Falsificationist Realism: Oh, What a Tangled Web We Weave, When First We Practice to Perceive

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Falsificationist Realism:
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i. Introductory Inclinations

“Suppose we want truth: why not rather untruth? and uncertainty? even ignorance?” In 1886, as the modern analytic tradition of philosophy was just beginning, the revolutionary philosopher Friedrich Nietzsche began a paper entitled “On the Prejudices of Philosophers” with these words, questioning the entire endeavor of philosophers and scientists. These questions were in response to Nietzsche’s recognition of the failure of the previous centuries’ Enlightenment project. Philosophers such as René Descartes and David Hume had faced the world as their contemporary scientific colleagues had faced the world, and sought to justify the conclusions and processes of scientific observation. They sought to overcome every possible skeptical limitation, and provide a clear path towards truth, or at least reasonable belief. To this end, they applied rigorous skeptical tools to any claim of knowledge, searching for a firm foundation for knowledge. Ultimately, however, their search was in vain, and yielded only uncertainty.

The founders of the analytic tradition faced these same failures and
asked the same question: why should metaphysical truth be the goal of science? Though, unlike Nietzsche, they saw an answer in pure observation and the relations between phenomena. These thinkers excised from science any concern for the underlying nature of the world or the true physical causes of the effects with which they were presented. They recognized the fundamental uncertainty that is inherent within any attempt to explain a natural phenomenon, and instead turned away from a realist’s search for truth. In favor of this, they redefined the goal of science more modestly, favoring investigations of phenomena that can be directly observed, and therefore known.

This turn was predicated upon two fundamental beliefs. The first was that a level of certainty and justification could be attained in observational knowledge of phenomena that could not be reached through any search for broad generality or for deep understanding. The analytic founders’ second belief was that there could be no systematic approach through which causality can be examined through science. Taking these two principles as necessary (though for many unpleasant) truths, the general framework of the rest of the analytic tradition follows.

I react against both of these methodological principles, and develop an ameliorative philosophy of falsificationist realism that takes as its goal the absolute nature of the world. Furthermore, I demonstrate that falsificationist realism is scientifically superior to those that developed out of the analytic tradition. The metric of this superiority, however, is perhaps non-standard.

I hold that in order to judge between ameliorative philosophies of science, one cannot merely reference how scientists have acted in the past – to do so not only belies the ameliorative project, it is itself unscientific. Rather, I will maintain that the preferable scientific methodology is that which most furthers the singular act that is definitive of science: progress. Philosophers of science have historically defined science in terms of the object of scientific inquiry; however, this is circular, for it is this very object that many philosophers of science are investigating and questioning. Regardless of what one defines as the object of science – be it ontological truth, constant conjunction, phenomenological predictability, underlying order, or any of the other hypotheses on the subject – the one thing that is consistent through them all is a concept of a progression from ignorance to knowledge (or belief or more encompassing theory, etc.). Thus, in arguing in favor of my own falsificationist realism, I will argue that it contains greater possibilities for progression, both in number of avenues and in depth.

**ii. Distinctive Definitions**

Before delving fully into the development of falsificationist real-
ism, I will make clear the definitions of ontology and phenomenology that I will be using, since they are very particular and different from those which many other philosophers have used. Phenomenology, as I will be defining it, is that field of study that analyzes phenomena in the world, or what is directly observable about the world. This is not to say that it examines actual sensations or observations. Phenomenological properties are properties that are observable, but the nature of this observability is a relationship between the object being observed and the individual doing the observation. Sensations, on the other hand, are defined purely from the perspective – indeed, as the perspective – of the observer.

To take an example from popular media, in the film The Matrix, a phenomenological experience would be an experience in the “real world,” whereas a sensation would include both those in the “real world” and those in the “matrix.” Essentially, sensations cannot distinguish between hallucinations and true observations, but phenomenological observations assume the existence of the object under study, without considering the actual nature of that object. Thus, phenomenological properties are those characteristics of the world that make the world observable.

Phenomenology is contrasted with ontology, which is generally defined as the field of study that analyzes the nature of being and existence, and is thus the study of that which is, independent of any observer. Ontological entities are those properties of the world that cause the world to act the way that it does. Ontology includes both broad generalizations as well as detailed instantiations. In essence, ontology is anything that exists in virtue of itself, regardless of whether it can be directly observed or not.

These two concepts relate to each other as a fundamental dichotomy. The phenomenological world consists of what is apparent to an observer. No phenomenon can exist until there is an observer who could observe it – again, this observation is not necessary, but for something to be observable there must be an observer. The ontological world, on the other hand, is completely observer independent. Ontology addresses existence itself and the universe as it actually operates on a fundamental level. It deals with the absolute nature of reality, whereas phenomenology deals with reality as it is presentable to us.

iii. Enlightened Errors

The philosophy of the Enlightenment has been one of the greatest influences of the past century’s philosophy and culture. Perhaps the most important result of this period’s thought was the realization that there is rarely a legitimate justification for any belief. In a sense, this impossibili-
ty marks the failure one of the central goals of the Enlightenment. Thinkers like René Descartes and David Hume searched for ways in which humanity may understand and justify its beliefs. To this end, they developed skeptical tools to gain a new perspective on the trust that had been placed in the foundations that were already in place. The Enlightenment failed, not because these skeptical tools were unsuccessful as a proving ground for the foundationalism that was prevalent at the time, but because every foundation proved unable to survive the tests.

Descartes’ and Hume’s skeptical philosophies provide strong arguments that knowledge of the underlying nature of the universe is impossible by demonstrating that such knowledge cannot be derived simply from pure observations. In response to this, philosophers in the analytic tradition of the early twentieth century posited two methodological principles: phenomenology and relativism. These two principles are based on the belief that it is impossible to overcome the doubt of the Enlightenment and make progress towards a realist picture of truth.

I will argue that this conclusion ignores an important alternative that was first hinted at in the philosophy of Karl Popper, though was developed within a phenomenological relativist framework. If we avoid any positive assertions of knowledge in favor of a general progression in the direction of some picture of truth, we are able to overcome many of the limitations that would seem to necessitate relativism. I will set up just such a methodology through this paper.

**iv. A Falsificationist Framework**

I will be taking Karl Popper’s falsificationist theory of verisimilitude as a framework for how one may overcome many of the problems that arose out of Enlightenment skepticism. He began by focusing on falsification, rather than proof. By systematically proving that various theories are false, Popper maintains that one may then gradually increase the *verisimilitude*, or truth-likeness of a theory. The underlying premise of the theory of verisimilitude is that by consistently ruling out potential theories, one is forced continually to rethink the theories that exist. With each reformulation or replacement of a theory, the new theory must be able to account for all of the phenomena under the umbrella of the old theory. However, it must also account for the newly observed phenomena, the phenomena that falsified the old theory. I will return to this requirement later on, and will ultimately be forced to revise it heavily, but for the time being this method is sufficient to provide a gradual asymptotic progression towards the ideal of a theory that could account for any conceivable observation – the theory with the greatest possible verisimilitude.
Another important principle arises from Popper’s theory of verisimilitude upon which I will rely. Since new theories and new understandings are the tools of scientific progression, they ought to be held with the highest regard – though this is rarely the case in actual scientific practice, for reasons that I will address later. Under this mentality, a theory can never be held as “true,” and it can never be assumed to be truer than another theory merely by virtue of the fact that it has persisted for a greater duration. A theory can be held as being closer to the truth than another theory only by virtue of having greater explanatory power, by accounting for phenomena that have falsified a competing theory.

v. Re-Formulating Falsificationism

Having outlined some of Popper’s important points, it is necessary to return briefly to a discussion of the distinction between ontology and phenomenology. It is clear upon consideration that neither ontology nor phenomenology can suffice without the other. Thus, unless there is a fourth possibility over and against ontological primacy and phenomenological primacy, some amount of ontico-phenomenological unity is now the only remaining option. It is yet to be determined, however, what the nature of the interactions between these two halves is, and in what proportions each is to be taken. Much of this explanation will have to wait until later sections, but a general outline can be presented here of the reliance of ontology on phenomenology through falsificationism and the dependence of phenomenology on ontology for generality.

