If in some cases composition occurs and in other cases it does not, then there are cases in which composition occurs that are connected by a continuous series with cases in which composition does not occur.

(P2) There is no sharp cut off point in any such series. That is, there is no pair of adjacent cases such that composition occurs in one and does not occur in the other.

(P3) It is always determinate whether composition occurs. That is, in every case, either composition occurs or it does not occur.

(C) Either composition always occurs or it never occurs.

To illustrate Sider’s argument, I will use the ‘heap’ version of the paradox rather than the ‘bald man’ version so that things don’t get complicated by controversies over partial baldness or pattern baldness etc.

We add grains of sand one by one – presumably allowing each to fall on the same location in the manner of sand in an hour-glass, and on the addition of each grain we are asked if we have a heap. I have never tried this – I have never been *that* bored or *that* interested. But we are told, presumably by people that have been *that* bored or

interested, and have tried it, that we never get to a point where we would say, upon the addition of one grain, that we now have a heap. The reason? Because the predicate ‘is a heap’ is semantically vague. It simply lacks the precision required for a single grain to warrant the transition to satisfaction of the predicate. Nevertheless, a heap does eventuate over an extended period of time despite our unwillingness to change predication.

In terms of parts and wholes, the Sorites presents us with a couple of mereological issues. With the addition of each grain, are we constructing a whole, or changing an existing whole? That is, are we involved in a compositional, entity-building exercise, or are we engaged in just a matter of change in the properties of an existing object? As a paradox that highlights *predicational* behaviour, one would expect that the paradox is *not* about the construction of an object, but rather *changes in properties* of an object – predicates are usually about properties. So my first question is; what object is supposed to be changing? The first time we are asked if the object has the property of being a heap, it is a single grain of sand, and that’s fine, a grain of sand is an object in my conceptual scheme. Then we progress to two, three grains of sand and asked if the property of being a heap *now* obtains. But obtains for what? I am not aware of any entity that is composed of two or three grains of sand. The properties of the original object, the single grain, haven’t changed one bit, it is the *object of change* that has changed. Accordingly, we need to quickly readjust our notion of the thing which is changing to include any number of grains of sand; we can settle for a general *state of affairs just involving grains of sand in a non-heap configuration*. Now we just predicate our way through the changes and ultimately fall foul of the trap laid by the Sorites.

Personally I don't buy this story. I don't think we are looking for changes in some non-heap-state-of-affairs parading as an object from the start at all. I think we are constructing an object from parts; we are presented with a linearly increasing set of parts, and we are challenged to say when we have reached the *minimal* number or volume of parts required to comprise a particular kind of object – a heap of sand. Not just any member of the kind 'heap', but the *least numerous of the kind in respect of composition with grains of sand*. Do keep in mind, according to paradox, that we are being challenged to identify that grain of sand that makes the difference between a non-heap state of affairs, and a heap. So, *ceteris paribus*, we are looking for the *smallest* heap in compositional terms.

Now if we were to be completely unmerciful with the paradox – and we shouldn't show it the least bit of mercy given that paradox is tantamount to logical homicide, at least for classical bivalent logic, then we should bring certain topological constraints to bear on this problem. That is, we should decide on what shape is to count as a heap for this exercise; then consider how each grain will be distributed in the process; and of course the direction of the wind, and finally after doing the appropriate engineering calcs we will get a quite precise answer. Graphically it will be linear with a well-defined point at which the heap – as we have defined it, will eventuate. At that point the graph will then shoot off, parallel to the x-axis into the never-never; or at least until the question of hills and possibly mountains arise. The problem though, is that *we are not allowed to do that kind of thing* with the Sorites. The predicate 'is a heap' is an *observational* predicate and as such its applicability is only ever a matter of *casual observation*. We are not allowed to count, we are not allowed to measure, and we are

certainly not allowed to do engineering calcs. And therein lies the mereological problem, any concept of the whole which would determine the relevant relations of parts to the whole required for a heap, simply fails at the level of singular grains of sand. In short, while grains of sand are obviously physical constitutive parts of a heap, they are not *mereological parts*. They fail to allow for the determination of relations of parts which the observationally determined whole requires.

In other words, *the Sorites is a reductio ad absurdum of the concept that individual grains of sand constitute mereological parts of heaps*. Physical constitution is not always sufficient for composition; the Sorites rings the logical alarm bells when we want to infer that all physical constituents are mereological. To be mereological, any part of a heap must be such that it is sufficient to observationally determine whether something is a heap or not.

You might have the feeling that what I have said is off topic; our concern was for *relations* required for composition and not the *objects* of composition. However, they are related. This marks the second step. At the start of this section I claimed that we can determine when composition has occurred by the holistic properties that have been produced. The argument against this was that it is a vague matter as to whether or not a compositional relation, in the moderate sense, has taken place. My response was that the paradox is a *reductio ad absurdum* of the concept that individual grains of sand constitute mereological parts of a heap; not all physical constituents contribute to the composition of an object in question. The consequence of this is that we must identify the mereological units that compose a heap, in this case any part of a heap must be such that it is sufficient to observationally determine whether something is a heap or not. Similarly, we might say that same thing about relations. If a relation is such that we

cannot determine whether a holistic property has been produced, then by utilizing the Sorites, it serves as a *reductio ad absurdum* that such a relation is sufficient for the composition of an object in question. As an example, we might say that trying to account for the orbital properties of a planetary system in terms of electromagnetism will yield unpromising result, since the composition of planetary systems is accounted for by gravitation: electromagnetism cannot tell us when a holistic property has been produced when thinking about large celestial bodies.

2.4. ARGUMENT: THE ARGUMENT FROM EMPIRICISM

Some theorists believe that the postulation of arbitrary mereological sums has justification beyond consistency and coherence, the standard criteria for assessing the intellectual merit of metaphysical theses. Instead, supporting justification for the principle tenant of Universalism can be drawn from empirical considerations. I will call this “The Argument from Empiricism”. This line of argument tries to bridge a traditional methodological gap between ‘metaphysical’ and ‘empirical’ theses by allowing inference to the best explanation to serve as additional justificatory power to support metaphysical principles.

John Bigelow and Robert Pargetter (2006) use thought experiments in conjunction with examples in the history of science to make just this point. The first example they draw upon is Galileo’s theory of motions that triumphed over the Aristotlean, Lucretian, and Platonic theories. The Galillean theory implies a tacit acceptance of the postulation of arbitrary mereological sums. This involves the

conjecture that the weight of a ‘single’ object has the same properties of motion as an object with dispersed parts of the same weight; the properties of motion of ‘unified’ objects are the same as scattered collections that form wholes. Though adopting this metaphysical principle might explain *why* both objects have the same properties of motion, Bigelow and Pargetter admit that this falls short of a definitive proof. However, we should take a weaker attitude and claim that the metaphysical principle can play *some* explanatory role in physical theories. Thus, there is *some* broadly empirical reason to believe in unrestricted composition; partial confirmation in light of experience.

