How to Choose a Theory:

Empiricism from Verificationism to Pragmatism

A Thesis in Philosophy

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Abstract

This thesis establishes a connection between an important and controversial theory of meaning championed by empiricists in the early twentieth century and a more reasonable position with the same goal. The principle of verificationism is the theory that any meaningful sentence is either analytically true or empirically verifiable. The original advocates of the principle wanted a way to distinguish philosophy as genuine inquiry from baseless metaphysics. The ambition of those empiricists lives on in a subtler framework of pragmatism that can still accomplish the same goals. The first chapter of this thesis establishes the analytic/synthetic distinction that provides the grounding for the principle of verificationism. Without solid criteria for distinguishing analytic judgements from synthetic ones, empiricists would not have grounds for admitting mathematics and definitional truths as meaningful. The second chapter takes a look at theories of space and illustrates different ways of considering theoretical frameworks. Theories of space and the resulting philosophical questions they provoke illustrate that theory often comes down to a matter of convention. This conventional decision making becomes essential for the pragmatic view in chapter three. The final chapter details the principle of verificationism itself and offers a pragmatic notion of inductive verification as a softer grounding for the empiricist project. Ultimately, the strict binary between verifiable theory and nonsense that the original principle of verificationism established is untenable. Instead, we verify theories inductively. Rather than conclusively confirming a theory, we gain confidence in the accuracy of our theories

each time we observe their implications born out in experience. While objective truth is a hopeless idea, we can instead develop a high degree of efficiency in explaining what we observe about the world.

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Introduction

There is a certain frustration that arises when an earnest question is given an unhelpful answer. Where were you yesterday? Nowhere. What did you see while you were there? Everything! Why did you do that? Because. These kinds of answers are frustrating because we want a better understanding of a situation but instead we receive opaque and mysterious pseudo-answers that bring us no such understanding. These are the kinds of answers that the members of an important philosophical movement, logical empiricism, felt comprised much of traditional philosophy.

One of the most controversial philosophical positions in the history of the Western Tradition was verificationism. This was a position held by logical empiricists in the early to mid twentieth century, and it held that any meaningful sentence is either empirically verifiable or analytically true. In essence, it is either a definition or an hypothesis that can be tested by experience. This position was radical, as much of the history of philosophy concerned itself with problems that could not be verified by experience. Questions about God, the soul, or reality independently of human perception were all dismissed as literally nonsense on the verificationist principle. It was a bold position, and many were firmly convinced in holding it.

Verificationism, given its extreme nature, came under attack by many other philosophers. Some, like W.V.O. Quine, undermined the notion of analyticity. What does it mean for a sentence to be “definitionally” true? What is a definition? Who gets to decide what properties are inherent to a concept? If the logical empiricists cannot help themselves to analyticity, then they have no

way of holding a position of radical empiricism without also abandoning tautological truths and mathematics. But those kinds of truth provide a basis for much human knowledge, so after analyticity is abandoned, what is left?

Other critics of verificationism asked a very simple question: is the principle of verificationism itself empirically verifiable or analytically true? Surely the former is not true, for the same reasons that David Hume demonstrated the shakiness of our notions of cause and effect. The principle cannot be empirically verified because it makes a universal synthetic claim. It claims that *all* meaningful sentences conform to this rule. That cannot ever be verified. Is the principle analytic, then? Of course not. No analysis of the concept of a meaningful sentence would yield this principle. The principle of verificationism is, therefore, a counterexample to itself.

Before throwing this philosophical movement in the garbage, however, we should pause and reflect on what the principle of verificationism was trying to do. Many works of philosophy are frustratingly unaccountable to the observable evidence. When Martin Heidegger talks of the Nothing, empiricists with a sober conviction to stay true to the evidence roll their eyes. What is this Nothing, and where can we find it? If the Nothing really has some important contribution to the world enough to philosophize, we should be able to measure it. Yet we cannot. Philosophy, therefore, needs a good way of ruling out theories that do not make any claims that we can scrutinize based on observations. Otherwise the whole project is useless. This is the import of the principle of verificationism. The objective is a noble one, if its execution was flawed.

Despite the problems faced by bold declarations of the verificationist principle, its legacy lives on in a much more subtle theory that is easier to defend and gives us much of the same method for distinguishing serious philosophy from pure unobservable metaphysics. This theory is the pragmatism of Rudolf Carnap in his Paper, "Empiricism, Semantics, and Ontology." Carnap offers a conception of theories as linguistic frameworks, or alternative ways of speaking about the world. He encourages us to see theory choice as a conventional decision as opposed to a matter of objective truth. Which theory best describes the evidence? In this way, the adoption of a theory does not commit us to the ontological belief in all of the theory's elements. In order to make sense of the world, we must adopt a linguistic framework to describe what we observe.

The first chapter of this work will lay down the foundations upon which both logical empiricism and pragmatism build their theories. These foundations consist in the linguistic distinction, coined by Immanuel Kant, between analytic and synthetic judgements. The first kind of judgements are those which require no more than the definitions of the terms used to determine their truth or falsity. For example, every physical body is extended in space. This sentence is necessarily true. That is to say that we need not search for any empirical evidence of the truth of my sentence because being extended in space is exactly what it means to be a physical body. In contrast, there are synthetic judgements which require observation. That the sun will rise tomorrow is a classic example of a synthetic judgment. Nothing in the definitions of the terms used indicates to me that the sun necessarily must rise. Without this distinction, there

would be no verificationism because the principle takes analytic judgements for granted and accepts them as the only class of meaningful propositions that are not empirically verifiable.

In the second chapter, I consider an important philosophical issue, the nature of space, and its implications for theory choice and pragmatism. There was initially a view that Albert Einstein had produced the definitive refutation of Immanuel Kant with his theory of relativity. This view turns out to be naive because it misses a pragmatic distinction between constitutive and empirical axioms of theories. Einstein himself indicated a familiarity with this issue. The supposed dispute was over whether or not space really was Euclidean, as Kant seemed to have indicated to some of his followers. In fact, as Einstein indicates in some of his personal letters, one can invent a perfectly plausible theory of space by taking either Euclidean or non-Euclidean geometry as an axiom. This is because geometry in theories of space is not an empirical but a constitutive axiom. It only serves to define terms like "straight line." With this understanding, Einstein seems only to indicate that explaining the universe in non-Euclidean terms provides a simpler explanation. This appeal to pragmatic values of efficiency and simplicity in theory choice is indicative of the natural progression from strict empiricism to a pragmatic outlook.

Thus, the third chapter deals finally with verificationism and the logical empiricists. Those philosophers of science who theorized about the previous distinction between different kinds of theoretical axioms were local contemporaries of the logical positivist movement whose center of orbit was Vienna, Austria. These thinkers were responsible for the principle of verificationism which stated firmly that any meaningful sentence is either empirically verifiable

or analytically true. Initial proponents of the principle were fed up with classical metaphysics and its unobservable terms and entities. As such they posed the principle in very strict terms which came off as radical in the contemporary intellectual context. The chapter shows the progression from this strong stance to a more liberal pragmatism demonstrated by Carnap.

The suggested shift from verificationism to pragmatism in the final chapter suggests a question: does the pragmatic view still preserve the confident empiricism of the logical empiricists? Once the dust settles, I think that pragmatism offers the means of distinguishing between earnest philosophy and mere metaphysical speculation that was so attractive in the verificationist view. Now, however, our theory appeals to pragmatic values originally voiced by Charles Pierce, rather than strict meaninglessness. We need not be so bold as to say that an unverifiable theory is *nonsense*, it just will not hold up to our processes of testing hypotheses with observable data. This is the very reasonable end at which verificationist zeal was aimed.

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The distinction between analytic and synthetic judgements is the foundation for the empiricist principle of verificationism. The principle admits as meaningful only those sentences which are verifiable or analytic. Verificationists need grounds for admitting analytic sentences because they are unverifiable but necessarily true. The distinction between synthetic and analytic judgements, then, differentiates between judgments that rely on experience and those whose truth value is determined by the meanings of the terms alone. It is Immanuel Kant who first coined the terms *synthetic* and *analytic*. In his view, the analyticity of a judgment is determined by two criteria. The first– his containment criterion– stipulates that a judgment is analytic if the predicate of the sentence is already thought of in the concept of the subject. The second criterion stipulates that a judgment is analytic if its negation violates the law of contradiction. Some scholars question the validity of Kant's distinction. Others still argue that Kant's distinction is unique and not reducible to similar formulations that came before him. This chapter will trace the origins of Kant's analytic/synthetic distinction and show that the idea was already present in the literature– specifically in the work of David Hume, John Locke, and Gottfried Wilhelm Leibniz. Ultimately, I will make the case that Kant's analytic/synthetic distinction provides the verificationist with the means to admit logical truths into a strictly empiricist framework..