Ontico-phenomenological unity is not a complete union, where the two halves become one single entity. Rather, ontico-phenomenological unity is a mutually dependent relationship between two distinct halves in such a way that they cannot be separated without the destruction of both. The nature and virtue of the connection between ontology and phenomenology can most easily be found in a new form of falsificationism.

Generalizing from and expanding upon the basic model of falsificationism, the ontological aspect of any theory must be constructed prior to any real tests of that theory. This is not to say that one must construct the ontology prior to any experience of the world – the problems with this view are clear, and will be addressed later. One must, however, create an ontology that can explain whatever phenomena are being described and predicted by the theory. The distinction between explanation and prediction is a subtle one, and many philosophers have equated the two. The difference becomes most clear through the example of a program such as quantum theory in which predictions are based on a mathematical model that does not have a corresponding picture of reality – indeed, most quan-
quantum theorists believe that such a picture is impossible. Nevertheless, it is
the ability of a theory to provide a clear understanding of the world such
that a particular phenomenon occurs that I am defining as explanation,
rather than its ability to precisely provide beforehand exactly what a result
will be. I will be postulating a scientific method that progresses science in
the direction of increased explanation in this sense, towards greater ontol-
ogical understanding.

The nature of scientific progression in general is such that a new
theory will usually be formulated only when it is needed, that is, when all
previously held theories have failed substantial phenomenological tests.
In this situation, the formulation of the ontology that would explain a
recalcitrant observation – that is, an observation that is inexplicable with-
in any of the earlier ontological structures – comes only after that obser-
vation. However, this formulation is a new theory that is merely explain-
ing all prior observations. The new phenomenal aspects of the theory –
and thus the means of further phenomenological progression beyond the
earlier falsifying experiment – would be new predictions that had not been
made or new extensions of the theory into realms that had been forbidden
to its forbearer, both of which would be derived from an analysis of the
new ontological structure.

It is important to recognize that this has not always been the his-
torical progression upon theoretical falsification. The most notorious
example of a theoretical development progressing in a purely phenome-
ological manner is the formulation of the standard interpretation of quan-
tum theory. In this situation, various ontological structures were system-
atically falsified, and a methodical rejection of ontological structures in
general grew in their place. In this situation, the phenomenological math-
ematical model was repeatedly all that was left after a falsification, and
that mathematical model – with the associated doctrine that no such onto-
logical structure exists – became the actual theory. In spite of this, I have
argued elsewhere that this progression was not necessary, and that it has
proved to be a hindrance to the science.4

The source of the phenomenological aspect of a theory comes from
a full logical analysis of its ontological principles. One must analyze the
theory in its original form fully, and find as many logical consequences as
one can. These logical consequences will ultimately tell a researcher what
the theory says more completely than the initial formulation of the theory,
because they will expand the theory to address much more than it did pre-
viously. An honest examination of this expansion will reveal that it is not
a rigid deduction of phenomena, as in the hypothetico-deductive method.
Rather, through a process that will be described throughout the rest of this
work, both ontological and phenomenological consequences and possibilities are discovered. Furthermore, this analytic method includes the discovery of different possible assumptions, yielding a justification of multiple different results to a given falsificationist test of a theory.

To investigate this more closely, consider the purely ontological theory that the universe is constructed of nothing but cheese. Ignoring that this is so obviously ridiculous – the ridiculous nature of this theory is a product of it having failed every conceivable phenomenological test – I will analyze the ramifications of this. Ontologically, a universe that is nothing but cheese leads to the conclusion that the universe is fundamentally a dairy product, and thus must either be full of preservatives, maturating nicely, or spoiling – depending on your preference of cheeses. There are other ontological consequences of this theory, but these will suffice. The phenomenological consequences are even more obvious – if the world is made of cheese, then I ought to be able to look at anything, smell anything, taste anything, and find that it is cheese. The consequences of the original ontological ramifications could be described thus: that the world must have been made by a giant cow and a cosmic farmer, and if the universe is not full of preservatives, then the apocalypse is nigh.

A more historical and well-grounded example of this methodology follows the ether theory at the end of the nineteenth century. This theory posited that there is an underlying structure that permeates the universe called the ether that is the medium through which light propagates as a wave. In 1887, Albert Michelson and Edward Morley published results of an experiment that would have evidenced the ether. Many scientists to that point had thought that the ether is purely epiphenomenal, and that it is phenomenologically indistinguishable from any other theory that accounts for the wave-nature of light. Michelson and Morley, however, found a problem with this when it is combined with James Clerk Maxwell’s recent discovery that light always travels the same speed. Since the Earth is traveling through the ether, and light always travels at a fixed rate relative to the ether, then light must travel a greater distance to go between two points when it travels in the direction of the Earth’s motion than it does when it travels perpendicular to it. Michelson and Morley devised an experiment that would have demonstrated this effect, and when they did not perceive it, disproved the ether.

By finding the phenomenological ramifications of the network of ontological consequences, one is able to develop a set of experiments that can test the accuracy of the ontological theory as a whole. Furthermore, as I will more fully explain later, analyzing different assumptions that could predict either conclusion in a particular experiment, one has means of
continual scientific progression, regardless of what experimental results are observed. A further result of this process is that different theoretical structures – individual explanatory mechanisms within a given theory – cannot be entirely independent, though they may be distinct. I will develop this point further during my analyses of the philosophies of Willard van Orman Quine and Roy Bhaskar, and then reconnect this with this view of ontological falsificationism.

vi. Quintessential Quinian Quandaries

In 1951, the logician Willard van Orman Quine published a groundbreaking article entitled “Two Dogmas of Empiricism.” This paper brought to its knees one of the most prevalent philosophies of science to that point: logical empiricism. Quine’s presentation of the dogmas of empiricism was only the very beginning of his philosophy, however – it was the justification of the need for the creation of a new philosophy to replace the reductionism and analytic-synthetic distinction of empiricism. Rather than reducing any statement about the world to individual synthetic sense experiences, he said that “the unit of empirical significance is the whole of science” and that “statements about the external world face the tribunal of sense experience not individually, but as a corporate body.”

One must face reality with the whole of one’s beliefs, rather than indivisible atomic statements of phenomenological content, because beliefs are not separable into individual statements about sense data. Evaluation of any given statement about the world necessitates evaluation of certain other statements, because they are logically interconnected.

This is not the whole picture that Quine wants to paint, however, because it is evident that not all statements are created equal, empirically speaking. Even without the analytic-synthetic distinction, it is evident that there are differences between the statements, “Apples fall from trees,” “Gravity exists as the warping of spacetime” and, “If apples are massive objects, they will fall from trees, and apples are massive objects, therefore they fall from trees.” In answer to this, Quine paints a picture of a tapestry or web “which impinges on experience only along the edges,” with a gradient flowing away from the edge to the center of the web, where we have the most sure laws of logic and mathematics – those ideas that had previously been thought of as a priori analytic statements.