The second example is taken from Hume’s analysis of two billiard balls colliding. Hume’s suggestion is that reason alone will not tell us anything about what will happen upon collision; prediction is only reasonably plausible upon constant repetition of observation. For Bigelow and Pargetter, reason in the guise of mereological principles plays a significant role in explaining this state of affairs. Assume that the principle of inertia is correct: the two billiard balls will continue on their course unless acted upon by an external force. Now let us assume that the balls are indeed *one* object. When the billiard balls collide, this constitutes nothing more than a change in shape in a bipartite material object that contains the two balls as distinct parts; a change in properties of a scattered whole. The collision, then, creates no *external* force on the bipartite object, thus there is no change in the way an object is moving. Given our assumption about inertial motions, Hume is wrong to think that reason can’t play a role in prediction. For “whatever *shape* the bipartite object adopts after collision, if it has not been acted on by an external force then its centre of gravity will continue to move on its current course without changing speed or direction” (2006: 13). From this you can derive, according to

Bigelow and Pargetter, a number of interesting constraints on how the bipartite object, and its parts taken individually, will have to move after the collision. I will not go into these details.

Lastly, unrestricted composition gets further explanatory power when used in conjunction with other mereological principles, namely “an auxiliary principle stating that a minimal sum of two parts of a thing will always be a part of that thing” (2006: 11). Given this, Bigelow and Pargetter consider a derivative mereological principle which states that “material objects have what might be called ‘arbitrary parts’ along with named and natural parts” (2006: 11). Though one’s initial thought might be that this is no more than an arbitrary posit with no explanatory power, Bigelow and Pargetter show that this principle can do some important work.

Where the former two thought experiments argued that arbitrary scattered collections form a whole, this thought experiment works in reverse: natural wholes contain arbitrary, scattered parts. Think of a balancing beam with various weights hanging from them at different distances from the fulcrum. If weights of 5kg and 7kg are suspended from a beam, where will be the point of balance? Using our mereological principle we can predict an answer:

“You could do experiments to see: although – how could you *tell* that the ratio of the weights is 5:7, until *after* you had worked out the principle of the balance? Another way to make progress, however, is use some principles of mereology and to recognise that the smaller of the two weights contains *five parts*, which are

such that, the larger weight contains *seven parts*, which are such that, all these twelve parts are the same weight as one other.” (2006: 12)

Now, imagine a symmetrical beam that is balancing at the point of symmetry. According to our principle, we are balancing a huge number of arbitrary parts. By adding to our mereological principle an additional principle that slight changes in shape for suspended objects will not affect how things balance, mereology leads us to predict the laws of balance, and “it also provides a satisfying explanation of *why* the laws of balance hold” (2006: 12). For Bigelow and Pargetter, this thought experiment shows that it is not just useful to distinguish arbitrary parts ‘in thought’, but that these arbitrary parts also ‘really exist’.

These three thought experiments show that there are empirical reasons, not in the form of deductive justification, but inference to the best explanation, that serve to justify metaphysical principles. Namely that, (1) arbitrary scattered collections form a whole, and (2) natural wholes contain arbitrary, scattered parts.

2.5. RESPONSE: SCIENCE AS MODERATE

I find The Argument From Empiricism to be quite persuasive. Though, it is not without its troubles. Under my way of thinking, science is within its right to posit arbitrary mereological sums. However, ontological commitment to such sums would be irresponsible if there were no further methodology to *confirm* their existence. In other words, we are not restricted in *positing* the existence of mereological sums, yet we are

restricted in our *commitment* to such sum if there is no reason to adopt them; positing is a matter of hypothesis, verification is a matter of commitment. Thus, it is an arbitrary matter as to whether we postulate a sum, but not an arbitrary matter as to whether they exist. This seems to me to be in line with Bigelow and Pargetter.

Why this is problematic is that this is distinctly *not* the Universalist position. There is in no sense a reason to verify the existence of a posit, for everything is on the table. That is, to ask for empirical support for the postulation of an arbitrary sum flies directly in the face of Universalism. Why? Science is in the business of discerning holistic properties. If in some cases an arbitrary scattered collection *has* certain holistic properties, then it is in virtue of *these* properties that the object is said to exist, not simply in virtue of the principle unrestricted composition. If the Universalist were to demand that in every instance of composition there must be the production of a holistic property, then this would fall well short of unrestricted composition; in fact, the requirement of holistic properties *is* a restriction on composition.

I believe this is precisely the position that Bigelow and Pargetter are arguing in this paper, though perhaps unbeknownst to them. In their first and second examples, the holistic properties in question are the properties of force and motion, and in the third example, the properties of balance.

If, for example, one demanded that in order to be justified in an ontological commitment to an arbitrary sum that there must be some empirical evidence, or explanatory power, and science was able to discriminate between good and bad posits in terms of confirmation and falsification respectively, then this in itself is making a distinction between objects that exist and don't exist – according to some employed

standard. Namely, the sums that exist are the ones that are confirmed, and the sums that don't are the ones that are falsified. One cannot appeal to science to justify Universalism, for science, mereologically speaking, is a moderate theory in an objectival sense; sometimes there are objects, other times there are not, and this is all determined on the grounds of whether a coalescent relation has taken place.

The sense in which Bigelow, Pargetter, and I agree would be on *epistemic* grounds; we have the linguistic right to posit arbitrary mereological sums, though it is not a metaphysical privilege. 'Arbitrary', in my way of thinking, refers to something epistemic, namely that in our theorizing about something being an object, we posit that object *as existing* until it is either confirmed or falsified. This however does not entail that composition is unrestricted. Instead, it is that we *assume*, for whatever purposes, that a collection of objects *could* indeed be an object in its own right. Yet, at this point, we do not know *which* compositional relations and holistic properties that determines this postulation *as an object*, and thus needs to remain unstated; an attitude of existential indifference as stated above. Thus, we will treat composition as unrestricted, *until we find what relations exist between such objects that produce holistic properties that would confirm them as parts of something bigger*. In this confirmation process, we establish the relations that define the objects by virtue of what properties it produces, and our investigation into these relations shifts our attitude to realism. Hence, unrestricted composition is a pragmatic tool, not a metaphysical principle.

2.6. ARGUMENT AND RESPONSE: THE ARGUMENT FROM INNOCENCE

A common argument given by the Universalist is that their theory is ontologically innocent: it is a metaphysical free-lunch. That is, the sum of some x s is nothing over and beyond the plurality of the x s. If one is ontologically committed to the existence of the x s, then there is nothing ontologically deviant about committing oneself to the sum; it is free of ontological charge.

I take Ned Markosian's (2008) line on arguing against this; there is a sense in which it is true and a sense in which it is false. The sense in which it is true is that if there are some x s, then the sum will not contain any more matter than what is given by the x s. However, the sense in which it is false is that if there is a sum, *there is something in addition to the x s*. In other words, the difference is metaphysical; do we quantifier over the sum or just its constituents?

Let me express this thought in the terminology of my proposed theory. By distinguishing between wholes and objects, I can accommodate both the thoughts that there is a 'free-lunch', in a sense, yet remain resistant to accept there is always *something further*. Wholes are an arbitrary matter. We have the option available to us to posit arbitrary mereological wholes without any question of why we are doing so. The reason is because the nature of a whole is purely formal; there is no question of existence at this point, *except for the objects of which it is composed*. Thus, a whole is free of charge. However, the existence of the parts do not transmit existence to the whole simply by virtue of existing themselves; a whole is free of charge, though only in the sense of the existent objects of which it is composed – existential inheritance does not automatically go

through. An object's existence must not be solely contingent of the existence of its parts, but on the relations that hold between parts that generate or produce holistic properties by coalescence. That is, an object is more than the existence of the things that compose it; it requires that parts relate to each other under the instructions of a morphological profile that determines an object's structural identity to produce a holistic property.