One of the most commonly cited origins of the analytic/synthetic distinction is David Hume's *An Enquiry Concerning Human Understanding*. In what is referred to as "Hume's Fork,"

Hume calls these two basic kinds of judgments "relations of ideas" and "matters of fact."[12] For Hume, relations of ideas are "discoverable by the mere operation of thought, without dependence on what is anywhere existent in the universe."[3] Relations of ideas are not confirmable or refutable with the application of sense data because they do not apply to the world of experience. These judgments are true or false based solely on the use of the terms. For a full understanding of Hume's theory, a closer look at his *Enquiry* is necessary.

To appreciate Hume's fork, one ought to look first at his distinction between impressions and ideas. In the *Enquiry*, he carefully divides "all the perceptions of the mind" into "impressions" and "ideas."[4] He does this because it seems important to take note of the fact that sensory input has a greater sense of immediacy and vibrancy than do things like reflections and memories. So he writes:

> "By the term impression, then, I mean all our more lively perceptions, when we hear, or see, or feel, or love, or hate, or desire, or will. And impressions are distinguished from

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[1] Wilf Bakhaus, "Hume's Fork and Analytic/Trifling Propositions", *The Journal of Speculative Philosophy*, vol. 8, no. 2 (1994), 79.

[2] David Hume, *An Enquiry Concerning Human Understanding*. (Oxford: Oxford University Press, 2007), 18.

[3] *Ibid*.

[4] *Ibid*, 14.

> ideas, which are the less lively perceptions, of which we are conscious, when we reflect on any of those sensations or movements above mentioned."[5]

Hume goes on to claim that the ideas of our imagination are combinations of impressions with which we have had prior experience. Any fictitious entity we might conjure in our minds has a grounding in reality in the sense that its components come from impressions. So "when we think of a golden mountain, we only join two consistent ideas, gold, and mountain, with which we were formerly acquainted."[6] For this reason, Hume calls impressions "innate" and ideas "not innate," meaning by innate "what is original or copied from no precedent perception."[7]

Impressions are basic and self-justificatory for Hume, and from them we build ideas and theories. We should therefore be wary of any idea which does not seem to find basis in impressions:

> "When we entertain…any suspicion, that a philosophical term is employed without any meaning or idea (as is but too frequent), we need but enquire, *from what impression is that supposed idea derived?* And if it be impossible to assign any, this will serve to confirm our suspicion."[8]

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[5] *Ibid*, 15.

[6] *Ibid.*

[7] *Ibid,* 17.

[8] *Ibid,* 13.

In this passage it is easy to find the inspiration for empiricist philosophers that came after Hume. He suggests that sense experience is to be the grounding for any complex ideas, and if an idea is not grounded in experience, it is meaningless.

From his theory of Impressions and Ideas Hume establishes his classic "fork." Based on the notion that ideas are complexes of Impressions, Hume determined that "all the objects of human reason may naturally be divided into two kinds, to wit, *Relations of Ideas*, and *Matters of Fact*."[9] Matters of fact are based on impressions or experience. Judgements such as "the sun is up" and "the stop-sign is red" are matters of fact that derive from impressions. Matters of fact, for Hume, "can never imply a contradiction" because "the contrary of every matter of fact is still possible."[10] This is crucial to Hume's definition of analyticity, because the contrary of a relation of ideas *would* imply a contradiction. It is perfectly conceivable that the above-mentioned stop sign is not red. I may be in a country which uses orange for stop signs, or maybe the stop sign printer malfunctioned. However, as Hume says, "though there never were a circle or a triangle in nature, the truths, demonstrated by Euclid, would for ever retain their certainty and evidence."[11] Importantly, relations of ideas are not informative in the sense that they remain true regardless of the matters of fact. Two right angles are always equivalent even if there are no such angles to be observed in nature. That this is true offers no information about the observable world at all. What

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[9] *Ibid,* 15.

[10] *Ibid.*

[11] *Ibid.*

it does offer is a clarification of definitions by way of a relation. All right angles are equivalent because what is meant by 'right angle' is an angle that measures 90 degrees and no more or less than that. All of mathematics fits into Hume's conception of relations of ideas. Increasingly complex calculations require no more than tangling with the definitions of the system of numbers.

Matters of fact are, in contrast, not necessarily true and must be proven with data from the senses. Hume uses the example of tomorrow's supposed sunrise: "*That the sun will not rise to-morrow* is no less intelligible a proposition, and implies no more contradiction, than the affirmation, *that it will rise*."[12] Most people feel certain that the sun will rise tomorrow and that this is a fact we can take for granted, but Hume notes that the suggestion that it will not is not logically forbidden. The only way to have certain knowledge of the sunrise is to wait and check for sunlight in the morning.

Hume outlines his distinction in order to support his theory of empiricism: that the only sensible claims are either relations of ideas (analytic) or measurable matters of fact (synthetic). Hume points out that matters of fact cannot possibly be known *a priori*. This is because matters of fact rest on cause and effect for Hume, which is a relation that requires sense data to establish. Hume imagines an object entirely new and unknown. When shown to a human, they would have no way of determining through pure reason what caused it or what effects it would have. In the same sense, pure reason cannot "unassisted by experience, ever draw any inference concerning

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[12] *Ibid,* 15.

real existence and matter of fact."[13] With this Hume firmly establishes the thesis of empiricism, which says that a serious theory of the world will rely on sense experience.

Although David Hume's distinction is most commonly cited as the precursor to Kant's, there are other examples of the idea from before Hume. John Locke offers a version of the analytic/synthetic distinction with his theory of trifling and instructive propositions. For Locke, trifling propositions are "universal propositions, which, though they be certainly true, yet they add no light to our understanding; bring no increase to our knowledge."[14] Hume makes the same point about his relations of ideas when he writes that they need not depend on the physical world of evidence. Trifling propositions do not offer any instruction on the real state of the universe at all. Instead, they are judgments that depend on definitions and language alone. Locke's primary focus when dealing with trifling propositions are identity relations. "When we affirm the said term of itself," according to Locke, "it shows us nothing but what we must certainly know before."[15] Locke likens all identity judgments to the form: "what is, is" and points out that this is obviously trivial.[16] He is careful, however, not to push this point beyond simply explicit identity statements. An identity relation between two different terms, such as Bruce Wayne and Batman, *is* an instructive proposition since it may not have been familiarly known that these terms do in

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[13] *Ibid*, 17.

[14] John Locke, *An Essay Concerning Human Understanding*. (New York: Dover Publications, 1959), 292.

[15] *Ibid.*

[16] *Ibid.*

fact refer to the same substance. Locke agrees with this point when he says that "he that would enlarge his own or another's mind to truths he does not yet know, must find out intermediate ideas, and then lay them in such an order one by another, that the understanding may see the agreement or disagreement of those in question."[17] The pursuit of knowledge relies on identity discoveries, or identity relations that are not trifling but in fact reveal some new characteristic of the world of experience.

Locke's theory also provides the basis for Kant's containment theory. Locke calls trifling those statements wherein "a part of the complex idea is predicated of the name of the whole."[18] If a judgment relates one concept to another where the two are commonly understood to be associated anyway, then the judgment in question is trifling. Locke uses a famous example that crops up elsewhere in this discourse: "It would be thought little better than ridiculous to affirm gravely, as a truth of moment, that gold is yellow."[19] For Locke, the concept of yellow is supposed to already belong to the concept of gold. Thus, to point out this connection is unhelpful and uninstructive for Locke. Even if this judgment is being made to someone who claims not to understand the terms, "then it teaches only the signification of that word, and the use of that sign."[20] (This last point echoes David Hume, as Locke points out that trifling propositions may

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[17] *Ibid*, 295.

[18] *Ibid,* 296.

[19] *Ibid.*

[20] *Ibid.*

clarify definitions without offering instruction on the state of the world of experience.) That predicating a part of the complex idea of the whole is trifling is a point that is later picked up by Immanuel Kant as a criterion for analyticity.

Gottfried Wilhelm Leibniz is also credited with a version of analyticity. In service of his principle of sufficient reason, Leibniz employs a distinction between truths of reasoning and truths of fact. In his *Discourse on Metaphysics*, Leibniz writes that "*truths of reasoning* are necessary and their opposite is impossible. Those of *fact*, however, are contingent, and their opposite is possible."[21] Hume's theory of relations of ideas maps well to Leibniz' truths of reasoning. Both push the point of necessity. Leibniz clarifies his notion of necessity: "When a truth is necessary, the reason can be found by analysis in resolving it into simpler ideas/ and into simpler truths until we reach those which are primary."[22] Leibniz' point about primary points indicates another idea present in the literature: that complex ideas are made of basic ones. For Hume, these basic ideas are impressions from the senses. Locke also suggests this point with his talk of trifling propositions which predicate a part of a complex idea of the whole. It is important for many early theories of analytic judgements that complex ideas be made of basic ones, and it is clear how Kantian containment follows naturally from this premise. Leibniz has something other than containment in mind, however. Theorist Brandon Look writes that "truths of reasoning will be resolvable into primitives or identities, and the Principle of Contradiction is

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[21] Gottfried Wilhelm Leibniz, *Discourse on Metaphysics*. (Chicago: The Open Court Publishing, co., 1918), 256.