Perhaps the most notable aspect of Quine’s web is that there is no greater certainty in the center than there is at the fringe. All that can be claimed is that the more centralized a statement is, the more that it is relied upon. Everything that is closer to the fringe than a particular statement is in some way dependent upon that statement, and an instantiation
of it. Thus, the logical, physical and observational laws that so strongly linked atomic statements to experiences are just more centralized parts of the same web of belief – no more certain, merely having more epistemological dependents.

Another result of the interlocking holistic nature of this web is that “any statement can be held true come what may, if we make drastic enough adjustments elsewhere in the system”7. To illustrate this, consider the example of a magic show where a magician “levitates” his assistant in front of spectators. Now, it is almost certain that every person in the audience has as a relatively prominent part of their webs of belief some sort of concept of gravity. It is also evident that this concept of gravity supervenes upon the statement “Gaudily clad assistants fall when not supported by something solid.” A further part of the audience’s webs of belief will certainly be a statement along the lines of “In ideal conditions, my senses can be trusted to report relatively accurately the nature of the world,” a statement which in Quine’s taxonomy will be close to the center of their webs. Finally, the majority will likely have some statement to the effect of “Magic does not exist,” or at least “This magician will not perform magic.”

Now, into the perceptual experience of a crowd with these aspects of their webs of belief comes the magician. Everyone in the crowd sees the magician – with the requisite pomp and flair, certainly – levitate his gaudily clad assistant, and then proceed to pass a ring over her body to “prove” that nothing more than his will is supporting her. Now, apart from being amazed, impressed and entertained, the audience is faced with a problem – the levitation of a gaudily clad assistant does not fit in their webs of belief, so something must change. However, there are a number of changes that can take place within the same web that allows for the levitation of gaudily clad assistants. The vast majority of the crowd will likely provide an addendum to the statement, “In ideal conditions, my senses can be trusted to relatively accurately report the nature of the world,” that asserts that, “Being in the presence of a magician is anything but ideal conditions.”

However, this is not the only possible response. The crowd could also decide that their concept of gravity was in need of revision, perhaps changing it from “There is a force called gravity that always causes unsupported objects near massive bodies to fall,” to something along the lines of “There is a force called gravity that always causes unsupported objects that are not gaudily clad individuals near massive bodies to fall.” The crowd could then cope with the statement about the falling of gaudily clad assistants when they are not supported, because it is no longer supervened by
this newly revised concept of gravity.

With the flexibility of possible changes to the web following a recalcitrant experience comes the reanalysis of the position of what were previously held as the absolute a priori analytic laws of logic. No statement in Quine’s web of belief is immune to revision, not even the laws of logic. Rather, the laws of logic are what make the links throughout the web, and are therefore pieces of the web that are particularly close to the center. The laws of logic therefore are tied to particularly large portions of the web, but they are not in any way impervious to the possibility of revision. Indeed, many of the points of logic that have held since the time of Aristotle came under scrutiny at the turn of the last century, with the work of Gottlob Frege and Bertrand Russell among others leading to the revision of some of the centrally located beliefs, although these revisions were subtle enough that their ramifications were not widely noticed.

vii. Tracing Truth

It is clear from this conclusion that, though his philosophy includes a full account of ontology, Quine is maintaining some of the phenomenological principles of the Enlightenment, in the same way as the rest of the analytic tradition. He still maintains a generally phenomenological perspective, in that the web of belief rests upon its phenomenological fringe, and foundationally relies upon that fringe to sustain a link to reality – while simultaneously arguing against the maintenance of foundations. While this may seem to be the link between ontology and phenomenology that I have been searching for, it is still lacking. Not only is it dependent upon a phenomenological world view, but it is also fully relativist, in the same way that Popper’s falsificationism is relativist.

Quine was fully aware of this, claiming “that we cannot require theories to be fully interpreted, except in a relative sense, if anything is to count as a theory.” His philosophy requires that any webs that are identical along the fringe be considered in essence identical, in the sense that there are no grounds or reason to choose between them. Just as with the early analytics and Popper, by building his foundation upon phenomena, relativism necessarily follows.

My reason for rejecting the philosophies of both Quine and Popper is not necessarily inherent in their philosophy. They both become trapped by relativist phenomenology because they do the same as Descartes and Hume: they justify their accounts of knowledge with a foundation of phenomenology. It is this foundationalism that has required them to assume ontological relativity and phenomenological primacy. The solution to all of these problems is to take the philosophy of these thinkers and to reject
the foundationalism.

Though his picture incorporates a complete ontology, Quine concluded that there are no criteria to govern that ontology except for phenomena, and no requirement that the ontology be fully analyzed. There is an almost limitless number of ways that any series of experiences can be interpreted, and therefore any belief can be maintained, so long as certain others are sacrificed. This is the heart of Quine’s phenomenological foundationalism – all that can concern a Quinian scientist is the phenomenological consequences of that belief. Thus, there is no requirement that the principles within a Quinian web fit together into a single worldview, so long as they do not provide predictions that contradict each other.

It would seem, then, that any science that attempts to progress without relativizing ontology must begin with a consideration of the nature of truth and maintain criteria for validity that includes full internal coherence. A philosopher of science attempting to develop such a science must first inquire into what true knowledge would look like, were it to be grasped. To this end, ignoring that science will probably never be a completed discipline, I ask what the silhouette of that picture would be, if it were to be seen.

The universe exists, and it exists in a coherent, universal, and constant way. These are the necessary guiding assumptions in science. The universe cannot contradict itself, and thus the underlying mechanisms that govern it cannot necessitate that the universe have two different natures. Furthermore, these mechanisms must be uniform in space and constant through time. Without assuming this, there is no reason to engage in scientific study, because what is discovered in one instance could never be applied to another instance. If the laws of nature exist, but are in flux, either in time or space, then scientific study is left studying nothing. Two laws of nature cannot ever contradict each other, so all of the laws of nature must be understandable in a single theory, if they are to be understandable at all.

These principles may be taken as a sort of foundation, but not in any way like the foundations of the Enlightenment and analytic traditions. These are fully ontological principles - they are principles of existence, principles that fully deal with the nature of being in general. However, what is more important about these principles is that they are principles in a Quinian web, and so are subject to revision and change, though they are also central, and therefore serve pragmatically as the basis of the rest of the web. Quine supported his ontological web along the fringe with phenomenology; these principles provide a second pillar of support for a Quinian web by providing ontological principles in the center that govern
the formation of the rest of the web.

These principles provide a second pillar for Quine’s web, working with the pillar of phenomenology. By doing this, these principles also provide a second application of Popper’s falsificationism, for truth is no longer merely correspondence, but also coherence. From this, the true possibilities of ontological falsification come into play. A theory can be rejected, not only because it does not correspond to the way that the world is observed to work, but also if it fails to be fully ontological and fails to provide a complete explanation for all relevant observed phenomena. A theory can be proven false by contradicting itself or failing to account for phenomena that fall within the realm of the theory’s applicability. It can further be falsified ontologically by providing a different picture of the universe than another theoretical structure with which it is attempting to merge, even if these two pictures provide entirely coherent predictions. Also, there is greater room for the development of phenomenological falsification with the inclusion of an ontology. This is because the ontological network of a theory includes various logical principles, and thus includes a concept of logical consequence, allowing for greater ontological and phenomenological expansion of the theory. This is not to say that a theory includes principles that are necessary for their own sake, but principles that provide for the necessity of other aspects of the theory, given the theory as a whole. By making these connections, it is possible to find a theory that is more fully a universal explanation that can spread to predictions outside of the bare phenomenology that the initial theory is capable of encompassing. I will return to this principle of theoretical expansion after drawing on the work of Roy Bhaskar.