3. NIHILISM: ALL WHOLE AND NO PART

As with Universalism, Nihilism shares the advantageous features of simplicity and elegance. Though, its elegance and simplicity comes rather cheaply because there are almost *no* objects compared to its rivals; a bedroom might be clean because the contents are properly organised, or because there is barely anything in it. This position maintains that there are no objects composed of two or more parts, though a formal characterisation is perhaps more useful:

“Nihilism: Necessarily, for any non-overlapping *xs*, there is an object composed of the *xs* iff there is only one of the *xs*” (Markosian, 2008: 347).

Nihilism is an unfavourable position amongst metaphysicians. It is often dismissed off the bat on the grounds that there just aren't enough objects, or perhaps even more problematically, objects that are thought to putatively exist turn out to be no more than mere collections of simples, yet this seems strikingly false; you and I exist for example.

The Nihilist meets this initial objection with the following:

“Common sense as we have construed it claims that A and B together make up a further thing. The compositional nihilist denies this. But of course he doesn’t deny that A and B are stuck together, that together they exhibit behaviour that neither would exhibit on its own, that together they contrast with their surroundings, and so on. In short, he denies the existence of the molecule but agrees that there are some things arranged ‘molecule-wise’.” (Rosen and Dorr, 2002: 157)

In other words, beliefs about objects typically considered ‘common-sense’ are false. Yet, talk of composite objects is meaningfully assertable, according to the Nihilist, on the grounds that they are, in a sense, similar to true propositions in the Nihilist’s language. The usual strategy for the Nihilist is to employ an ‘*F*-wise’ predicate that is intended to replace standard predicates that look to commit one to composite objects in a metaphysically robust sense. Merricks expresses this point:

“I commend false folk-ontological beliefs for being—here I shall introduce a technical expression—‘nearly as good as true’. Any folk-ontological claim of the form ‘*F* exists’ is nearly as good as true if and only if (i) ‘*F* exists’ is false and (ii) there are things arranged *F*-wise. So, for example, ‘the state David exists’ is nearly as good as true because (it is false and) there are some things arranged Davidwise.” (2003: 171)

Thus, we might better think of Nihilism as involving two claims: (1) there are no composite objects; (2) we should offer paraphrases for our ordinary language talk that *seems* to be about composite objects. (Tallant, 2014: 1512)

3.1. RESPONSE: ALL PART AND NO WHOLE

Nihilism is another theory that trades on the benefits associated with avoiding metaphysical vagueness. There is no question of whether composition has occurred in a given instance; it never does. However, this benefit is not strong enough to successfully fend off all the arguments against Nihilism. Most of the arguments against Nihilism, at least from my observation, tend to focus on the possibility of a paraphrase from folk-ontological assertions to Nihilistic ones. This has been sufficiently argued for such that it's not worth going into any great detail. I will, however, throw in my two cents on this point, but I will first try to assess the metaphysics of the Nihilist's commitments.

The plausibility of a fundamental object, a simple, seems to me a dubious notion. A simple-object is just an object without parts; all whole, and no part. However, physicists tell us something interesting about the fundamental world. Ladyman and Ross explain this curious phenomenon:

“Both [quantum mechanics] and relativity theory teach us that the nature of space, time, and matter raises profound challenges for a metaphysics that describes the world as composed of self-subsistent individuals. In so far as quantum particles and space-time points are individuals, facts about their

identity and diversity are not intrinsic to them but rather are determined by the relational structures into which they enter... [A]ll the properties of fundamental physics seem to be extrinsic to the individual objects (Ladyman and Ross, 2007, p. 151)

This, I take it, is just to say that the objects of fundamental reality can only be described by the relational structures of which they are a part. Without the notion of an intrinsic property, it is difficult to make sense of a fundamental object *qua* object. That is, if we are to commit ourselves to, ontologically speaking, the realm of fundamental objects, the best science can provide is what philosophers of science and metaphysicians refer to as *Ontic Structural Realism* (OSR). Standard metaphysical realism makes a substantive claim about the existence of individuals in terms of the substances of which such individuals are instantiations. OSR, however, disregards the metaphysics of substance in favour of a commitment to structure, while disregarding the properties that are produced by such structures. For example, taking John Worrall's observation, "on the structural realist view what Newton really discovered are the relationships between phenomena expressed in the mathematical equations of his theory" (1989: 122). That is, it was not *objects* that Newton discovered.

The appeal of OSR is that it accounts for the continuity of scientific change; while a change from one scientific paradigm to another results in the requirement of different objects, structural aspects can be preserved. However, this seems to be problematic for the Nihilist. For the Nihilist, the domain of existents contains *objects*, not

in the sense of structure¹⁰, but in the sense of substance. Can we find a way to make sense of the Nihilist's commitments?

There are a range of different structural theses varying in degree of strength. The strongest position is *eliminativism*. Someone who is an eliminativist rejects the existence of individuals, while committing themselves entirely to relational structure. This is clearly not the Nihilist line. Moreover, it is difficult to make sense of the idea of *relations* without *relata*. However, a commitment to *relata* can be made while maintaining structural realism. Michael Esfeld (2004) argues that though relations require *relata*, these 'things' do not have *intrinsic* properties over and beyond the relations in which they stand. To be clear, "an intrinsic property is one whose possession just depends on the possessor itself" (Humberstone, 1996: 239), or as Alyssa Ney suggests, "when a property is intrinsic, this is a feature of the property itself; it is not a feature of the way we think about a property." (2010: 4). Thus, according to Esfeld, things and relations are neither ontologically primary nor secondary. This position is called *moderate structural realism*.

There have been many notable theorists who have denounced the possibility of objects having *only* structural properties. These include Paul Benacerraf (1965), Michael Dummett (1991), and Bertrand Russell, who writes;

"...it is impossible that ordinals should be, as Dedekind suggests, nothing but the terms of such relations as constitute a progression. If they are to be anything at all, they must be intrinsically something; they must differ from other entities as points from instants, or colours from sounds. What Dedekind intended to

¹⁰ In fact, objects for the Nihilist don't have internal structure.

indicate was probably a definition by means of the principle of abstraction... But a definition so made always indicates some class of entities having... a genuine nature of their own.” (1902: 249).

If this is right, it forces one to weaken their structuralist position. I take it as right. Accordingly, our search for a Nihilistic interpretation of fundamental objects *qua* objects continues.

Instead of denying that the properties of objects are only structural, one can admit that the facts about the identity and diversity of objects are ontologically dependent on the relations of the structure in which they appear (Ladyman, 2014). This has been defended by Ladyman and Ross (2007), Saunders (2003a, 2003b, and 2006), and Satchel (2006). However, as you might expect from philosophy, there is a problem with this way of thinking: relations are thought to presuppose numerical diversity. If this is right, then relations are not responsible for individuals. Why? Without distinct individuals that are metaphysically prior to relations, there can be no relations. Hence, there are no individuals, no relations, and thus no structure. This argument has been notably discussed by, again, Bertrand Russell, as well as contemporary philosophers such as MacBride (2006).

What now for Nihilism? If we are to agree with Russell that if an object is to be anything at all it “must be intrinsically something”, how do we make sense of the properties of fundamental objects while still committing ourselves *to* objects? It seems we are at a dead end – at least in terms of the relevant literature. This is not just a problem for Nihilism but any theory that admits of fundamental objects. In my mind we have

three options: (1) remain strong in one's belief that fundamental objects exist and blame our inability to discern intrinsic properties on epistemic restrictions (viz. *Epistemic Structural Realism*), (2) maintain that fundamental objects are purely theoretical entities designed for the purpose of theoretical explanation, or (3) admit that there is no fundamental objects either because fundamental reality is entirely structural or else because fundamental reality does not exist.