[22] *Ibid*.

thereby operative."[23] Leibniz' criterion for a truth of reasoning is logical rather than linguistic. Where Locke's criterion deals with the essential characteristics of the subject in a trifling judgment, Leibniz makes a truth of reasoning a matter of its negation violating the law of contradiction. Locke can therefore help himself to examples like "gold is a yellow metal", since he takes yellow and metal to be simply inherent parts of a complex idea. Leibniz, in contrast, limits his distinction to include only judgments whose negation would be logically impossible. The differences between Locke's and Leibniz' criteria for their versions of analyticity will be important in later discussions of Immanuel Kant's theory.

Immanuel Kant first uses the language "analytic" and "synthetic" in this context in his *Critique of Pure Reason*. His distinction follows closely the frameworks of Hume and Locke. Just like relations of ideas and trifling propositions, Kant's definition says that a judgment is analytic if "the predicate B belongs to the subject A as something that (covertly) is contained in it."[24] Kant's explicit definition of the analytic/synthetic distinction is based on 'containment', a notion that has had an enduring impact on the discourse around the distinction. Kant means by containment that purely linguistic analysis of the judgment in question will reveal an identity relation between the subject and the predicate. In other words, analytic judgments are a matter of "explication" rather than "extension" in the sense that they aim not to identify the real things which the terms point out, but rather to reveal something about the linguistic characteristics of

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[23] Look, Brandon C., "Gottfried Wilhelm Leibniz", *The Stanford Encyclopedia of Philosophy* (Spring 2020 Edition)

[24] Immanuel Kant, *Critique of Pure Reason*. (Cambridge: Cambridge University Press, 1998), 130.

the term.[25] His primary example of an analytic judgment on the containment criterion is the judgment, "all bodies are extended," because "I do not require to go beyond the concept which I connect with 'body' in order to find extension as bound up with it."[26]

Kant's containment theory clearly bears similarity to Locke's trifling propositions in that Locke includes a criterion of trifling propositions that is similar to containment. Locke says that it is trifling to "affirm any one of the simple ideas of a complex one of the name of the whole complex idea."[27] Here Locke makes the claim that identifying any of the essential features of a complex idea is trifling since the feature would be contained in the concept of the complex idea already. Kant even borrows Locke's example: "all analytic propositions are still a priori judgments even if their concepts are empirical, as in: Gold is a yellow metal; for in order to know this, I need no further experience outside my concept of gold."[28] Kant's containment theory is his primary condition for analyticity, and it is not an entirely new idea when he gives it voice in the *Critique*.

Kant also employs a second criterion of analyticity. This shows up in the *Critique* in which he suggests that when assessing an analytic judgment,

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[25] *Ibid*.

[26] *Ibid*.

[27] Locke, 296.

[28] Immanuel Kant, *Prolegomena to Any Future Metaphysics*. (Cambridge: Cambridge University Press, 1997), 17.

> "Before appealing to experience, I have already in the concept of body all the conditions required for my judgment. I have only to extract from it, in accordance with the principle of contradiction, the required predicate, and in so doing can at the same time become conscious of the necessity of the judgment."[29]

Kant also makes use of the principle of contradiction in determining an analytic statement. This is a markedly different criterion than his containment theory, as it is clearly not a contradiction in the explicit sense to suggest that, for example, gold is blue. The difference between Kant's criteria of analyticity is the subject of much scholarship, and the significance of this difference will be explored later in this chapter.

Crucial to Kant's distinction are the notions of *a priori* and *a posteriori* judgements. These are terms that Kant inherits from the tradition. Hume makes use of the notion of *a priori* when he says that knowledge of cause and effect "is not…attained by reasonings a priori; but arises entirely from experience."[30] Hume's usage is well in accordance with the tradition. *A priori* justification is used to describe justification that rests on pure thought and not on experience. Kant carries on this standard usage when he invokes Hume's example: "the proposition, that all change has its cause, is an *a priori* proposition; but it is not, at the same time,

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[29] Kant, *Critique*, 131.

[30] Hume, 20.

purely such, for change is an idea which can only be derived from experience."[31] Kant's notion of *a priori* rests on necessity and universality. An *a priori* truth must necessarily be true, and it must not be sensible to suggest that it may not have been the case. The *a posteriori*, in contrast, is not necessary. One could easily imagine a scenario wherein the sun did not rise tomorrow. Therefore, that it will rise is not certain *a priori* and it is not necessarily true.

A posteriori judgments, or "judgements of experience" are all synthetic for Kant. This is relatively uncontroversial, and it seems as though Hume would have nothing to say on this point. In fact, this point falls in line with Hume's definition of matters of fact. "Judgements of experience" are exactly what Hume is referring to when he uses the term "matter of fact." Kant diverges dramatically from Hume when he suggests that there are also meaningful synthetic *a priori* judgements. These judgements are not necessarily true and therefore reveal something about the nature of reality but can be knowable without any experience. That this kind of knowledge is possible is the antithesis of David Hume, who confidently asserts that "all the laws of nature, and all the operations of bodies without exception, are known only by experience."[32] So the novelty of Kant's theory in this respect is that he asserts that certain judgments cut across the categories of analytic/synthetic and a priori/a posteriori.

It is worth noting at this point that scholars have found inconsistencies in Kant's own account of analyticity. Lewis White Beck outlines these inconsistencies in his essay, "Can Kant's

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[31] Immanuel Kant, *Text-book to Kant: The Critique of Pure Reason*. (Edinburgh: Oliver and Boyd, 1881), 117.

[32] Hume, 18.

Synthetic Judgements be Made Analytic?" Beck identifies a problem with Kant's two diverging criteria for judging the analyticity of statements. Beck claims their differences are significant, and that "Kant, in apparent disregard for their differences, uses first one and then the other as it suits his purposes, perhaps in the conviction that their answers will in any specific case be the same."[33] Beck calls the criterion that appeals to the principle of contradiction the "logical criterion" and the criterion that has been called the containment theory in this paper the "phenomenological criterion." The former says that a statement is analytic if its negation "will infringe the law of contradiction," making the statement necessarily true.[34] On the second criterion, a statement is analytic if the predicate of the statement is "found introspectively to be really thought in the concept of the subject."[35] These two criteria have obvious differences, and critics deny that the two are interchangeable for good reason. On the phenomenological criterion, the classic example of "gold is a yellow metal" is analytic just as Kant says. If we apply the principle of contradiction, however, then there is no contradiction from suggesting that gold is not yellow. In fact, it is perfectly conceivable that geologists find a piece of blue gold one day. Clearly there are cases wherein the two criteria disagree.

The phenomenological criterion seems more ambiguous than the logical. It relies in part on knowledge of the given subject. Two different observers may have different knowledge of

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[33] Lewis White Beck, *Essays on Kant and Hume*. (New Haven: Yale University Press, 1978), 8.

[34] *Ibid.*

[35] *Ibid*, 9.

some subject, X. Then the statement "X has A," where A is some attribute, could conceivably be analytic for one observer and synthetic for the other. Suppose a colorblind individual finds a piece of gold one day and has never heard of the substance. They might conclude that all gold appears green. If this individual is a Kantian, then they might also conclude that it is analytic to say that "gold is a green metal." On these grounds the phenomenological criterion is insufficient.

Kant also seems to rely on another vague notion of essential characteristics. When he suggests that "gold is yellow" is analytic, he suggests that yellow color is essential to gold and therefore to suggest that some gold is not yellow would be a violation of the law of contradiction. Yet empirical attributes such as this are also considered synthetic in some cases. I doubt that Kant would have accepted as analytic the judgment that uranium emits radiation. It seems arbitrary to decide that certain predicates belong to a subject in an essential sense and are therefore "contained in the concept of the subject." If a case is discovered that bears almost all the attributes of a certain term but differs in one respect only, a reasonable person would admit the new discovery into the extension of the term in question and modify the definition. Then a new list of attributes would have to be considered in any application of the phenomenological criterion, and so the criterion is not so solid.

Although issues arise from Kant's phenomenological criterion, his logical criterion holds up. That a statement is analytic if its negation violates the principle of contradiction is a useful definition for sorting analytic judgments from synthetic ones. What is necessary is an expansion of the term contradiction to include not only explicit contradictions of the form "X and not-X,"

but also identity contradictions, such as “X does not equal X,” and logical impossibilities more generally, such as “this circle is a square.” On this conception of contradiction, analyticity demarcates those judgments which are necessarily true a priori from empirical judgments which require verification from evidence.

Some scholars deny that Hume’s fork can really be equated with Kant’s distinction between analytic and synthetic propositions. Wilf Backhaus takes exactly this position in his paper, “Hume’s Fork and Analytic/Trifling Propositions.” Here Backhaus invokes John Locke's notion of trifling and non-trifling propositions and argues that this theory is closer to what Kant had in mind, but a distinct separation from Hume’s fork.