**viii. Basics of Bhaskar**

In the final quarter of the twentieth century, the philosopher Roy Bhaskar argued that the analytic philosophers before him had inadquate-ly explained the actual process of scientific inquiry. He was not concerned as I am with developing an ameliorative philosophy, but took “it to be the function of philosophy to analyze concepts which are ‘already given’ but ‘as confused.’”\(^{10}\) Bhaskar’s goal was to describe how science *does* work, rather than how it *could* work.

Nevertheless, Bhaskar’s work makes great strides towards developing a conception of truth and knowledge as the goal of science that is well suited to provide what is needed as a central pillar for my revisions of Quine’s philosophy. The growth of his ontological philosophy also casts light upon Quinian web-creation within my model. Furthermore, out of Bhaskar’s philosophical structure a clear account of ontological falsifica-
tionist scientific progression can be developed, the backbone of falsificationist realism. I will also use his ideas to formulate a method of describing the universe such that this progression is one towards greater ontological truth, rather than the greater phenomenological correspondence of Popper’s philosophy.

Bhaskar argued against the logical empiricism and phenomenology of the analytic tradition. He attacked pure phenomenalism, but not by demonstrating that it is an inefficient philosophy of science, as I do. Rather, with Kant, he argued that pure phenomenalism is impossible, because some degree of interpretation is unavoidable. We can never face phenomena without positing an account of their reality, so any interpretation must involve ontology. This is a radical assertion of the theory-ladeness of observation: one cannot have a pure observation, which can then be incorporated into a theoretical structure. It is impossible to categorize experiences as such into an objective scientific law. Rather, in the very act of observing, one interprets those observations through a veil of one’s prior experiences and beliefs to construct a picture of the world.

Closely tied to this assertion is Bhaskar’s principle of “the non-spontaneous production of knowledge, viz. the production of knowledge from and by means of knowledge.” In the same way that the theory-ladenness of observation denies the possibility of truly fresh observational eyes, this principle of epistemological relativism denies the possibility that one could develop an interpretation of those observations without the inspiration and limitations of prior theoretical structures. Rather, new theories always arise out of the perspectives of priorly held beliefs, and creativity in science comes out of new perspectives being applied to a particular set of phenomena.

Bhaskar’s final critique of phenomenalism is the common denial that “there is an ontological distinction between scientific laws and patterns of events.” Constant conjunction describes phenomenalological events, and a law that maintains a specific constant conjunction between events can provide phenomenological predictions. The problem with this picture of causal laws is that it is of extremely limited applicability. Laboratories create what Bhaskar calls a closed system and what phenomenological science calls the isolation of a variable in order to investigate causal laws. The situations used in these analyses very rarely occur in nature. If causal laws are defined as constant conjunction, and these conjunctions only occur within the closed systems of laboratories, then they are applicable only within these close systems. In open systems, not only do the “causal” events in a law defined by a constant conjunction rarely occur, but when they do, the “effect” events will only rarely follow. In most
situations, both the “cause” and the “effect” will be dwarfed by the other effects inherent to the open system.

Bhaskar overcomes this failing of phenomenological theories by rejecting the validity of constant conjunction as a definition of a scientific law. Rather, “the objects of knowledge [are] the structures and mechanisms that generate phenomena.”\textsuperscript{13} The closure of a system amounts to the cordonning off of all except one of these generative mechanisms, not the isolation of a phenomenological conjunction of events. The causal laws that develop out of this isolation are not based on any constant conjunction, but provide information about how that generative mechanism always acts. This causal realist approach to the investigation of generative mechanisms allows what is learned from closed systems to be applied when there are other generative mechanisms acting against the one that has been studied. It is the interaction of a plethora of these actualized generative mechanisms that produces open systems. However, by systematically studying and isolating the nature of each generative mechanism that is present in a given open system, one is able to gradually perfect one’s ability to understand any particular open system.

\textbf{ix. A Hermeneutic Handmaiden}

One of Roy Bhaskar’s central theses is that knowledge can never come into being \textit{ex nihilo}. “Knowledge depends upon knowledge-like antecedents.”\textsuperscript{14} This principle is an extension of Immanuel Kant’s argument that it is impossible to observe the world without interpreting it. To this is added that these interpretations of the world do not come from the world or from purely creative reasoning. The sources of interpretations are the theories that have already been formulated, structures of belief that have already been developed. Thus, radically new theoretical structures are merely the application of pre-existing principles to situations on which they had not previously been brought to bear.

A notable example of this dependence upon prior theoretical constructions from the history of science surrounds James Clerk Maxwell’s development of field theory to explain electromagnetism.\textsuperscript{15} The ingenuity of field theory was not a burst of pure insight, but the result of his theological understanding of the trinity in Christian doctrine, and the application of that understanding to the problem of electromagnetic action at a distance.

Bhaskar takes innumerable examples such as this and concludes that “whenever we speak of things or of events etc. in science we must always speak of them and know them under particular descriptions, descriptions which will always be to a greater or lesser extent theoretical-
ly determined, which are not neutral reflections of a given world." Such neutral reflections are in principle an impossible philosophical undertaking, for the world is always observed through a lens of theory. Thus, there is in any scientific activity a sort of epistemological relativism, an individual dependence on the history and prior beliefs of the scientist that is inseparable from the product of his or her work.

This epistemological relativism, however, is not the metaphysical or methodological rejection of fixed ontological structures in favor of relativistic phenomenology in Quine. Rather, it is an assertion that the beliefs on the phenomenological fringe of a Quinian web are not only logically dependent upon those points closer to the center, but were developed out of their influence and inspiration. Whenever a scientific inquiry faces an explanatory hole in its operational Quinian web, that hole is always rimmed by certain phenomenological and theoretical structures that determine how it could be filled. We cannot directly perceive reality at the fringe of our webs of belief; rather, any perception is inescapably colored by a necessary apperception through all of the beliefs that have predated that perception. The creation of any new belief must occur through these veils, and the creative element of any solution is the ability to view an ontological gap through a veil different from those previously used. Thus, Maxwell’s creativity was in perceiving the effects of electricity and magnetism through the veil of his Christianity.

In spite of the apparent limitations imposed on objectivity by epistemological relativity, Bhaskar maintains that this apperception is not only inescapable, but is invaluable for the maintenance of a realist conception of science. This is because interpretation is meaningless unless it is realist interpretation in the same way that belief is meaningless unless it is belief in the truth of the object of belief. Without the attribution of real content to interpretations, as to beliefs, the interpretation becomes meaningless and unfounded. Since scientists must interpret their observations, Bhaskar argues that it is inconceivable that those scientists posit interpretations that are anything other than possible ontological truths. A scientist who minimalizes the breadth or depth of his or her interpretations minimizes the possibility of the truth of those interpretations within a realist framework. This is to what Bhaskar is referring when he asserts that “epistemological relativism ... is the handmaiden of ontological realism and must be accepted.”