I tend to favour (3), but let me first discuss (2). Previously I argued that a mereological whole is a matter of free postulation without ontological commitment (not withstanding a commitment to the objects which serve as parts). We confirm or deny the existence of a whole depending on whether or not the relations between its parts produce a holistic property, where such a property is a product of causal relations. Such a property in my mind is just the notion of an *intrinsic* property; though the holistic property is in some sense dependent on the internal relations that hold between its parts, the property is not a product of any extrinsic relations to other objects. The postulation of fundamental objects is this same process in reverse. Say, we have an alleged object we wish to commit ourselves to, though we have nothing to explain its holistic properties; we know that the property must be a product of the relations between its parts, but we do not know what its parts are or how they relate. Thus, we posit its *parts*. Now, it is no surprise that at the fundamental level we can only explain such properties *extrinsically*. Why? *Parts only have extrinsic properties*. This is why I have called them object-variables; they are not objects since they do not take intrinsic properties *until* a cardinality shift has taken place. If parts only have extrinsic properties, then their existence remains up in the air – they serve as purely theoretical postulates. Given that there is no chance of

confirming the existence of these ‘objects’ by acquaintance, the best we can do is try to explain their intrinsic properties by further postulation of parts that explain their holistic, or intrinsic, properties. This might seem like an epistemic point, and it might well be. However, from the point of view of metaphysics, we might say that this means that the world is indeed infinitely complex; we require positing more and more lower-level objects to explain higher-level objects in terms of parthood relations and property production. I will say more on this shortly.

Now onto (3). My theory makes sense of the properties not just in terms of the relations that exist between objects, but the holistic properties that are true of an object *in virtue of these relations*. For physical, or material objects, causal relations are responsible for the production of holistic properties. The intrinsic properties of an object are determined by the extrinsic relations between its parts; an H₂O molecule has its intrinsic properties by virtue of the extrinsic relations that hold between two hydrogen atoms and a single oxygen atom, namely a covalent bond. Under the way I am thinking, we need to qualify what we mean by an intrinsic property. This simply requires an addition to Humberstone’s description above: an intrinsic property is one whose possession just depends on the possessors itself *in a mereological frame of reference*. It is not in virtue of H₂O’s relation to anything else in a mereological frame of reference that gives it certain properties, but the relations between the parts that *make it up*, where the parts, as has been suggested, are not taken as objects but object-variables.

The implication of this thought is that the world is infinitely complex. Some theorists refer to this as, the inelegantly named, *gunk*. Why? For any object with intrinsic properties, in the way that I have suggested, it has those properties in virtue of the

relations that exist between its parts (prescribed by a morphological profile). In order to explain the properties of the objects of which come to be parts, we explain those properties in virtue of the relations that exist between *their* parts. This is what I have called cardinality shifting. And this goes on into the never-never.

In summary, the Nihilist can only ever commit themselves to simples as purely theoretical postulates, as they cannot explain precisely what it is that gives them intrinsic properties. As I have suggested, the Nihilist either says that the world is fundamentally structural and face the problems associated with this thought, or else blame our inability to discern the intrinsic properties of simples on epistemic grounds. I doubt that Nihilist would be happy with either.

3.2. RESPONSE: WHAT DO YOU MEAN BY LEGS?

The semantics of folk people allow certain inferences to be made by virtue of a commitment to parthood relations. Take the following inference:

- (1) There are tables
- (2) If there are tables, then there are table-legs
- (c) There are table-legs

The reason why the conditional expressed in (2) is true is because table-legs are ontologically dependent on the existence of tables. However, it is the kind of ontological dependence that is the important point. It is by virtue of being a *part* of a table that there

are such things as table-legs; put simply, without tables, there are no table-legs. That is, the truth-maker for (2) involves two things: the existence of tables, and the existence of parthood relations. Now, if we believe the Nihilist's paraphrasing methodology, we might do the following:

- (1) There are simples arranged table-wise
- (2) If there are simples arranged table-wise, then there are simples arranged table-leg-wise
- (c) There are simples arranged table-leg-wise

In what sense is (2) true in this inference? What is its truth-maker? As we saw above, the reason why there are things such as table-legs is because there are such things as tables of which table-legs are a part. Yet, given the Nihilist rejects parthood relations, I cannot see how (2) is true. Why, or perhaps better, how would we commit ourselves to simples arranged table-leg wise?

If the Nihilist rejects ontological dependency, and rejects the inference altogether, problems will emerge. In what sense do table-legs have an ontologically independent existence as simples? That is, what does it mean for some simples to be arranged table-leg-wise? It seems odd to say that there are simples arranged table-leg-wise without saying what relation this arrangement of simples has to the arrangement of simples table-wise. If there are simples arranged table-leg-wise, it will only be by virtue of a relation to some simples arranged table-wise. A candidate relation might be *sub-section* or *sub-set*. Though, this does not capture the nature of the relation between tables

and table-legs in folk-ontology; it is not just a sub-section for this seems to have a hint of arbitrary division, yet there is nothing arbitrary about table-legs. Further, I am reluctant to accept the language of sets for this seems to be tangled up in parthood talk also. Thus, there is a serious deficiency in the Nihilist's analysis.

Though it is difficult to make sense of what 'being in an *F*-wise arrangement' amounts to, the Nihilist might respond that the concepts involved in being *F*-wise are *phenomenal* concepts. That is, when simples are in an *F*-wise arrangement this is to say that they are merely of the appearance of being *F*. However, this kind of view can be easily denounced. Precisely what is it that is perceiving the thing as *F*-wise? Phenomenalistic language presupposes a sensory-apparatus of which sense-experience can be understood. That is, we require a commitment to a physical object – our sensorial faculties. Presumably such faculties are composite entities. And thus, the Nihilist cannot appeal to this sort of explanation.

The second problem is that the Nihilist cannot preserve folk-language, nor can it explain why we make such inferences. By rejecting the inference above, the Nihilist is not able to account for the kinds of reasoning that we employ in daily life. Often in everyday discussion we make these kinds of inferences, though perhaps tacitly. This is exemplified in discussion with mechanics, doctors, musicians, and the like. Again, here lies another deficiency in the Nihilist's analysis.

4. ORGANICISM: AT LEAST WE EXIST

Organicism is considered a *partial nihilistic theory*. It asserts that the only objects that have proper parts are living organisms. Thus it is a moderate theory; composition occurs sometimes. Though our intuitions may tend to sway in favour of a restriction on composition, Organicism is by no means intuitive. While it admits of mountain goats, it denies mountains. For the Organicist, the existence of ‘objects’ that we are familiar with in our everyday lives do not exist *over and above* an arrangement of simples. In this sense it has its allegiances to Nihilism. However, where it parts ways is the existence of organisms; any *living* system – in the biological sense. These are things that fall into the categories of vertebrate, insect, plant, or bacterium. The Organicist argues that composition occurs when there is a system of relations between objects that is sufficiently complex to bring about life – the good news is that at least *we* exist. When this does not occur, there are just simples.