Backhaus starts with the point that Lockean trifling propositions are ones which have certainty either by identity or by Kantian containment. Identity statements are trifling for Locke, such as “X=X,” but so are propositions “which affirm something of another, which is a necessary consequence of its precise complex idea.”[36] Locke borrows some language from David Hume in his talk of complex ideas. For him, the concept of an object is a complex of ideas. The concept of a red apple is just the complex of the idea of red and the idea of apple. The idea of an apple is also complex, because when an apple is thought of, all of its parts, like the stem and seeds, are thought of as well. So to say that a red apple has seeds would be trifling for Locke since our complex idea of an apple already contains the idea of seeds. Locke suggests Kantian containment precisely when he chooses an example to illustrate this second kind of trifling proposition: “he

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[36] John Locke, cited in Backhaus, 81.

trifles with words who makes such a proposition, which, when it is made, contains no more than one of the terms does; v.g. 'A triangle hath three sides,' or, 'Saffron is yellow.'"[37] Similarly to Kant, Locke implies that any suggested relation between a subject and a predicate is trifling if the predicate can be found to belong to the concept of the subject.

Locke would agree with Kant's second criterion of analytic, but would consider these types of judgements insignificant on his theory of nominal essence. In contrast to *real* essence, the nominal essence of a substance is the complex idea for which the name of the substance stands. For Locke, the nominal essence of some term can never produce certainty about the real essence of the substance to which the term refers. When considering what constitutes "man", "our idea the word *man* stands for is only an imperfect collection of some sensible qualities and powers in him, there is no discernible connection or repugnance between our specific idea, and… his constitution."[38] 'Gold is a yellow metal' is trifling for Locke because he takes yellow to be an essential feature of the nominal essence of gold. The sentence, then, is not instructive since it points out a characteristic that is already thought to take part in the nominal essence. The nominal essence says nothing about the real essence of gold, so Locke would find no significance in the sentence at all.

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[37] *Ibid*.

[38] Locke, 266.

For Backhaus, Hume differs from both Locke and Kant in that "Hume's fork is a division of synthetic propositions into those that express 'infallible relations' and those that do not."[39] According to Backhaus, Hume would not have been interested in the notion of analyticity to begin with. He would agree with Locke that analytic statements are trifling because they are either tautologies and thus tell us nothing, or they are simply definitions of our concepts. Hume's relations of ideas, in contrast, are about statements that Kant would deem synthetic. "For a relational expression to actually say something about something," Backhaus says of Hume's position, "it must have a true subject and a true predicate: it must relate two distinct ideas…to one another."[40] According to Backhaus, then, Hume's fork is only concerned with synthetic statements that are certain and those that are not.

Backhaus' argument fails after considering Hume's stance on mathematics as relations of ideas. Hume is explicit that the content of mathematics does not contain matters of fact but only relations of ideas. Importantly, it does not matter to Hume whether the terms of math and geometry actually refer to anything physical, as indicated in his claim about the truths of Euclid. This means that for Hume analysis of numbers is all that is required in understanding mathematics. In Kant's own example, the concept of 12 is already baked into that of 7+5. Kant says of analytic judgements that "through the predicate [analytic judgments] do not add anything to the concept of the subject, but only break it up by means of analysis into its component

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[39] Bakhaus, 94.

[40] *Ibid*, 93.

concepts, which were already thought in it."[41] Kant's notion of the analytic aligns closely with Hume's relations of ideas, then. Hume is committed to saying that mathematics is merely an operation of analysis, or else it would require some kind of experience to validate. Mathematics is Hume's chief example of a relation of ideas, so he would have no trouble with the equation of his term to Kant's notion of analyticity.

Hume would only accept the logical criterion of analyticity, however. When outlining his own theory of matters of fact Hume states that "the contrary to every matter of fact is still possible; because it can never imply a contradiction, and is conceived by the mind with the same facility and distinctness, as if ever so comfortable to reality."[42] If the judgment does not imply contradiction for Hume it is a matter of fact. For Hume, justification of a matter of fact always rests on the relation of cause and effect, which "arises entirely from experience."[43] So if the judgment does not imply a contradiction, it requires justification by experience and therefore falls under the definition of synthetic. This point eliminates Kant's phenomenological criterion because, as is mentioned previously, the contrary to a statement such as 'gold is a yellow metal' is perfectly conceivable. Thus, 'gold is a yellow metal' is better understood as a synthetic judgment, and we are left with a more rigorous sense of analyticity that fits in well with the history of similar distinctions.

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[41] Kant, *Critique*, 130.

[42] Hume, 19.

[43] *Ibid*, 20.

Immanuel Kant is responsible for the terms analytic and synthetic, but the concepts they point out were certainly present in the literature that predated his own work. David Hume is most famously cited for the prototype of Kant's distinction, but Leibniz and Locke also articulated the idea. By the time the logical empiricists began advocating for verificationism in the twentieth century, the distinction between analytic and synthetic judgements was a widely held assumption. The distinction was so uncontroversial that the empiricists in Vienna built their theory of verificationism on it. Evoking a Humean outlook, they took it that all meaningful sentences were either analytic, and could therefore be taken for granted, or synthetic, in which case they must necessarily be verifiable by empirical evidence. Although the distinction between analytic and synthetic was born out of Kant's idealism, the empiricists of Vienna would go on to take it as a bedrock premise.

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Empiricist philosophy in the twentieth century was inspired to a great degree by Albert Einstein and his seminal work on relativity theory. The principle of verificationism seemed to follow very naturally from the supposed refutation of Kant's synthetic a priori that Einstein was said to have offered. Kant took a Newtonian framework of rectilinear space to be synthetic a priori in the sense that the human mind must hold this kind of intuition about space before it can perceive anything *in* space. When Einstein used non-Euclidean geometry in his general theory of relativity, many saw this as a direct refutation of Kant. These theorists took it that Kant was wrong about synthetic a priori claims because one of his most important examples turned out not even to be true. This picture is misleading, however. For one, Kant cannot really be treated as an empirical realist. His point about space is not an external, empirical point, and therefore could not have been refuted by an empirical theory of space. Even if we take Newtonian physics as our theory of space, however, a pragmatic viewpoint shows us that neither Euclidean or non-Euclidean geometry can rightly be called the empirically correct theory. This chapter will illustrate the pragmatic answer to theory choice using the example of physical space. This answer substitutes efficiency of explanation in place of objective truth. Ultimately, this view is more useful for inquiring about the nature of space.

The discoveries of Albert Einstein in the early twentieth century are crucial to understanding the logical empiricist movement. Einstein was said to have undermined the reigning metaphysics of the day by showing that Kant may have been wrong about notions of

space and time. In some sense this development revived sympathy for David Hume. Hume originally theorized about the distinction between relations of ideas and matters of fact as breaking along the same lines as the distinction between *a priority* and *a posteriority*. A relation of ideas is *a priori* because it contains no empirical reference. A matter of fact, in contrast, is *a posteriori* necessarily because its content is empirical and therefore relies on experience. Kant's suggestion that there are cases that cross these lines, crucially the synthetic *a priori*, was a rebuttal of Hume. When Einstein published his famous theory of relativity, many thought that he had provided the strict empiricist answer to Kant. Relativity theory, in conjunction with non-Euclidean geometry, inspired a generation of empiricist philosophers to throw out metaphysics that had no accountability to empirical science.

Through the nineteenth century, Immanuel Kant's metaphysical framework, that there are factually significant things to be said *a priori*, became a status quo. It was popularly accepted that substantive truth was achievable through pure intuition. One area of thought that he believed we have this kind of access to was the nature of space and time. For Kant, reasoning about space cannot be grounded in experience because our ability to perceive spatial relations indicates that we already have a pure and non-empirical notion of space.

Kant spells out his conception of space and time in his famous Transcendental Aesthetic in the *Critique of Pure Reason.* He starts by pointing out that our minds represent space to us before we have experience of objects in space. He writes that "the representation of space cannot be obtained from the relations of outer appearance through experience, but this outer experience

is itself first possible only through this representation."[44] For Kant, the mind must already have a pure concept of space in order to perceive objects as *in* space and as holding spatial relations to one another. This is also evidenced by the fact that one can imagine empty space, but could never imagine there not being space at all.[45] Thus minds are born with a representation of space through which they perceive spatial relations of objects.

Kant believed that the necessity of a pure and *a priori* intuition about space makes the truths of geometry, i.e. "that in a triangle two sides together are always greater than the third," certain.[46] This is because Kant believed that "one can only represent a single space, and if one speaks of many spaces, one understands by that only parts of one and the same unique space."[47] The mind conceives of and represents only one infinite space, and each localized concept of space is really a part of the one infinite space. It is through this intuition, rather than through analysis of "general concepts of line and triangle," that one discovers the principles of geometry.[48]

Importantly, Kant takes geometry to be an example of synthetic *a priori* truth. He believed that geometry "determines the properties of space synthetically," meaning that the

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[44] Immanuel Kant, *Critique of Pure Reason*, 175.

[45] *Ibid*.

[46] *Ibid*.

[47] *Ibid*.

[48] *Ibid*.

conclusions of geometry contribute in a significant way to our understanding of space in itself.[49] Yet we can come to understand the truths of geometry only through intuition and not experience, since we do not perceive space in itself but only in its representation in our minds.