The inescapability of epistemological relativism requires that any interpretive framework arise out of the priorly held beliefs and experiences of the scientist positing that framework. These interpretations of phenomena cannot be minimalized in order to maintain a generally positivist per-
spective, for their very existence is an insoluble problem for positivist philosophers. Interpretations of reality thus cannot be merely operational assumptions to be used and discarded at will without subjecting them to the scientific gaze and without any consideration of their relevance apart from their ability to predict phenomena. In place of relativist phenomenology, I will develop a scientific methodology that governs and systematizes an ontological consideration that is founded on realism and the teleological goal of which is complete and true interpretation in the same way that empirical completeness was the teleological goal for Popper.

**x. A Manifest Manifold**

If we accept our inability to avoid the effects of our prior experience and beliefs, then we must also accept that the differences between the prior experiences and beliefs of the scientists studying a given phenomenon will result in a manifold of interpretations of that phenomenon. The result is the possibility of drastically differing theoretical structures arising from and explaining the same phenomena. This ontological degeneracy need not be complete – two theories may merely explain some of the same phenomena, but have different foci – but it is unavoidable.

This conclusion, however, neglects the possibility that ontological interpretations may also have scientific virtue. It is not necessarily a straightforward matter to determine which of a number of degenerate interpretations and theories one ought to maintain. I have argued that the goal of science is a true – or at least truer – understanding and explanation of reality, rather than a complete description of the phenomena of nature, as positivism maintained. In light of this, the choice of a single theory out of a manifold is an issue of great importance. There are three substantial considerations that must be given to any treatment of a theoretical manifold: the fallacy of ontological interchangeability, a realist unification of the ontological manifold and falsificationism, and theoretical pluralism and falsification.

**xi. Inherent Interchangeability**

Two ontologically distinct theories can only ever be equivalent phenomenologically – that is, the extent of similarity that can ever be claimed of two theories is a similarity of predictions for those experiments that have already been performed. However, unlike within the positivist methodology, these two theories may not be thought of as interchangeable, if the goal of science is ontological truth. A similarity of phenomenological predictions does not equate two theories, even if the phenomenological overlap is complete. Such an assumption is merely viewing ontol-
ogy as the tool of science, rather than its goal.
Since phenomenologically indistinct theories are not interchangeable, a choice of one over the other can never be considered final – unless they are only partially indistinct and experiments have been performed which have explicitly falsified one theory or the other. Lacking a definite falsification of one theory or the other, it is difficult to see how any preference paid to one theory over another may be founded on more than utility or aesthetics. One theory may either provide greater ease of applicability than another theory, or the picture painted by it may be more elegant in its completeness. Both of these criteria, however, are matters of personal preference, and it is difficult to see how one could systematically decide between two such theories.

xii. First Formulations of Falsificationist Realism
The second consideration is the direct result of the impossibility of complete confirmation of a given theory: the underdetermination of theory by observation. As has been clearly demonstrated by numerous skeptical thinkers, it is never possible to attain certain knowledge of the truth of the existence or agency of a generative mechanism or theoretical structure. It is thus inescapable that any given postulate may be false, and the positivist fear arises of making unfounded and dogmatic assumptions. An unexamined prudence would lead to the conclusion that, if it is impossible to ever decide that one or another theory is true, one must accept every conceivable theory. A closer analysis, however, demonstrates that it does not follow from this that each theory must be regarded as equally legitimate or that we may postulate freely. Rather, I will confine this ontological manifold to a realist and falsificationist framework, and systematize scientific hypothesizing so that both ontological and phenomenological science may progress.

Embracing the principles of the ontological manifold and realism together overcomes the dangers that arise from holding either individually. When taken outside of the strict boundaries of realism, the ontological manifold invites an epiphenomenal designation of ontology, the belief that ontological differences can have no direct bearing on perceived reality because they are not causally efficacious. Epiphenomena can never be proven or disproved, because by definition their existence has no effect on observed reality. If a manifold of ontological theories exists without any practical or objective means of moving beyond their degeneracy, then it would seem that at the least ontology ought not to fall under the gaze of science, and could perhaps be seen as beyond any investigation at all.

On the other hand, realism without the ontological manifold faces
the dangers that positivism attempted to avoid by inviting the assumption of unfounded dogmas. Such a position does not accept the possibility of degenerate ontological structures, the possibility that another reality with a drastically different underlying structure could provide all of the observations that have thus far been made within a given realm of inquiry. Without this acceptance, a realist scientist is left assuming that the interpretation that has been posited is the only one possible, and a dogmatic adherence to a paradigm is the result.

It is not necessary that ontological progress cease at this point, but the establishment of a paradigm greatly limits the possibility of falsificationist scientific progress primarily to periods of scientific revolution, as described by the philosopher of science Thomas Kuhn. Under Kuhn’s philosophy, science cycles between periods of “normal science” and periods of scientific revolution. Periods of normal science are those times when a particular field of science is united under a single paradigm. These are the times when few experiments are known to contradict the paradigm, and the bulk of scientific undertakings investigate the finer details of the theory, discovering the information whose existence is predicted by the theory, but whose content cannot be.

Periods of normal science will, as Kuhn describes and history confirms, continue until a body of experimental evidence develops that explicitly calls the paradigm into question. When this happens, normal science cannot progress, for there is no framework within which the existence of unspecified information can be accurately predicted. As a result, the field falls into a chaotic state, during which numerous possible theories will arise and fall in a short period of time, each attempting to explain a different set of phenomena that the old paradigm explained. This state of scientific revolution will continue until a single theory rises to prominence and can explain most of the phenomena that the old paradigm explained, as well as the phenomena that cast the scientific community into revolution.

By this philosophy of science, the periods of greatest – or at least most dramatic – scientific progress are those of revolution. Indeed, I will maintain that the only time when ontological progress can occur is during a revolution, because during periods of normal science, individual theories are upheld because a theoretical manifold is viewed as either superfluous or unscientific. Paradigms lock a single theory into place, and science progresses by examining the phenomenological particulars that are predicted by the paradigm and by falsifying various minor fluctuations of the form of the paradigm.

Kuhn saw no problem with this picture of progression within a par-
adigm, because like Quine and Popper, he was operating within a phenomenological perspective of science. During periods of normal science the details of the paradigm are examined and phenomenological knowledge of the world grows steadily. However, as a result of the paradigm, there can be no strong competition between different theories, and the ontological manifold as I have described it is ignored in favor of an unjustified paradigm. By confining this competition to substantial paradigm shifts that result from unexpected inexplicable observations, progress in the sense defined by Popper is limited to these accidents.

**xxii. Crucialities and Controversies**

A cursory glance at the bureaucracy and economy of the modern scientific community will demonstrate that free experimentation could – and probably should – never occur. The first type of “important” experiment is in the progression of Kuhnian normal science, those that provide knowledge that the theory says exists, but which the theory cannot predict exactly. A straightforward example of this is the decoding of the human genome: the modern theory of genetics predicts that the base-pair sequence has an effect on the individual, but the raw theory cannot predict which strings of base-pairs will result in which particular attribute.

The other type of experiment that will receive funding is the type upon which I will focus: those experiments which bring into sharp contrast the predictive differences between two theories, what Sir Francis Bacon and Popper called crucial experiments. For this type of experiment to be considered, however, there must be a manifold of competing and contrary theories, a situation that Kuhn limits to periods of revolution.