One of the expectations that I, and other philosophers, have is that an answer to the question of when composition occurs must not be vague. That is, “if composition obeys a vague restriction, then it must sometimes be a vague matter whether composition takes place or not. And this is impossible.” (Lewis, 1986: 212). Organicism cannot seem to find a way around this problem. It is a vague matter when something participates in the activity of an organism. This point is expressed by Markosian:

“[C]onsider some simples that would ordinarily be taken to compose a carbon atom. Suppose those simples get ingested by a woman drinking tea, so that they

are eventually absorbed into her bloodstream. At precisely what instant does it come to be the case that those simples are caught up in that woman's life?" (Markosian, 2005: 14).

This is a powerful objection. It seems that we should reject Organicism straight off the bat as it fails to pass even the first hurdle. However there is something to admire about this theory. For composition to occur, Organicism requires that objects must relate to each other to bring about *a holistic property*. In this case it is *life*.

In previous cases where moderate theories were accused of vagueness, the finger was pointed towards the relations involved (i.e. contact, cohesion, fastening, and fusion). That is, composition was considered vague when we could not tell whether something was in, say, contact or not. However, Organicism, at least in my mind, is unique. The issue of vagueness moves from the kinds of relations involved such as contact, to a property – being 'caught up' in *life*. In other words, it is vague whether something is contributing to life or not. However, it is not clear that this is the same kind of vagueness that we have seen before. The difference is this: where the accusation of vagueness was previously directed at a relation, the kind of vagueness that plagues the Organicism concerns a monadic property. This, however, is a question of a concept, or at the linguistic level, a predicate – what is it for something to be *alive*. It seems that this is a matter of semantic indecision, and not an admission of metaphysical vagueness.

When Markosian asks, "At precisely what instant does it come to be the case that those simples are caught up in that woman's life?", the vagueness is a product of not knowing the conditions under which something is alive. In this sense, it is no different

from concepts such as the ‘outback’ or ‘heap’. Thus, when Lewis argues that it is impossible for composition to be a vague matter, the Organicist can wholeheartedly accept this while still being reasonable in maintaining their beliefs. The job for the Organicist, however, is to give the conditions under which something is alive, if this is possible, and no doubt the biological sciences will be consulted.

This, however, does not guarantee a way out of relational vagueness. Even if we were clear on the conditions under which something is alive, it might be said that we cannot pinpoint the instant in which something meets those conditions by virtue of some parthood relations. In Markosian’s passage, it is when certain simples meet these conditions with respect to a human. In the next section, I will respond to Markosian’s concern in light of what I said previously about the role of the Sorites paradox in mereology.

4.1 SAVING ORGANICISM: THE SORITES PARADOX, AGAIN

In Markosian’s passage above, the troublesome question that was asked was at what point do certain simples get caught up in human life? The answer is: This is irrelevant. Where the concept of a whole that would determine the relevant relations of parts to the whole required for a heap *fails* at the level of individual grains of sand, so too does the concept of a whole that would determine whether something *participates in a woman’s life* fail at the level of individual simples.

There is more work to be done. For very small organisms, simples might satisfy the relevant parthood relations. Though, what the argument above is claiming is that when deciding what parthood relations are relevant to *human life*, I am suggesting that this will not be decided at the atomic level.

There might be some confusion at this point: why am I defending Organicism? The answer is that I have great sympathies for this position for it is not far from what I have given as an object-theory. Where the Organicist demands life be the determiner for whether composition occurs, I demand something much more general, simply put; holistic properties. Life is, or might be, just one of the holistic properties we could accept, though it is arbitrary as to why we should draw the line here. Perhaps we could say that life is a *clear* case of a holistic property, though it should not be considered as a *defining* case.

Errata

Page 2: Delete: “The language of mereology even goes beyond the realm of extent objects to talk of fictional entities; the wings of Pegasus, for example – which might even confuse some into thinking that such things *must* exist (*a la* Meinong and his followers).”

Page 3: Remove: “Unger, 1979; Dorr 2002; Rosen and Dorr (2002)”.

Remove: “Merricks 2001”.

Insert: “those who believe that composites have to have non-redundant causal powers, and remain neutral on whether only organisms have those” After: “those who embrace only those composites that are living”

Page 3: Replace “all objects compose further objects”, with “given any collection of two or more different objects, no matter how disparate or widely scattered, there is a further object composed of exactly the objects in the collection”.

Page 4: Insert footnote: “Not all of the neo-Carnapian literature concern the nature of the quantifier. See Amie Thomasson’s paper, ‘Ontology Made Easy’ (2014).” After: “...we are under no truth-related constraints.”

Page 166: Insert bibliographic content:

Thomasson, Amie. (2015). *Ontology Made Easy*, Oxford University Press; Oxford.

After:

Tallant, Jonathan (2014)...

Before:

Tobin, E. (2010b)...

Page 5: Replace “mereology takes things further and asks in virtue of what relations do things exist” with “mereology is concerned with parthood relations; that is, the relations of part to whole, and part to part in the context of a whole” (Varzi 2016).

Page 6: Replace “For the most part of the early twentieth century, mereology was considered predominantly a matter of language. It was the project of establishing an axiomatic system of parthood relations.” with “For the most part of the early twentieth century, the primary ‘mereological project’ was to axiomatise a theory of parts and wholes.

Page 7: Replace “...by knowing the means by which something *becomes* a part sheds light on *what it is to be* a part, or, in other words, answer the Parthood question” with “Though this is not Peter van Inwagen’s position, I argue that knowing the means by which something *becomes* a part sheds light on *what it is to be* a part, or, in other words, answer the Parthood question. That is, there is no understanding of composition without understanding parthood; but there can be understanding parthood without understanding composition.”

Page 8: Replace “The objects that we take as existing are no more than simples arranged in an F-wise fashion” with “Our ordinary beliefs about what object exist turn out to be false. While ordinary objects might appear to exist, the only objects that do exist are simples.”

Page 8: Insert footnote: “Katherine Hawley (2002) argues that problems of vagueness also arise for nihilists.” After: “...arbitrary postulations of metaphysical relations.”

Page 163: Insert bibliographic content:

Hawley, Katherine. (2002) “Vagueness and Existence”. *Proceedings of the Aristotelian Society*. 102 (1): 125 – 140.

After:

Hall, Ned. ‘David Lewis’ Metaphysics’...

Before:

Hellar, Mark (1990)...

Page 9: Replace “The Universalist accepts that our ontology consists of the objects we wish to commit ourselves to, albeit with the questionable addition of an infinite amount more” with “Universalism accepts that our ontology consists of the objects that we wish to commit ourselves to, albeit with a questionable addition of unintuitive entities.”

Page 10: Insert: “Given that Universalists typically do not recognise a distinction between those things that exist and those that do not, compositions of existent entities are themselves existent entities”.

Page 11: Replace “Organicism holds that simples compose an object if and only if they are involved in the existence of a living organism” with “Organicism holds that simples compose an object if and only if there is a living organism exactly composed of those simples.”

Page 12: Insert: “That is, ‘the ys compose x’ entails that ‘the ys are part of x’, but the reverse is not true: it is not the case that ‘the ys are part of x’ entails the ys compose x.’ After: “unless each compositional theory comes with an implicit theory of parthood;”

Page 13: Insert footnote: “Ned Markosian (2014) attempts to answer the Parthood Question by arguing that all of the mereological properties and relations of physical objects are determined by their spatial properties and relations” After: “The Parthood Question is more primitive than The Composition Question.”

Page 164: Insert bibliographic content:

Markosian, Ned. (2014). “A Spatial Account of Mereology” in Kleinschmidt, S. *Mereology and Location*. Oxford University Press: Oxford.