Although he does not name Euclid, the Kantian mental intuition about space abides by Euclidean rules. Kant even says that we can be sure that "geometrical propositions are all apodictic, i.e., combined with consciousness of their necessity, e.g., space has only three dimensions."[50] Thus Kant conceives of a three-dimensional and infinite grid as the mental representation of space. Kant ties this representation to something objective, however, when he says that "our exposition accordingly teach the reality (i.e., objective validity) of space in regard to everything that can come before us externally as an object, but at the same time the ideality of space in regard to things when they are considered in themselves through reason."[51] Kant thought that we have no empirical access to space in itself, and only a mental representation of it based on non-empirical intuitions. Through these intuitions, however, the truths of geometry are discoverable and in turn we can say significant things about the nature of space in itself.

Einstein's general theory of relativity was broadly taken as a challenge to the Kantian picture. Bertrand Russell gives an authoritative account of this challenge in his *The ABC of Relativity*. Here Russell lays out the philosophical implications of Einstein's work. Russel

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[49] *Ibid, 176*.

[50] *Ibid.*

[51] *Ibid,* 177.

writes that "the whole notion that one is always in some definite 'place' is due to the fortunate immobility of most of the large objects on the earth's surface. The idea of 'place is only a rough practical approximation: there is nothing logically necessary about it, and it cannot be made precise."[52] That a notion of place "cannot be made precise" would be unacceptable to Kant, who thought of space as an a priori pure framework in the mind.

Russell provides grounds for the claim that Einstein disproved one of the important assumptions of the Transcendental Aesthetic in showing that intuitions about space are little help for discovering its true characteristics. Russell writes that "circumstances on the surface of the earth, for various more or less accidental reasons, suggest conceptions that turn out to be inaccurate, although they have come to seem like necessities of thought."[53] The subjective human experience of space and time would lead one to believe that space is predictable and determinate. There are certain units of measurement that provide a good basis for judging the spatial relations of all the objects in the world. This is what Kant argues for, and he takes these intuitions to be trustworthy because he takes them to be synthetic a priori. Einstein casts intuition to the wind, however. He showed that, in fact, it is not easy to measure space at all. Russell provides a colorful example of how relativity theory subverted intuitions:

> "Instead of using a steel measuring-rod to fix our co-ordinates, let us use a live eel, which is wriggling all the time…We are apt to think that, for really careful

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[52] Bertrand Russell, *The ABC of Relativity*, 12.

[53] *Ibid*, 11.

> measurements, it is better to use a steel rod than a live eel. This is a mistake; not because the eel tells us what the steel rod was thought to tell, but because the steel rod really tells no more than the eel obviously does. The point is, not that eels are really rigid, but that steel rods really wriggle."[54]

Relativity produces some conclusions that our intuitions would never have arrived at. Space does not behave globally in a predictable way. This is because it turns out that the point of view of the observer is a relevant factor in the determination of concepts of "here" and "now." Again Russell provides a helpful example. He imagines that he can observe someone on a distant planet, and they can observe him. Some event E occurs and a flash of light is sent out from Russell's location. Anything after the light reaches a certain point can be said to have happened after event E, and anything before the flash also happened before Event E. For the person on the distant planet observing Russell, however, the flash of light will take years to arrive. So in some sense there is a period of years where things are happening to the distant person "simultaneously" with event E.[55] Notions of simultaneity are rendered ambiguous by relativity because it matters where and when the observer is located. Two things can happen at the "same time" but if one is further from the observer than the other they will not be simultaneous since the light must travel further from the one event. For this reason, there is a causal limit surrounding each event in space-time outside of which the

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[54] Russell, 74.

[55] Russell, 43.

event could not have interacted causally with any others because light could not have moved fast enough. This picture of space varies quite dramatically from the uniform Kantian grid universe. Thomas Ryckman writes that "the conclusion seemed inevitable that any assertion of the necessarily Euclidean character of physical space in finite, if not infinitesimal, regions, is simply false."[56]So if we take Euclidean geometry to inform the structure of space, our description of the universe turns out to be problematic. Many understood Kant to have taken this kind of space as an example of synthetic *a priori*. That is to say, we can know that the structure of the universe really is Euclidean through intuition alone. Einstein seems to have proved that view wrong, and many understood that Einstein had thereby taken down Kant.

Russell addresses a popular concern that the conclusions of Einstein's theory had not yet been tested directly when he asserted them. This seems to be a substantial issue. How can we call ourselves empiricists when our theories of the universe have not been observed, and are therefore no different from metaphysics? Are we receding back to Kant's synthetic *a priori*? In fact, Russell shows that the conclusions of Einstein's theory were grounded in experiment indirectly. The problem of time dilation is an example of the indirect connection between experiment and theory. Time dilation is the idea that "two perfectly accurate clocks, one of which is moving very fast relatively to the other, will not continue to show the same time if they come together again after a journey."[57] The speed of time turns out to be

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[56] Thomas Ryckman, "Early Philosophical Interpretations of General Relativity", *The Stanford Encyclopedia of Philosophy*. (2001).

[57] Russell, 20.

dependent on the motion of the observer. Time actually slows down for a fast moving object. This theory was accepted as true by physicists despite the fact that speeds fast enough to test it are impossible on Earth. Evidence for time dilation came from particles moving through Earth's atmosphere from outer space: "some of these particles, called mesons, disintegrate in flight, and the disintegration can be observed. It is found that the faster a meson is moving, the longer it takes to disintegrate."[58] Intuition would tell us that if something unstable moves very quickly it would fall apart faster as its speed increased. These particles, however, move at extraordinary speeds that effectively slow the passing of time. The result is that their disintegration appears to take more time than slower moving particles. The conclusions of relativity theory are thus not directly grounded in experience, but experience has been found to support those conclusions.

It is important to note at this point that Kant was not an empirical realist. Kant's work must be understood in the context of transcendental idealism. To commit him to a claim about the objective physical world in itself would be a mistake. The transcendental aesthetic is not to be taken as a physical theory, which would presuppose empirical realism. Rather, Kant was working with the notion of pure intuitions of space. Principally, he wanted to show that there must be some conception of space baked into the human mind in order to conceive of things in space and time. It is in this sense that he calls Euclidean geometry synthetic a

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[58] *Ibid*, 20.

priori. Given Kant's idealist perspective, Einstein cannot be understood as challenging Kant directly.

Even if we (wrongly) chose to disregard the differences between Kant's idealism and Einstein's scientific perspective, an important theory in philosophy of science shows the two theories not to be contradictory. Michael Friedman deals with the tension between Euclidean and non-Euclidean geometry in physical theory in his book, *Reconsidering Logical Positivism*. His chapter titled "Geometry, Convention, and the Relativized A Priori" traces a useful distinction in the philosophy of science from Kant to Hans Reichenbach, Moritz Schlick, and Rudolf Carnap. He begins by invoking Kant's distinction between "pure" and "empirical" parts of scientific knowledge. The pure part of scientific knowledge, for Kant, consists of geometry and applied mathematics, or "in short, the entire spatiotemporal framework of Newtonian physics-what we now call the structure of Newtonian spacetime."[59] These principles represent the scaffolding of Newton's theory of space that is presupposed for the theory to make sense. For Kant this scaffolding is the pure and non-empirical concepts of space and time. From these concepts, Newton is taken to have deduced the empirical part of his theory. This empirical part of Newtonian physics consists of specific conclusions like gravitational forces. These conclusions would not be meaningful without the necessary axioms in place.

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[59] Michael Friedman, *Reconsidering Logical Positivism*, 59.

Philosophers of science in the twentieth century maintained Kant's distinction between theoretical framework and the empirical conclusions of a theory. Hans Reichenbach re-introduced the distinction as "axioms of coordination" and "axioms of connection." The former axioms are the non-empirical principles that a given theory assumes in order to define the terms of the axioms of connection, which are the empirical assertions of the theory.[60] An important aspect of Reichenbach's distinction is that these terms are relative for each theory. Euclidean geometry is an axiom of coordination for Newtonian physics; taking space as Euclidean allows the Newtonian conception to say meaningful things at all about motion in space. But Euclidean geometry is itself a theory, and in that context its laws are axioms of connection.

Friedman provides a helpful example of Reichenbach's distinction between axioms of coordination and connection that will help to illustrate its implications. Carl Friedrich Gauss, a German mathematician, "attempted to determine the curvature of physical space by measuring the angles of a terrestrial triangle determined by three mountaintops."[61] Modern physicists would chuckle at the naiveté of Gauss' experimental design, because as Friedman writes: "Gauss's proposed 'experiment' to determine the geometry of physical space *presupposes* the notion of 'straight line,' which notion is simply not well defined

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[60] *Ibid,* 61.

[61] *Ibid*, 60.

independently of the geometrical and optical principles supposedly being tested."[62] Gauss wanted to test whether space was "really" Euclidean, but to take a measurement in space you have to decide on a definition of a straight line for your measurement to be meaningful. Whichever theory of geometry Gauss decides on for his definitions will yield the conclusion of his experiment. The point is that any geometry can be taken as axiomatic in developing a theory of the observable data, because the geometry of a physical theory is part of the theories' axioms of coordination.