I will provide no argument against these criteria for determining what experiments are performed. There must be some guidelines for determining areas of focus for scientific inquiry, both in order to provide a means of focus for scientific inquiry as well as to determine the bounds of scientific inquiry. The criteria of normal scientific inquiry and crucial experiments provide just this focus. However, I will nevertheless maintain that confining crucial experiments to periods when there is no established paradigm will unnecessarily hinder scientific progression.

If some form of falsificationism is assumed, then science progresses most through crucial experiments, that is, the performing of experiments that must falsify one theory or another. Granted, there are rare exceptions when an experiment in the former group, Kuhnian normal science, provides results that are entirely unexpected, as mentioned earlier. Such falsifications are very rare, however, and in their nature accidental. Theories are rarely falsified when they are not expected to be falsified: to
rly upon falsification arising out of the former type of experiment is to rely upon the luck of the experimenter, rather than the ability of the scientific method, to progress science.

The reason that accidents of normal science are the only other means of falsification is the intrinsic impossibility of determining which aspects, predictive or ontological, of a given theory are controversial, in the sense of being open to question. The only conceivable criterion for establishing that a given theoretical structure is controversial and in need of deeper examination is in comparison to another theoretical structure – though it is important to note that this alternative theoretical structure is often merely common sense or what a researcher is willing to accept.

The only way to overcome the shortcomings that arise out of limiting falsification to the accidents of normal science is within the context of a body of ontologically distinct theories. Such a community would not only encourage the development of parallel explanatory structures, but would encourage their development towards mutual contradiction. Scientists working within this ontological manifold would determine which experiments may prove fruitful within a falsificationist framework by inquiring into the meanings and ramifications of each of the theories and specifically searching out these points of contradiction.¹⁸

The systematic development of parallel explanatory structures that I am outlining would also expedite scientific progression after the falsification occurs, in addition to increasing the number of falsifications available. Reliance upon the chance falsification of a lone paradigm through the accident of normal science results in a chaotic crisis state, in which normal scientific progression cannot proceed until a new paradigm rises in place of the old. Within falsificationism, science does not progress with the falsification of the only extant theory, but with the rise of a theory to replace it or with the limitation of the number of possible explanatory models.

Popper’s philosophy of falsificationism requires a progression towards verisimilitude. However, verisimilitude is a measure of a theoretical structure, not a measure of the general state of science. A science cannot be thought to be “truth-like” if every theory has been falsified, and can only be said to be moving towards “truth-likeness” if new theories develop out of the vacuum left by the prior falsification. Science can only progress when another theory arises in place of the falsified paradigm, but if there is no pool of parallel systems of explanation in place at the time of falsification, and that predicted the falsification, the new theory must be constructed after the falsification, from nothing.

This criticism of the limitations of Kuhnian science is slightly weak-
ened by the arguments below against the possibility of complete falsification. Nevertheless, it still applies in the case of incomplete falsification, and is still overcome by the system that I am presenting in this work. The virtue of con-
joining the ontological manifold with realism arises from this picture of
Kuhn. By maintaining a tension between these two rival scientific practices,
falsificationist realism and the ontological manifold can feed each other.
Opposing theories and parallel explanatory structures are a requirement for
scientific progress. A maximization of both the number and opposition of
those theories results in the greatest possibility of scientific progression, so
long as realist falsification is the predominant scientific method.

A plethora of competing explanations arise from embracing the
ontological manifold and attempting to expand upon it as much as pos-
sible. By focusing theoretical developments on the ontological differences
between parallel theories, one can discover the points where possible con-
tradictions between them would arise, and further analysis could yield
phenomenological distinctions between the two theories. Progression
within this framework is not limited to the discovery of inherent phenom-
enological differences. In addition to this, these theories may be deliber-
ately modified or augmented so that they contradict each other, while
simultaneously maintaining a correspondence to those phenomena that
have already been observed. Forcing these contradictions eliminates more
possible theoretical structures and realist pictures of the world, which
would result in greater verisimilitude for the remaining theories.

A philosophy of science that values this process of theoretical pro-
gression would most utilize scientific creativity to devise as large a body of
alternative interpretations as possible. This allows those theories which
would fail to fully account for observed reality to be summarily falsified.
Thus, alternative theories are discovered explicitly so that a body of theo-
ries may be eliminated, and whether the falsified theories were well estab-
lished or newly discovered is irrelevant. This may appear counterintuitive
– the body of theories is continually increased for the sole purpose of
decreasing it – but this is only because verisimilitude is not necessarily
intuitively transparent. So long as the theories that form these contradic-
tions account for all priorly observed phenomena, these contradictions
could falsify the established theory, regardless of how far fetched they may
seem intuitively. Furthermore, the more unique a given modification is,
the greater the push towards verisimilitude that could arise out of it,
because a greater body of theories will likely be falsified.

xiv. Pursuing Plethoric Pluralism
The final result of the ontological manifold arises out of the elmi-
nation of complete falsification and the role of epistemological relativism in the valuation of the ontological manifold that I have posited. The inescapability of epistemological relativism necessitates an ontological manifold, which in turn brings into focus the possibility of both partial and total ontological degeneracy. I have argued that the conjunction of this ontological manifold with a strict realism yields a valuing of partial ontological degeneracy’s utility for the progression of science. This is because partially degenerate theories predict some of the same phenomena, but also some different phenomena, and thus experiments may be able to be performed that falsify one or the other. As a result, two potentially dangerous scientific perspectives - the ontological manifold and realism - are brought together to promote scientific progress. This entire falsificationist methodology, however, hinges upon the maintenance of the breadth of the plurality of epistemological relativism, the ability of different individuals to approach any scientific quandary with different sets of experiences and beliefs.

It may seem to be a pseudo-problem to consider situations where epistemological relativity ceases to yield a plethora of interpretive frameworks. No two people can ever have the same experiences, and there have never been two people with identical beliefs. While this is superficially true, it denies the relevance of similarity of beliefs to the broadening of the ontological manifold. Furthermore, such a perspective ignores the fact that science has historically gone through regular periods of relative stasis, during which very few original explanatory structures have arisen. If one maintains that scientific progress is to be maximized through the falsificationist methodology that I have been outlining, then such periods of relative scientific inactivity must be minimized by augmenting the ontological manifold as much as is possible.

I have addressed how we may maximize progress and minimize lulls in scientific progress in general through encouragement of, and engagement with, a plethora of parallel explanatory structures within a rigorous realism. I have not yet addressed, however, the causes of these lulls, and thus I have not discussed the particulars of how to avoid them. It is true that scientific lulls may be alleviated slightly through a valuing of epistemological relativism and the resulting ontological manifold. However, the lack of this practice is rarely the efficient cause of the lulls. In most situations the cause of the lull is the same as the primary symptom: the uniformity of belief structures.

Under most circumstances, periods of stasis are the result of falsificationism succeeding while the ontological manifold fails. If every theory is falsified, save one, then that theory will be the only one that is taught.
What results is a strongly entrenched paradigm that is not pushed at its edges. Its prominence will not only prevent other theories from rising to compete with it, but will also cause the theory to become ingrained as intuition and eventually will develop into a taken-for-granted “scientific fact.” When scientists begin unanimously to accept any principle as given and to take all of the contemporary alternatives as completely falsified, then those alternatives cease to be taught or considered, unless one of the falsified theories becomes a standard approximation.