After:

Markosian, Ned (2008)...

Before:

MacBride, F., (2006)...

Page 16: Insert footnote: “The definition that I have used here is taken from Berto and Plebani (2015) and Theodore Sider (2009), however Hirsch (2012) understands quantifier variance as a linguistic idea that is quite independent from the ontological question of what exists.” After: “...*there is no metaphysically privileged quantifier.*”

Page 17: Replace: “The truth-value of a sentence can change the meaning of the quantifier” with: “The truth-value of a sentence can change according to the meaning of the quantifier”.

Page 20: Replace “Mereology is no more than the study of oneness, an investigation into the formal properties of being one” with “Despite the complexity of the logic of parthood relations, mereology is about the structure of wholes, and the concept of a whole, in my view, is fundamentally the concept of a singleton or unity”.

Page 21: Insert footnote: Colin McGinn (2001) argues that the existential quantifier is neutral, meaning that the existence predicate can do meaningful work.

Page 164: Insert bibliographic content:

McGinn, Colin. (2001). *Logical Properties*. Oxford University Press: Oxford.

After:

MacBride, F. (2006)...

Before:

Meinong, A. (1904)...

Page 22: Replace: “The concept of a whole is fundamentally quantificational. We posit, recognize or acknowledge a whole by simply counting a collection, aggregation or group of things as one. It is not required that anything should justify, or warrant me doing so. If I want to that seems to be my privilege. You might question, out of curiosity, why I would want to do it, but I don’t think you can simply declare it mistaken” with “The concept of a *mere* whole is fundamentally quantificational. We posit, recognize or acknowledge a mere whole by simply counting a collection, aggregation or group of things as one. It is not required that anything should justify, or warrant me doing so. If I want to that seems to be my privilege. You might question, out of curiosity, why I would want to do it, but I don’t think you can simply declare it mistaken.”

Page 23: Insert footnote: “Upon reflection it doesn’t seem right to suppose that members of sets are parts of sets. See Lewis’ “Parts of Classes”. After “It renders individuals as parts of *one* thing, a whole or mereological sum”

Page 23: Insert: “More is said on how this idea relates to parthood in the section of genealogical relations, starting on page 34.”

Page 25. Replace: “An object is a mereological whole ... analytically good assumption.” with “Objects are existing wholes. All objects are mereological wholes; but only some mereological wholes exists. For example, while the fusion of my left toe and the Eiffel Tower is a mereological whole, it is not an existing whole: there exists no such entity as the fusion of my left toe and the Eiffel Tower.”

Page 26: Insert footnote: “This idea is closely related to Mark Johnston’s discussion of principles of unity in his paper ‘Hylomorphism’ (2006). Johnston examines what principle unifies parts into the whole that is the complex item. For Johnston, this principle of unity for a given item is a relation holding of some other items, such that ‘what it is for a given item to be is for the relation to hold amount those items. Moreover, each genuine kind of complex item will have associated with it a characteristic principle of unity; for arguably, it is sameness in principle of unity and kinds of parts that in turn qualifies the members of a given kind to be included in the complex whole that is the kind.’ (Johnston 2006, 653).” After: “...it’s history and all other contextual facts cannot be brought into consideration.”

Page 163: Insert bibliographic content:

Johnston, Mark. (2006). ‘Hylomorphism’ *Journal of Philosophy*. 103 (12): 652 – 698

After:

Husserl, Edmund (1901)...

Before:

Khalidi, M.A. (1989)...

Page 27: Insert: “While the substitution of parts might affect the property of having *original* parts, there are many things that could be changed that does not affect the property of being a car of a certain object-kind (i.e. a SS100 Jaguar).” After: “...and perhaps by a certain person.”

Page 28: Replace: “The structural relation between parts, at least for physical objects, is causal, and provides for properties of the object as an ontological singularity” with “The structural relations between parts for those things that exist are causal. This provides for properties of the object as an ontological singularity – a new entity, with novel properties; that is, (a) parts of physical objects are causally related; and (b) causal properties of physical objects supervene upon causal relations that hold between parts of those physical objects.

Page 28: Insert footnote: One might think that the causal relations of parts of physical objects involve exchange of conserved quantities between parts (i.e. the fusion of my left toe and the Eiffel Tower is not a physical object: there are no causal properties of the fusion of my left toe and the Eiffel Tower that supervene upon exchange of conserved quantities between my left toe and the Eiffel Tower.” After: “...causal properties of physical objects supervene upon causal relations that hold between parts of those physical objects.”

Page 29: Insert: “This is only to say that, roughly, what is for something being a Strad is that it was produced in the workshop of Antonio Stradivari at a particular time.” After: “...all bridges that when put into relation C with all other parts of S produce acoustic output K”

Page 30: Replace: “what is most important in this event-based concept of an object is that containment or nesting is defined and exhibited when it, the nesting of events, is itself acted upon by other objects as a singularity, and when it acts upon other objects as a singularity” With: “what is most important in this event-based concept of an object is that containment of parthood is exhibited when an object acts upon the world as a causal unit, and when it can be acted upon as a causal unit.”

Page 31: Insert: “That is, objects are distinct from mere whole by causal properties; objects are always in causal interaction with other objects. An object is composed of further (distinct) objects only if (a) those composing objects causally interact with one another and (b) the causal properties of the object supervene upon the causal interactions between the composing objects. Mere whole never causally interact with anything; mere wholes never have causal properties that supervene upon causal interactions between the things of which they are composed. After: ““I have tried to explicate the concept of object as being not that of a mereological sum or a basic cantorinan set, but as an ontological function which takes a mereological sum as an argument, and by causal operations on the members of that sum as structural relata,

returns the holistic properties of a singularity.”

Page 32: Insert: “That is, all objects are wholes; but not all wholes are objects. All objects have the constitutive properties of objects; but they also have the constitutive properties of wholes.” After: “The mereological dimension of an object is that object considered purely in terms of a whole, a sum. The ontological aspect of an object is that whole considered as a causal structural entity generating properties that make it part of the causal wash of the world.”

Page 33: Insert footnote: “Amie Thomasson (2007) makes related points about how we don’t count the parts once we’ve counted the whole.” After: “...of what we count as one.”

Page 166: Insert bibliographic content:

Thomasson, Amie. (2007). *Ordinary Objects*. Oxford University Press: Oxford.

After:

Tallant, Jonathan (2014)...

Before:

Tobin, E. (2010b)...

Page 36: Delete: “I know there are some obstinate metaphysicians who would insist that their car still exists when it lies in a completely dismantled state on the garage floor.”

Page 37: Insert footnote: “Upon further consideration, the theory of part/whole relations that I proffer implies that the world has much more structure than I would like to admit.” After: “Existential Inheritance”.

Page 42: Insert footnote: “Perhaps I could be a bit more explicit:

We can give a compositional -- bottom-up -- account of what compositely exists, on the assumption that there are simples, as follows.

Starting definition: A composite thing is either a simple or it is ultimately exhaustively composed of simples.

Starting assumption: All composite things are either objects (= existing things) or non-existing composite things; no composite things are both objects and non-existing composite things. Non-existing composite things divide into merely possible composite things and impossible composite things.

Base Case: Some existing composite things -- objects -- are simples. Some non-existing composite things are simples.