Moritz Schlick, in correspondence with Reichenbach, accepted the distinction between axioms of coordination and connection but disagreed that the former could count as a priori. Friedman summarizes Schlick's suggestion: "we should no longer characterize constitutive principles- for example, and especially, the principles of geometry- as a priori at all: we should rather characterize them as *conventions*."[63] Whichever principles of geometry we take to define our physical theory are not a priori because they are not necessary. This is obvious from the fact that we get to choose them.

Through Einstein's personal letters he articulated an understanding of the conventionality of a priori theoretical axioms. In a letter to Hans Reichenbach in 1920, Einstein describes the issue of defining space and time in a classical Newtonian framework:

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[62] *Ibid,* 61.

[63] *Ibid*, 63

> "One rather has to decide to define *x* and *t* themselves as absolute, or physically meaningful quantities. For *t* this succeeds with a clock if one ignores the problem of simultaneity, *c* = practically ∞; but for *x* it won't work. One has to resort to ascribing a mysterious, i.e., empirically inaccessible reality to space. But the special principle of relativity in mechanics again speaks against this."[64]

Einstein saw that the definitions that give a theory its significance are ultimately matters of choice. To say that Einstein's relativity in some way refuted Kant would be a mistake on these new terms. It is not the case that Einstein's four-dimensional spacetime is the correct theory of space, it only does a better job of solving some problems of physics. Ultimately these problems are also solvable with a three-dimensional Newtonian geometry as well. Even if we are to commit Kant to empirical realism (which may be dubious) we still cannot say that his intuitive Newtonian picture is incorrect.

The question remains: how does the analytic/synthetic distinction hold up in light of Reichenbach and Schlick's distinction of constitutive and empirical terms? The new scientific distinction points to a helpful way of understanding the linguistic distinction. Analytic statements can be understood in much the same terms as axioms of coordination. They are definitions we have chosen in order to make sense of the rest of our language. "All bachelors are unmarried" is a simple definition of the term "bachelor." It identifies the reference of the term. When the phrase is uttered, it seems obvious and trivial because

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[64] Albert Einstein, Letter to Hans Reichenbach

convention has firmly established that definition. If, however, someone utters the term bachelor in a unique way, they are responsible for making the new use known to the listener to avoid being misinterpreted. Now analyticity is relative. Someone may ask, “what is the sun?” They mean one of two things: either they are asking about the definition of the term, in which case my reply that “The sun is the star in the center of our solar system” is analytic. If the content of the question is empirical, however, then my answer is synthetic. The thing we call the sun happens to be the center of our solar system. This conception of the linguistic distinction hinges on another theory from Rudolf Carnap that will be discussed later.

The supposed disagreement between Albert Einstein and Immanuel Kant over the nature of space and time offered a test-case of the distinction between analytic and synthetic judgements. Einstein was said to have challenged Kant because he showed that a Newtonian three-dimensional picture of space that Kant took to be synthetic a priori (in other words, necessarily true) leads to problems in our physical theories. A picture with better descriptive power is a four-dimensional spacetime. In fact, there really was no disagreement between the two theoretical giants. Even if Kant is to be read as an empirical realist (which may not be correct), Einstein did not show that space really was different than Kant conceived of it. What he did show, and what was clarified by philosophers after him, is that the geometry we use to describe space is a matter of choice. There is no such thing as a correct geometry, because all a geometry does is define the terms upon which a physical theory rests. This fact about geometry as an axiom points to a shift from a verificationist viewpoint to a pragmatic

one. Instead of asking whether or not a given theory is the correct one, we should really inquire as to how efficiently the theory describes what we observe. This suggestion will be explored in chapter three.

3

Empiricist philosophy was given its most assertive articulation in the early twentieth century. The logical positivists, sometimes called the logical empiricists, were firmly committed to the Humean notion that any sentence with any meaning at all must have some associated sense impressions. This school was also sympathetic to Kant's insistence that there must be a class of judgments that are true by definition alone. Logical empiricism as a movement was relatively tightly based around the city of Vienna, and its proponents included physicists, mathematicians, logicians, political philosophers, and psychologists. The loose coalition of academics that comprised the movement were a sign of not only intellectual but also cultural and political tides. The logical positivists advocated for a central thesis, referred to as verificationism, which states that any meaningful sentence is either analytically true or empirically verifiable.In essence, if any statement is to be taken seriously, and it is not a mere tautology, it had better have some empirical consequences that we can measure. Alfred Jules Ayer, a British empiricist, gave perhaps the clearest and most forceful articulation of this position. The verificationist principle and its original advocates came under attack in subsequent literature. Some tried to undermine the notion of analyticity, like W.V.O. Quine. Ultimately, Rudolf Carnap provides a somewhat pragmatic version of the verificationist principle that can be saved from criticism.

The logical empiricist movement sprang out of a group of intellectuals in Austria that were sympathetic to Einstein. The group became known as the Vienna Circle and represented a minority of philosophers, mathematicians, and logicians in Vienna who felt that Einstein had in

fact upset the ruling Kantian framework of space and time. These few thinkers who took Einstein to be correct rallied around their objection to Kant's synthetic *a priori*. Einstein had shown, for them, that truths of the universe could not be discovered through intuition alone since Newton's conception of space turned out to be false.

Moritz Schlick was the founder of the Vienna Circle. Schlick was a professor at the University of Vienna and chair of natural philosophy, due to the recommendation of Einstein himself. Immanuel Kant had such a thorough influence on contemporary thought that Einstein was wary about Schlick's popularity when he recommended him for chair, since he was "no member of the indigenous 'church' of Kantians."[65] Despite his outsider status, Schlick was awarded the position and organized a reading group in Vienna, composed of philosophers, mathematicians, logicians, and many other academics. The group was interested largely in formal logic and philosophy of science. They studied Einstein as well as Ludwig Wittgenstein, a contemporary of many of the circle members who produced profound novel work in logic in the early twentieth century.[66]

The Vienna Circle represented not only an acceptance of Einstein's physics, but a wholesale rejection of the classical method of metaphysics. The circle was committed to the idea that Einstein had shown that the only method for obtaining knowledge was through experience. This epistemology manifested itself in the principle of verification. This principle was introduced

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[65] Einstein to Max Born, 1969, quoted in Stadler, p. 173.

[66] David Edmonds, *The Murder of Professor Schlick: The Rise and Fall of the Vienna Circle*, (Princeton: Princeton University Press), 2020.

in order to "make all domains of inquiry scientific, and so banish metaphysics from the domain of 'meaning.'"[67] The principle says that if a statement is not analytic, then it is only meaningful if it is empirically verifiable. Despite differences of opinion regarding what exactly constitutes verification, the principle claimed a central position in the movement of logical empiricism.

Alfred Jules Ayer gives perhaps the clearest and most forceful voicing of the principle of verificationism in his book, *Language, Truth, and Logic*. Ayer was an English philosopher with some ties to the Vienna Circle. He attended a few meetings and certainly shared their passion for both logic and empiricism. He wrote his famous book in an attempt to show "that philosophy, as a genuine branch of knowledge, must be distinguished from metaphysics."[68] The way to show this, for Ayer, was through the verification principle. He thus writes that,

"all propositions which have factual content are empirical hypotheses; and…every empirical hypothesis must be relevant to some actual, or possible, experience, so that a statement which is not relevant to any experience is not an empirical hypothesis, and accordingly has no factual content."[69]

The purpose of the principle was not to accuse metaphysics of being pure gibberish, but rather to distinguish it from earnest hypotheses.Verificationism seems rather natural for an empiricist. If a statement has any factual content, then it makes a prediction about the physical world. That

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[67] Edmonds, 110.

[68] A.J. Ayer, *Language, Truth, and Logic*, (New York: Dover Publications), 1952, p. 41.

[69] *Ibid*.

prediction ought to be testable, at least in theory. Otherwise, the statement cannot be declared true or false because it does not claim anything about what is observable. If this is the case, and the physical world has no bearing on the truth value of the statement, then in what sense is it really *about* the real world at all? Many of the logical empiricists agreed, and took much of the standard metaphysics of the day to be completely void of meaning.

The most well-known metaphysician at whom the Vienna Circle took aim was Martin Heidegger. Heidegger was a German philosopher in the same idealist tradition as Immanuel Kant. He also infamously joined the Nazi party in 1933. The Vienna Circle maintained an antagonistic relationship with Heidegger because he was frequently guilty of making the kinds of assertions that verificationism would rule out as meaningless. Historian David Edmonds documents a disagreement between Heidegger and Rudolf Carnap, who will be discussed in more detail later:

> "At first glance statements about 'spirit' or 'the absolute' look as if they are saying something; we may even be persuaded that they are on to something profound. We may feel the same when Heidegger asserts, 'the Nothing is prior to the Not and the Negation.' But, asks Carnap, 'Where do we seek the Nothing? How do we find the Nothing? . . . What about this Nothing?— The Nothing itself nothings.' Here was where verificationism was needed."[70]

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[70] Edmonds, 144.