Occasionally, when a theory is unanimously recognized as having been falsified, it is still retained as an approximation of the theory that replaces it. This occurs when the falsified theory is simpler to apply than the more widely held theory, and still provides “close enough” results. Probably the most common example of this phenomenon is the continued teaching and use of Newtonian mechanics, though most of its most fundamental principles have been demonstrated to be false under extreme circumstances. Once a set of theories has been falsified, the only utility that they can offer is as simple approximations. In such circumstances, the theory that will be retained will be the most simply applicable, rather than the closest to truth, and all alternatives will fade into history.

Regardless of whether the standardization of approximations or complete falsification is the cause, when falsified theories cease to be considered, any possible influence they may have on epistemological relativity is lost. During scientific lulls, contrary theories have been either gradually or systematically falsified, and then forgotten. As more falsified theories fade from memory, the sources of epistemological relativity must be increasingly radically afield in order to break into the paradigmatic hegemony. Maxwell’s introduction of the ideas of Christian theology into the study of electromagnetism – at a time when text books were being published asserting that everything that is to be known about the physical world is known – is a good example of what can be necessary to overcome a strong scientific lull.

Regardless of whether a theory can be completely falsified, a scientist who has studied it may still bring its influences to bear on any new problem and utilize it as a basis within epistemological relativism. This is because it is not the truth of a theory that is the source of its value for epistemological relativism; nor is it even belief in that theory. Rather, what most promotes epistemological relativism in the development of the ontological manifold is the number and range of the theories and beliefs that are ready to hand. By retaining falsified theories, epistemological relativism may continue to promote the development of the ontological manifold, allowing it to be in constant tension with falsificationist realism. So
long as there is a tension between the ontological manifold and falsificationism, scientific lulls cannot occur, for there will always be new points of potential falsification to bring to bear against any theory that would become an established paradigm. To put it differently, any theory, regardless of its truth or falsity, can prove to be the inspiration for a theory that is itself true or that may aid in the falsification of another theory.

**xv. Enabling Extra Explanation**

In response to this claim emerges the question of how one could judge that a theory is true, or at least more true than another theory. This is the same question that has arisen before of how one is to choose between two competing theories when there is not any strong phenomenological reason to choose one over another. The standard solution in the analytic tradition, as originally posited by Popper, has been to prefer the theory that is able to explain or describe the phenomena that another theory can, as well as some that it cannot. I will maintain that the most transparent interpretation of this criterion, however, contradicts the ontological realist perspective that has thus far been developed throughout this paper.

Roy Bhaskar articulates this explanatory breadth criterion, stating that “theory T₁ is preferable to theory T₂ ... if theory T₁ can explain under its descriptions almost all the phenomena ... that T₂ can explain ... plus some significant phenomena that T₂ cannot explain.” He asserts that this is the principle measure of scientific progress, and that thinking in this way is necessary if one is to maintain a concept of progress. Further analysis of this criterion in light of the developments to this point, however, demonstrates that it can only be thought of as necessary with a very particular interpretation, and not with Popper’s original meaning.

In its original meaning, the explanatory breadth criterion for scientific progress makes a metaphysical assumption that Bhaskar had previously rejected. It asserts that the “better” of two competing theories is the one that can take more into account, the one that can explain and predict more aspects of the physical world. While this may seem to be a valid measure, and is indeed one that is widely held throughout the scientific community, it is assuming that the world is atomistic in the sense that it can be reduced to a single theoretical structure. For the explanatory breadth criterion to apply, the goal of science must be a *single* mechanism that governs *all* phenomena. It ignores the possibility that there are a *multitude* of interacting mechanisms at work in any given situation, and that the existence of each is independent of any of the others.

Bhaskar adheres to this second possibility very strongly and rejects all forms of atomism, asserting that “the higher order level [of a hierarchy
of theoretical descriptions] is ... irreducible to ... the principles and descriptions of the lower order level.”\(^{21}\) He denies that a more broadly scoped science, for instance thermodynamics or sociology, can be generally reduced to a more fine-grained science, such as quantum theory or psychology.

Bhaskar is not claiming that metaphysical reduction is necessarily false, but that it is fundamentally uncertain, and therefore epistemologically unjustified. For a reduction to be valid, he requires that it leave “the reality of ... higher-order entities intact, at least in as much as they [are] causal agents capable of acting back on the materials out of which they are formed.”\(^{22}\) In other words, so long as the adequacy of any given reduction remains in question, the higher order fields of science must remain as efficacious causal powers. This principle, however, further maintains that if it were possible to successfully and completely reduce a given theory to a more overarching and atomistic theory, then such a reduction would be completely legitimate – though not necessarily correct.

Thus, the historical account of the explanatory breadth criterion clearly flies in the face of Bhaskar’s rejection of reductionism. Many philosophers and scientists since the early days of the Enlightenment have regarded reductionism as a necessary and obvious assumption for science. This assumption, however, is only necessary based on the further assumption of theoretical monism, or the belief that all of science can be explained by a single mechanistic theory. Theoretical monists value theories in terms of their entirety, as Quine does, but do so because they believe that every aspect of the theory is tied to a single underlying principle.

Theoretical monism is contrasted with the theoretical pluralism of this paper, which asserts that individual aspects of a theory are examined in order to distinguish between those structures that are truly inseparable and those that are merely accidentally conjoined within the theory. The purpose of this process is to discover individual generative mechanisms and to differentiate between the effects of distinct generative mechanisms. Approaching science in this way, I recognize that there is no reason to suppose that there is a complete unity to nature, but that there may well be multiple independent generative mechanisms. This is not to say that natural unity is impossible or that coherence is an inessential aspect of nature. For science to exist, contradictions cannot exist within the natural world. Rather, theoretical pluralism stresses that the form of this coherence need not lie in the ability of science to reduce all phenomena to a single principle. I agree with Bhaskar that it is reasonable and useful to suppose, instead, that there may be multiple active agents in the world that provide different influences. “The concept of a field of potential
seems closest to meeting these requirements. However it seems to me that there is no reason in principle why there should not be strata of fields (of perhaps radically different kinds), forever unknown to us.”

The central thesis of theoretical pluralism asserts that the properties that are present in one category of entities, objects or events need not be present in another. Take as a historical example from physics the series of discoveries culminating in the theory that the properties of light are fundamentally dissimilar from those of either the corpuscular view of matter or the stochastic view of fluids that were prominent at the time. One of the great breakthroughs of Einstein’s theory of the photon was that it, unlike all of the theories of light that had come before, contended that light was neither fluid nor corpuscles. He asserted that light was something drastically different, and that the laws and principles of corpuscles and fluids do not apply to light, but that light has its own properties that are unique to it.

By dissolving the necessity of the unity of theoretical structures, one does not necessarily dissolve the unity of nature, and does not necessarily dissolve all possible interpretations of the explanatory breadth criterion. Within this pluralist framework, the breadth of a theory’s explanatory power does not lie in the number of phenomena that can be explained by it. Rather, the explanatory breadth of a theory is defined as the success with which that theory can maintain inter-theoretical coherence, the ability of a given theory or theoretical structure to conjoin with other theoretical structures to provide a more complete explanatory picture.

Different theoretical structures, when conjoined, do affect each other; the criterion for the conjunction of different theories cannot be limited to a lack of phenomenological contradiction. Rather, theoretical conjunction must be the formation of a new Quinian web, of which both theories are interconnected parts. Theoretical pluralism agrees with Quine’s claim that “any statement can be held true come what may, if we make drastic enough adjustments elsewhere in the system.” Any individual statement can, indeed, be held come what may, but webs of belief and theoretical conjunctions cannot be. It may be impossible to falsify any single theoretical structure, but it is certainly possible to falsify a conjunction of theoretical structures.