Constructive Formula: (a) Any fusion that is a mixture of objects and non-existing composite things is itself a non-existing composite thing. (b) Some fusions of objects are themselves objects; some fusions of objects are non-existing things. (c) A fusion of distinct objects O_i is itself an object O only if the O_i are appropriately causally related.

We can give a partitive -- top-down -- account of what exists, whether or not there are simples, as follows:

An existing composite thing -- an object O -- can be exhaustively partitioned into distinct objects O_i only if the O_i are appropriately causally related. An existing composite thing -- object -- cannot be exhaustively partitioned into distinct composite things some of which do not exist. A non-existing composite thing may be exhaustively partitioned into distinct composite things that exist, or into distinct composite things that do not exist, or into a mix of composite things that exist and composite things that do not exist.

Suppose that S_1 and S_2 are distinct existing simples. It may be the the fusion S of S_1 and S_2 is an existing object. If S is an existing object, then some of S 's properties supervene on actual causal interactions between S_1 and S_2 . (And, if the fusion of S_1 and S_2 has properties that supervene on actual causal interactions between S_1 and S_2 , then there is an object -- S -- that is composed by S_1 and S_2 .)

If it is merely possible for there to be causal interactions between S_1 and S_2 on which properties of their fusion would supervene, then S is a non-existent, merely possible composite thing.

If it is not possible for there to be causal interactions between S_1 and S_2 on which properties of their fusion would supervene, then S is a non-existent, impossible composite thing.

It is no more difficult to count mere composite things -- things that do not exist -- than it is to count objects.

We can construct a theory of composite kinds on the basis of our theory of composite things. We distinguish between actually instantiated composite kinds, merely possibly instantiated composite kinds, and what we shall call impossibly instantiated composite kinds (i.e. composite kinds only instantiated by impossible composite things).

There are actually instantiated composite kinds that divide actual composite things -- objects -- into things of the kind and things not of the kind. (Some merely possible

composite things would have instantiated this kind if they had been actual. No impossible composite thing instantiates -- or could instantiate -- one of these kinds.)

There are merely possibly instantiated composite kinds that divide merely possible composite things into things of the kind and things not of the kind. (No actual composite thing instantiates one of these kinds. No impossible composite thing instantiates one of these kinds.)

There are impossibly instantiated composite kinds that divide impossibly instantiated composite things into things of the kind and things not of the kind. (No actual composite thing instantiates one of these kinds. No merely possible composite thing instantiates one of these kinds.)

Suppose that any fusion of a toe and a tower is an impossible composite thing. Then the fusion of my left toe and the Eiffel Tower is an impossible composite thing that falls under the impossibly instantiated composite kind: fusion of a toe and a tower.

The above account only applies to composite things. You might suppose that there are impossible things that flout the rules of mereology (e.g. the simple that is the fusion of my left toe and the Eiffel Tower). I have not attempted to include them in this theory. They would need to be dealt with separately.

After: “We can *refer* to such proto-objects, we can even name them, but in doing so we do not imply the physical existence of anything but the constituents of the proto-object.”

Page 42: Insert: “This position is Meinongian in the way of Richard Sylvan and Graham Priest who claim there are physical things that do not exist.” After: “With a certain degree of melodramatic spin, proto-objects are literally things that don’t exist.”

Delete: While I hesitate to venture that all attributions of non-existence relate to proto objects, I am nevertheless sceptical that we have a fully articulated alternative concept of non-existence. The null or empty set should do that job, but set theory is typically silent on the nature of sets minus members; so to explicate the nonexistence of any membership as an empty “we-know-no-what” seems to indicate an explanatory shortfall. This is not to dispute a need for the concept of the empty set; set theoretic closure under intersection where there is a lack of a common member demands the empty set – but it does not explain it, it does not tell us what is empty or null. If we suppose that a set, at least in a naive cantorin form, is nothing more than the concept of a whole, then the intersection of say, the set of all equine creatures, and the set of all winged creatures yields a proto-object, a non-objectival whole. That whole, an aggregation of parts comprised of the corpus of a horse and a set of wings, fails to achieve physical objecthood through the requisite causal relations. What set-theory prescribes as a set devoid of any physical member is a non-objectival whole possessing the parts required of an object to satisfy membership of the intersection of the two sets. It is in just this sense that we can agree that the null set is ontologically empty, but in specifying the parthood conditions required of any object in that intersection, we specify

and posit a purely mereological, non-objectival whole.

Page 48: Delete: “Any reductionist who wants to claim that an object is just its parts, usually its fundamental parts, and who implies an identity relation between those parts and the whole in question, is asserting the unlikely thesis that there is an identity relation between certain existing wholes and the non-existent parent whole.”

Page 121: Delete: “The Universalist believes that everything is a proper-part of everything else”.

Page 123: Insert footnote “McGrath (1998) argues that no universalist should endorse Van Inwagen’s version of Universalism, and thus must either reject that material things endure through time, or that persons are material objects.” After: “...almost like a law of nature”

Page 164: Insert bibliographic content:

McGrath, Matthew (1998). “Van Inwagen’s Critique of Universalism”. *Analysis*. 58 (2) pp. 116 – 121.

After:

MacBride, F., (2006)...

Before:

Meinong, A. (1904)...

Page 123: Insert: “That is, *only* objects (and not mere wholes) exist; but not all (possible) objects exist.” After: “while mereology can tell us that for any object that does exist it will have particular formal characteristics as a whole, it cannot tell us what objects exist as a matter of fact. While we can infer from what objects exist to certain formal properties, we cannot infer from formal properties to the existence of objects.”

Page 124: Delete: “In a very real sense the Universalist is committing the fallacy of verbalism. In order to defend fusion as an object relation, and not simply a logical relation, Universalists seem to treat propositional or sentential conjunction as a compositional relation. However, it is a mistake to regard logical conjunction as an object relation. The notion of conjunction we are familiar with in standard first-order logical calculus is a sentential connective. It expresses a specific truth functional relation between propositions, and not a relation that exists between the objects or states of affairs expressed by propositions. Logical conjunction is not temporal conjunction. Temporal conjunction is a feature of reality insofar as coincidence in time is regarded as a relation between temporally bound entities. It is therefore quite wrong to use the concept of logical conjunction as any sort of relation that might bear on object relations. Given an object A, and an object B, there is no sense in which, as the logical

conjunction of objects A and B, we therefore have an object C. The idea that there is a valid inference from “an object A exists”, “an object B exists” to “an object A and B (call it object C) exists” is to commit the fallacy of verbalism. For objects A and B, we can only validly infer “objects A and B exist”.”

Page 131: Insert: “Hence, an answer to the special composition question is: The *x*s compose some further object *y* if and only if some of *y*’s intrinsic properties supervene upon causal interactions between the *x*s. After: “The answer will not be given by simply looking at any *R*, but by understanding the nature of *F*.”

Page 133: Insert: I have not tried to characterise Sider’s argument as a typical Soritical argument about the predicate ‘...is a heap’, but instead a revised version of a Soritical argument about the predicate ‘being a part of a heap’.

Page 148: Insert footnote: “Hawthorne and Corten’s (1993) argue that ontological nihilism should be taken as a serious metaphysical picture; that ‘the concept of an objects has no place in a perspicuous characterisation of reality’. After: “...is not the nihilist line.”

Page 148: Insert footnote: “Jason Turner (2009) argues that in order to defend the thesis that there is nothing at all, ‘we need a bloated ideology, indefinitely brute, necessary connections, and a deep-seated holism about the structure of reality.’ After: “is not the nihilist line.”