Empiricists saw in metaphysicians like Heidegger's a clear need to constrain philosophy to what could be verified. How does one read Heidegger and feel confident that they grasp the concepts to which he refers? If Philosophy could only be bound to statements based on empirical evidence or on hard logic, then we would not need to busy ourselves with murky concepts like the "Nothing."

A complaint might arise quickly from empirically minded thinkers who want to save room in their ontology for theoretical entities which have not yet been observed. A physicist might point out that under the criterion of verification any talk at all of atoms was purely mystical for many years before the atom could actually be measured. Similarly, there are many empirically based theories which cannot be affirmed or refuted with certainty. One thinks of the problems of quantum mechanics. Amongst the well-read experts in the field, there are many different and incompatible theories of quantum mechanics. Are these theories all nonsense?

Ayer anticipates this line of critique and makes the important point that,

"the question that must be asked about any putative statement of fact is not, Would any observation make its truth or falsehood logically certain? but simply, Would any observations be relevant to the determination of its truth or falsehood? And it is only if a negative answer is given to this second question that we conclude that the statement under consideration is nonsensical."[71]

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[71] Ayer, 38.

It would be unreasonable to demand of every theorist that they have in mind a measurement to be taken that would eliminate the possibility of disproving their theory. This is too strict a criterion for the validity of a theory, and it also betrays the natural flow of scientific theory. Theory construction often suggests new terms or entities that have not been observed but that explain the observable phenomenon well. In cases like this, all that is necessary for the theory to be taken seriously by good empiricists is that it has some relevant measurements that would help one to argue against or advocate for the theory in question. The necessary measurements may even be practically unachievable at the time of the theories' construction. If someone suggests that a certain star sits just beyond the reach of modern telescopes, they are still suggesting a valid empirical hypothesis. There are relevant measurements that would support the claim, we need only wait for telescope technology to advance far enough to allow us to take these measurements.

Ayer was not alone in holding a verificationist position. Ludwig Wittgenstein also held the verification principle to be a useful means of separating meaningful and meaningless propositions. Wittgenstein conceived of the principle in slightly different terms, however. He felt that "the meaning [of a sentence] *consisted* in the conditions of its truth."[72] Wittgenstein's position is subtly different from that of Ayer and other empiricists. He makes a claim about the language itself, namely that all that is necessary for understanding a sentence is its empirical

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[72] Edmonds, 111

implications. If a proposition does not have any measurable implications, then the proposition must not have any meaning at all.

All of the different conceptions of verificationism were aimed at discrediting metaphysics as a legitimate branch of inquiry. Throughout the history of philosophy there are many great minds that were steadfastly committed to the idea that the five senses deceive us and should not be trusted. This tradition is usually referred to as the Rationalists. Rene Descartes is considered the founder of modern Rationalism. He wrote that "because our senses sometimes deceive us, I decided to suppose that nothing was such as they lead us to imagine it to be."[73] Thus, Descartes as well as his followers took as an epistemological maxim that the only way to obtain true knowledge is through the operation of pure reason. Immanuel Kant adjusted the rationalist thesis in his *Critique of Pure Reason*, but as has been shown previously, he still preserves the notion of synthetic *a priori* necessary for *wissenschaft,* or metaphysics as science. Essentially, Kant gave a critique of rationalism but still held on to a need for substantive claims that have no basis in sense experience.

Given this tradition, verificationism was a shocking position. Historian of philosophy David Edmonds conveys the drama of verificationism in early twentieth century philosophy. He writes that "fairly standard statements about God…have the surface appearance of sense but, according to the verification criterion of meaning, they are in fact nonsense."[74] Any proposition

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[73] Rene Descartes, *A Discourse on Method*, trans. Ian Maclean, (New York: Oxford University Press), 2006, 28.

[74] Edmonds, 111.

about God cannot be verified by experience. This may not come as a challenge to theists on its own. They might respond that this is entirely the point of faith, and that believing without seeing is the purpose of religion. That this qualifies a statement as literally nonsensical, however, was an upsetting idea. Verificationism did not just upset religious views, either. As mentioned earlier, the philosophy of Immanuel Kant was, in the twenties and thirties, the dominant framework of the day in Europe. One of Kant's most important theories in his *Critique of Pure Reason* was that there are some true synthetic propositions which cannot be verified by experience. Thus, until the verification principle, many philosophers assumed there was real informative work to be done by intuition alone. This was the worldview of Einstein's "indigenous 'church' of Kantians."

The principle of verification, the most controversial contribution of the logical empiricists, rests on the analytic/synthetic distinction. Logical empiricism was largely opposed to the frameworks of Immanuel Kant, but they did accept his distinction because it provided a justification for *a priori* truths. Extreme empiricism mandates that every proposition be verifiable by experience, but what about the propositions of math and geometry? Is 7+5=12 verifiable? What about the proposition that two parallel lines will never intersect? These kinds of judgments are provable through the manipulation of the rules of mathematics, but not verifiable by experience. The key difference between these statements and metaphysics, however, is that these follow from a system of definitions. The meaning of the term 12 is just defined as 7+5. To suggest otherwise would lead to contradiction. Parallel lines will never intersect because that is what it means to be a pair of parallel lines. If definitional truths are admitted to our framework,

now we have good grounding for a position of radical empiricism. A statement is meaningful if it is analytically true or empirically verifiable.

Criticism of the analytic/synthetic distinction thus poses a serious problem for the verification principle. If there really is no distinction to be made, how do the logical empiricists demand verifiability *and* admit definitions and tautologies with obvious *a priori* truth? For example, the judgment that there is no round square is not empirically verifiable. No conceivable measurement would confirm that nowhere in the universe is there a round square. Nonetheless, we say with certainty that there cannot be one. This certainty is based on definitions, on analyticity. There is no round square because such a thing would be self-contradictory. Verificationism leaves room for this kind of certainty, but without a notion of analyticity this becomes murky. Empiricists would no longer be able to help themselves to logical truths with certainty prior to experience.

The most famous critique of the validity of the analytic/synthetic distinction comes from Willard Van Orman Quine. In his "Two Dogmas of Empiricism," Quine supports the critique of Kant' containment theory, but goes on to suggest that even an appeal to the law of contradiction suffers the same ambiguity. Quine conceived of analyticity in two ways. The first sense of analytic refers to a judgment which "is true and remains true under all reinter-pretations of its components other than the logical particles."[75] Statements of this kind have the form of "x is x," where the sentence is definitionally true on its surface. The second kind of analytic judgment

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[75] Quine, 23.

relies on definition. The most classic example of this kind is the phrase "all bachelors are unmarried men," which Quine insists relies on "extra-logical synonym pairs."[76] It is this second class of analytic statements that Quine will not allow us to help ourselves to. According to him, there can be no analytic/synthetic distinction that rests purely on logic and the law of contradiction unless it only applies to sentences of the form "X is X," which would be trivial.

Philosophers H.P. Grice and P.F. Strawson respond in kind to Quine's objection. In their "In Defense of a Dogma," Grice and Strawson first point out that the terms "analytic" and "synthetic" have a "more or less established philosophical *use*."[77] The history of the distinction laid out in this paper illustrates that philosophers have, through a variety of terms, noticed the same apparent difference between two types of judgments. Grice and Strawson assert that,

> "If a pair of contrasting expressions are habitually and generally used in application to the same cases, *where these cases do not form a closed list*, this is a sufficient condition for saying that there are *kinds* of cases to which the expressions apply; and nothing more is needed for them to mark a distinction."[78]

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[76] Q.V.O. Quine, *From a Logical Point of View*. (Cambridge: Harvard University Press, 1980), 23.

[77] H.P. Grice and P.F. Strawson, "In Defense of a Dogma", *The Philosophical Review*, vol. 65, no. 2 (Apr., 1956), 143.

[78] *Ibid*.

Quine certainly does not have grounds for denying the distinction entirely, even if the distinction is mistaken or confused in some other way. There is a clear and well-established use of the terms of the distinction between analytic and synthetic judgements.

Grice and Strawson further argue that Quine's criticism of synonyms leads to absurdity. If Quine is committed to denying synonyms, then he is committed to denying that some sentence might have the same meaning as another. If he is committed to this, then he must be committed to the denial of meaning itself. This is a serious problem for Quine. As Grice and Strawson write, "if we are to give up the notion of sentence-synonymy as senseless, we must give up the notion of sentence-significance…as senseless too."[79] The paradox Quine's position leads to is obvious. How are we to deny the significance of sentences without rendering the sentence used to express that denial insignificant? Even if the notion of a synonym requires further clarification, the denial of the notion entirely would be absurd. Thus, Quine would be forced to admit synonyms and consequently a notion of analyticity that relies on synonymy.

Analyticity seems to be a solid enough premise, but what about empirical verification? The verificationist principle also runs into an attack on this notion. What does verification look like exactly? The predictions of a theory may be observed without the theory being correct. Suppose, for example, that I predict that the sun will halt its combustion for three minutes tomorrow. My hypothesis will be verified by three minutes of dark sky tomorrow. Now suppose that tomorrow comes around and the moon passes between the sun and the earth and blocks out

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[79] *Ibid*, 146.

the sun for three minutes. The sky goes dark. Has my hypothesis been verified? Of course not. What happened was a solar eclipse, not a pause in the burning of the sun. Just because the predictions turn out true does not entitle us to confirm the argument. This case illustrates the logical fallacy of affirming the consequent. It also illustrates the problem in assuming that any sentence can be definitively verified.