Theoretical pluralism seeks out different possible webs of belief that maintain the realist pillar in the center that I described earlier and account for most of the same phenomena at the fringe, but which have explanations in between that differ to varying degrees. It is when a scientist analyzing a set of theories discovers the possibility for a single theoretical structure or predictive mode to be included in two otherwise
substantially different webs that he or she is able to determine the necessity of that structure or mode. If a theoretical structure can fit equally well into two different webs, then it cannot be said to be necessarily tied to either. In all likelihood, such a theoretical analysis would discover that the majority of the theoretical structures in any particular web are not bound to that web, but are independent generative mechanisms.

Nature does not contradict itself; therefore, even if the theoretical structures that we develop to describe and explain nature are independent of each other, if they are conjoined they cannot contradict each other. Two theories that provide differing predictions for a given phenomenon clearly cannot both be true. In the same way, two theoretical structures which do not overlap cannot both be true if they provide two opposing pictures of the fundamental nature of reality. The unity of nature is depicted theoretically in a single coherent picture formed of a plethora of theoretical structures and generative mechanisms which do not necessitate each other, but which complement each other. For two theoretical structures to be accepted together they must be able to coexist both phenomenologically and ontologically. Two theoretical structures cannot be accepted into the same Quinian web if they provide different predictions to even a single phenomenon or if any aspect of the picture of reality that the one paints contradicts that of the other.

The explanatory breadth criterion is met if one set of theoretical structures can be unified to explain a greater number of phenomena than can another set. To rework Bhaskar’s account of the explanatory breadth criterion, theory $T_a$ is preferable to theory $T_b$ if a web of belief can be developed around $T_a$ that can account for (most of) the phenomena that every web of belief that has been constructed around $T_b$ can explain. Furthermore, for $T_a$ to be preferred, that web of belief must also be able to explain some phenomenon that none of the webs into which $T_b$ has entered can explain.

The sense of “prefer” here is the same as it was for Popper. “From a rational point of view, we should not ‘rely’ on any theory, for no theory has been shown to be true, or can be shown to be true” but we can “prefer as a basis for action.”25 This is not a preference that leads to either a rejection of $T_b$ or the acceptance of $T_a$ as a fundamentally more true theory, this preference is one of utility and application. Within this system, the only reason to have a strong preference for one theory over another is when one is leaving the realm of pure science in order to practice applied science or engineering. This is because it makes no sense to have any strong theoretical preference – so long as there have been no
falsifying evidence – within a purely scientific enterprise when there is always a real possibility that any or all of the theoretical structures are false. However, within the realm of applied science, the goal is not to investigate these particular sets of theories, but to use one of them in order to investigate another matter. In this situation, it is not the truth of these theories that is important, but their ability to aid in the discovery of truth in different realms of inquiry.

**xvi. Finalizing Falsificationist Realism**

Theoretical pluralism casts falsificationism in a very different light, because falsifying an entire theoretical network becomes a nearly impossible task. Rather, it is the interaction between competing and overlapping theoretical structures that provides the grounds for falsification. In the vast majority of scientific inquiries, only individual theoretical structures or individual theoretical conjunctions can be falsified, rather than whole theoretical networks. This is not always the case, for there is always the possibility for a fully reductionist science, but such a science is far from necessary. This picture of falsificationism, falsificationist realism, allows for a “pick and choose” system of theory construction, where different theoretical structures are chosen from a multiplicity of possibilities and pieced together like a jigsaw puzzle.

Furthermore, falsificationist realism allows for the flourishing of new theoretical structures, which would provide the groundwork for a more widespread and varied pool of knowledge from which epistemological relativism can develop new theories. This is a system under which new individual theoretical structures can easily arise, and which could then lend their influence upon the further development of new theoretical structures. It also allows for greater utility to be found for falsified theories through a liberal and conscientious use of epistemological relativism. Beyond providing inspiration for new theories, falsified theories can be reanalyzed and deconstructed into their composite theoretical structures, possibly revealing that not all of these structures were in fact falsified. Thus, these un-falsified structures may be reintroduced into the greater body of theoretical structures, expanding theoretical pluralism, again furthering the possibility of falsificationist progression.

This pluralist interpretation of Bhaskar’s version of the explanatory breadth criterion is required when the criterion is conjoined with his rejection of the claim that reductionism is an epistemological or metaphysical necessity. This modified criterion also employs his theory of epistemological relativism to provide a tool for scientific progression and a means of overcoming the dangers of the ontological manifold and real-
ism. By valuing these two principles as opposing sides of a necessary scientific tension, they are able to be utilized and their limitations may be minimized.

**xvii. Conclusive Conjectures of Caution**

The goal of science under falsificationist realism is more than merely accurate predictions or reproducible results, but an inquiry into the nature of truth itself. This is because scientists cannot avoid the interpretation of their observations and shunning a search for true interpretations makes those interpretations unfounded and unanalyzed. This is not to say that it is necessary that we be able to dictate that which is true; rather, the goal here has been to formulate a center point of a Quinian web of belief. In accomplishing this, however, I recognize that this cannot be done from a god’s eye view. Even in this analysis, I am working within my web of belief through epistemological relativism. Falsificationist realism is an attempt to utilize the inescapability of epistemological relativism to posit a system through which this relativism may operate as an agent of scientific progress.

**Notes**

2 I argued for this in more detail in the full version of this paper, my undergraduate honors thesis in philosophy, which is currently held at Bucknell University’s Ellen Clark Bertrand Library.
3 I am using the terminology, ontico-phenomenological unity instead of onto-phenomenological unity because, in combining ontology and phenomenology, ontology comes to focus on the being of entities, which is called ontic, rather than being in general.
4 Purves, G. M., “In Search of Reality: A Comparative Study of the Bohmian and Orthodox Interpretations of Quantum Theory,” 2006. This is my undergraduate honors thesis for physics, and is currently being held in Bucknell University’s Ellen Clark Bertrand Library.
6 Ibid, 286.
7 Ibid.
9 I am tacitly ignoring here and elsewhere in this work the possibility that the universe is able to contradict itself, that it is inconstant, and that science is nothing more than a confused stumbling. If that were to prove to be the case, then either it could be made clear through sci-
ence, at which point there would be a rational justification for rejecting scientific inquiry, or it would not be made clear through science, which would make the universe phenomenologically identical to one that is fully coherent. In either case, this critique is no justification for abandoning either science or philosophy of science, for either scientific progress can be achieved or knowledge that it cannot can be achieved scientifically.

12 Ibid, 12.
13 Ibid, 17.
14 Ibid, 22.
16 Bhaskar, 249.
17 Ibid.
18 It has been brought to my attention that this principle of a body of generative mechanisms is very similar to the philosophy of Imre Lakatos. Lakatos posits ‘scientific research programs,’ within which a coherent unity of theoretical structures is viewed alongside a Manifold of explanatory mechanisms. An important difference, however, is that Lakatos is operating within a phenomenological framework, and therefore does not have the allowance for the ontology/phenomenology distinction that is central to my philosophy.
20 Bhaskar, Roy, 248.
21 Ibid, 112.
22 Ibid, 181.
23 Ibid, 180-81.
24 “Two Dogmas of Empiricism,” 286.
25 Popper, 21-22.

**Bibliography**