Page 163: Insert bibliographic content:

Hawthorne, John and Corten, Andrew. (1995). ‘Towards Ontological Nihilism’. *Philosophical Studies*. 79 (2) pp. 143 – 165.

After:

Hall, Ned. ‘David Lewis’ Metaphysics’....

Before:

Hellar, Mark (1990)...

Page 166: Insert bibliographic content:

Turner, Jason. (2011). ‘Ontological Nihilism’. In Bennett, Karen and Zimmerman, Dean. (eds). *Oxford Studies in Metaphysics*. Oxford University Press.

After:

Tobin, E. (2010b)...

Before:

Unger, Peter (1979)...

Page 153: Delete: “3.2. RESPONSE: WHAT DO YOU MEAN BY LEGS?”

The semantics of folk people allow certain inferences to be made by virtue of a commitment to parthood relations. Take the following inference:

- (1) There are tables
- (2) If there are tables, then there are table-legs
- (c) There are table-legs

The reason why the conditional expressed in (2) is true is because table-legs are ontologically dependent on the existence of tables. However, it is the kind of ontological dependence that is the important point. It is by virtue of being a part of a table that there are such things as table-legs; put simply, without tables, there are no table-legs. That is, the truth-maker for (2) involves two things: the existence of tables, and the existence of parthood relations. Now, if we believe the Nihilist’s paraphrasing methodology, we might do the following:

- (1) There are simples arranged table-wise
- (2) If there are simples arranged table-wise, then there are simples arranged tableleg-wise
- (c) There are simples arranged table-leg-wise

In what sense is (2) true in this inference? What is its truth-maker? As we saw above, the reason why there are things such as table-legs is because there are such things as tables of which table-legs are a part. Yet, given the Nihilist rejects parthood relations, I cannot see how (2) is true. Why, or perhaps better, how would we commit ourselves to simples arranged table-leg wise? If the Nihilist rejects ontological dependency, and rejects the inference altogether, problems will emerge. In what sense do table-legs have an ontologically independent existence as simples? That is, what does it mean for some simples to be arranged table-leg-wise? It seems odd to say that there are simples arranged table-legwise without saying what relation this arrangement of simples has to the arrangement of simples table-wise. If there are simples arranged table-leg-wise, it will only be by virtue of a relation to some simples arranged table-wise. A candidate relation might be subsection or sub-set. Though, this does not capture the nature of the relation between tables and table-legs in folk-ontology; it is not just a sub-section for this seems to have a hint of arbitrary division, yet there is nothing arbitrary about table-legs. Further, I am reluctant to accept the language of sets for this seems to be tangled up in parthood talk also. Thus, there is a serious deficiency in the Nihilist’s analysis. Though it is difficult to make sense of what ‘being in an F-wise arrangement’ amounts to, the Nihilist might respond that the concepts involved in being F-wise are phenomenal concepts. That is, when simples are in an F-wise arrangement this is to say that they are merely of the appearance of being F. However, this kind of view can be easily denounced. Precisely what is it that is perceiving the thing as F-wise? Phenomenalistic language presupposes a sensory-apparatus of which sense-experience can be

understood. That is, we require a commitment to a physical object – our sensorial faculties. Presumably such faculties are composite entities. And thus, the Nihilist cannot appeal to this sort of explanation.

The second problem is that the Nihilist cannot preserve folk-language, nor can it explain why we make such inferences. By rejecting the inference above, the Nihilist is not able to account for the kinds of reasoning that we employ in daily life. Often in everyday discussion we make these kinds of inferences, though perhaps tacitly. This is exemplified in discussion with mechanics, doctors, musicians, and the like. Again, here lies another deficiency in the Nihilist's analysis.

Glossary

CARDINALITY SHIFTING: Parts of objects are rendered objects in their own right by counting them as one. Cardinality shifts are movements to and from frames of reference within which we do mereological accounting. When we consider the idea of a part of a whole we engage in a downward cardinality shift, and conversely when we consider a whole as a part we engage in an upward cardinality shift. This involves the dismantling and assembly of wholes and parts the shifts the level of reference.

CATASTROPHE: an identity-*destructive*, causal interaction.

COALESCENCE: an identity-*productive*, causal interaction.

COLLISION: an identity-*preserving*, causal interaction.

EXISTENCE PREDICATE: The explicit expression of existence with a *realist attitude*. The existence predicate captures one's standards for existence.

EXISTENTIAL INDIFFERENCE: One's attitude when performing a referential gesture insensitive to ontological matters, but performed with pragmatic goals in mind.

EXISTENTIAL INHERITANCE: Cardinality shifting carries objecthood from the highest level of ontology, the world as an object, down through each lower level of objecthood to fundamental particles (if such things exist). It is the inheritance of existence through the bequeathing of objecthood, the passing on of object status, from parent-wholes to child-wholes in the genealogical family-tree structure forced by cardinality shifting.

GENEALOGICAL RELATIONS: When we consider the parts of a whole, those parts are themselves conceptually rendered as wholes and assume a child-to-parent relationship with the initial whole, and a sibling-to-sibling relation to other parts. This is the effect of cardinality shifting.

MEREOLGY: A matter of form; an object considered entirely in terms of a whole, a sum. Just as we do not expect first-order logic to tell us which proposition are true or false, so mereology as a formal structure should not propose to tell us about what exists and what does not. The ontological status of an object is not the business of mereology but the substratum of which ontology emerges.

MORPHOLOGICAL PROFILE: A profile that specifies for a certain degree of generality, the composition and the properties of an object. The profile provides an account of parts and relations that determines an object with specific properties. A profile can, at a higher level, define a kind, and at a lower level a specific individual. Parts under the instruction of a profile assume *structural identity*.

OBJECT: an ontological function that which takes a mereological sum as an argument, and by some relational operations on the members of that sum, *parts*, returns the holistic properties of a singular entity.

OBJECT VARIABLE: the notion of a part under the constraints of *structural equivalence* can take one or more values.

ONTOLOGY: The aspect of an object that is a whole considered as a causal structural entity generating properties that make it part of the causal wash of the world. It provides the content for the metaphysical substratum given by mereology. Objects are wholes, and it is within that form as wholes that ontology must find accommodation. If mereology provides the formal basis for the relationship between parts and wholes, the ontology should assume the task of describing and telling us about what goes on in that relation, it should fill the content of that relation.

PART: Purely structural entities defined entirely by the extrinsic relations within the context of a whole. Parts are not counted as one; they are considered in the context of something that is counted as one.

QUANTIFIER: The linguistic expression of countability: counting something *as one* – a mereological whole. This is ontologically neutral, and expressed with an attitude of *existential indifference*.

THE REALIST ATTITUDE: One's attitude when performing a referential gesture sensitive to ontological matters, or truth.

STRUCTURAL EQUIVALENCE: Under the notion of structural identity, a part can be replaced without affecting the identity of the object when it preserves the relevant part-to-part relations required to produce properties prescribed by the morphological profile of the object; when it is *structurally equivalent* to the part it replaces. A part is *structurally equivalent* to another when, if put in identical relations with all other parts, the properties of the object as a whole are preserved.

STRUCTURAL IDENTITY: the relations that bear between object-variables responsible for the output of certain properties. The relational structural and property output define the object and is captured by a morphological profile.

WHOLE: A postulation, recognition, or acknowledgement of a collection, aggregation, or group of things *as one*, as given by the fusion principle.

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