Rudolf Carnap, who was involved closely with the logical positivists, encourages a pragmatic shift in his paper, "Empiricism, Semantics, and Ontology." Carnap opts to relativize analyticity in much the same way that Reichenbach and Schlick relativized a priori theoretical definitions. He does so by considering new theories as positing new ways of describing the observable world. From this consideration, he argues that all questions of the theory are either internal, i.e. "what does the framework say about *x*", or external, i.e. "Is the framework itself acceptable?" By considering theory choice in these terms, we arrive at a notion of analyticity and of verificationism that is weaker than previous conceptions, but all the more reasonable.

The way Carnap relativizes analyticity is by considering theories as "Linguistic frameworks." As Carnap puts it, "if someone wishes to speak in his language about a new kind of entities, he has to introduce a system of new ways of speaking, subject to new rules; we shall call this procedure the construction of a *framework*."[80] Any phenomenon occurring in the world can only be communicated through language. Whenever someone suspects some new phenomenon that has not yet been described, it is their responsibility to come up with terms for

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[80] Rudolf Carnap, "Empiricism, Semantics, and Ontology",

describing the phenomenon to others and rules for combining those terms. This is what Carnap calls the construction of a framework.

Once construction is finished on a new framework, we can either ask *internal* or *external* questions of the new framework. For Carnap, internal questions are "questions of the existence of certain entities of the new kind *within the framework*."[81] Suppose one makes the choice to accept the framework of physical things. Then their question, "is there a star at the center of our solar system?" is answered by empirical investigation. That investigation produces an affirmative answer. There is no more argument over the matter because what has been asked is an internal question. All parties agree on the framework in which the question was asked. The framework of physical things has its own terms and rules that we are all familiar with by habit. The question could have been intended as an external question, however. In this case, the question must be re-interpreted.

External questions, in contrast, are questions of the validity of the framework itself. Continuing the example, Carnap points out the "question of the reality of the thing world itself." This question has been asked many times throughout the history of philosophy, and "realists give an affirmative answer, subjective idealists a negative one."[82] Carnap thus reframes a central debate of metaphysics around his concept of linguistic frameworks. Realists are really

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[81] *Ibid,* 21

[82] *Ibid*, 22

advocating for the adoption of the linguistic frameworks of physical things, whereas idealists reject the framework. This is a helpful way of understanding Carnap's formulation of ontology.

To illustrate Carnap's example, consider two opposing theorists, John Locke and George Berkeley. Locke advocated for a causal theory of perception, that our sense experience is caused by real physical objects outside of the mind.[83] In contrast, George Berkeley thought that since we only have access to our internal ideas, there must not be anything outside of ideas in the mind.[84] Now both theories describe what is observable, but in different terms. Berkeley says that anything we observe is merely an idea without any external existence. Locke argues that every object of perception exists independently of minds. So if we ask the question, "are there physical things?", each theorist may consider it an internal question. In that case, one will answer in the affirmative, the other negative. Carnap argues that what will settle the debate is the external question, "should we adopt the framework of physical things?" Now we are not asking what each framework says about physical things, but which framework does a better job of explaining the world. Carnap writes about what this "better job" might entail: "the purpose for which the language is intended to be used, for instance, the purpose of communicating factual knowledge, will determine which factors are relevant for the decision. The efficiency, fruitfulness, and simplicity of the use of the thing language may be among the decisive factors."[85]

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[83] John Locke, "*An Essay Concerning Human Understanding*, Book IV, Chapter 11", *Readings in Modern Philosophy*

[84] George Berkeley, "*Principles of Human Knowledge*, Part 1", *Readings in Modern Philosophy*

[85] Carnap, 23

Conceptualizing theoretical discussion in this way, objective truth is de-emphasized in favor of a pragmatic approach. Whether one of the theories is objectively true is not knowable because they both make claims about the world outside of experience. What is knowable are the relations that hold between each of the two linguistic frameworks and the pure observable evidence.

Carnap's linguistic frameworks thus give analyticity a relative status. In order to say anything about the world, we need to first adopt a linguistic framework. Only after we have chosen a way to speak about the world can we begin doing so. Therefore, what statements are analytic or synthetic depends on the terms and rules of the adopted linguistic framework. Only the answers to internal questions can be analytic or synthetic, because "a question of this kind may be either empirical or logical; accordingly a true answer is either factually true or analytic."[86] If a judgment follows directly from the rules of a linguistic framework, then it is analytic relative to that framework. The answers to external questions are not, however, analytic or synthetic because "an alleged statement of the reality of the framework of entities is a pseudo-statement without cognitive content." Adopting a linguistic framework cannot be true or false, it is a matter of convention. External questions of linguistic frameworks are analogous to the selection of axioms of coordination in Reichenbach and Schlick's conception of theory construction. They point out that a physical theory requires some axioms to define the terms of the theory. In the same way, any description of the world requires the acceptance of some forms of language in order to make sense.

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[86] Carnap, 31

As a test case, consider again the opposing Einsteinian and Newtonian physical theories from chapter two. Now, however, let us treat them as linguistic frameworks predominantly. As ways of speaking about space and time, they each say something quite different. Einstein's framework describes space as four-dimensional and non-Euclidean. In contrast, Newton's framework takes space to be rectilinear. If we ask an internal question, such as "what is the geometry of space?," each framework will tell us that, based on their rules, space is non-Euclidean or Euclidean respectively. The answer in each case is analytic because in adopting the framework we make the choice to conceive of space in accordance with the rules of the framework. The external question of which framework to adopt is a fundamentally different question because now we are not asking a cognitive question with a yes-no answer. Instead, we are preparing to do a meta-analysis of the frameworks and characterize their different abilities at describing the universe. One may have certain advantages over the other, but there is no correct answer about which one we ought to choose.

Through Carnap's theory, verificationism can be reconstructed with an appeal to Charles Pierce's very reasonable pragmatic values. Pierce believed that our reasoning could be divided into three processes: deduction, induction and abduction. In his own words, "Deduction proves that something *must* be, Induction shows that something *actually is* operative, Abduction merely suggests that something *may be*."[87] Carnap's construction of linguistic frameworks is much like the process of abduction in the sense that it does not require us to confidently declare what must

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[87] Charles Pierce, *Pragmatism as a Principle and a Method of Right Thinking*, 230

be. Rather, it is a suggestion of a certain way of describing what we all observe. Also, like constructing a linguistic framework, the "only justification [for abduction] is that from its suggestion deduction can draw a prediction which can be tested by induction and that if we are ever to learn anything or to understand phenomena at all it must be by abduction that this is to be brought about."[88] Carnap is right in line with Pierce. If we are ever to come to some understanding, we need to adopt a mode of speaking in order to do so. A hypothetical thesis must be adopted for the sake of argument. Only once this happens can the thesis be tested. What do we mean when we speak of testing a hypothesis? Pierce gives us an answer: "the hypothesis must be capable of verification by induction. Now induction, or experimental inquiry, consists in comparing perceptual predictions deduced from a theory with the facts of perception predicted and in taking the measure of agreement observed as the provisional and approximative, or probimetric, measure of the general agreement of the theory with fact."[89] verification thus becomes the process of confirming a general theory by observing particular instances of it's conclusions. This is a realistic picture of science and inquiry because it shows that we really adopt theories first and then check to see their validity. Without a theory, we have no way to make sense of our raw observations. We therefore suggest a story that pieces our observations together, and the story has implications that, if true, we should be able to observe. Each time we do observe those conclusions, we gain confidence in the general theory.

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[88] *Ibid*

[89] *Ibid*, 239.

An appeal to pragmatism is an appeal to Pierce's very reasonable form of verification. When we ask external questions of a linguistic framework as Carnap conceived, and we are good pragmatists, we are asking about the extent to which the hypothetical states of affairs that necessarily follow from the framework agree with our facts of perception. Combining Carnap's linguistic frameworks and Pierce's pragmatic values, verificationism can simply assert that any valid hypothesis can be stated as an internal question to a well-defined linguistic framework and can be inductively verified. Inductive verification never confirms a theory outright, but it does increase confidence in the theory as the degree of agreement between the hypothesis and the observables increases.

Rudolf Carnap's linguistic frameworks offer the perfect conclusion to the logical empiricist project. The principle of verificationism was originally too strong a thesis in some of its earlier voicing, but the spirit of that principle is still present in Carnap's more pragmatic theory. A statement is meaningful if it can be considered an internal question to a well-defined linguistic framework and can be assigned a truth value in that framework. If it cannot, then it is either an ill-defined judgment or it is an external statement about frameworks themselves. The former requires better definitions for the terms of the judgment, the latter is not a factual statement at all but a pragmatic one. If we want to know which framework we should select in order to make sense of our language about the world, we need to do some meta reasoning about the capabilities of the given frameworks. Here we look to pragmatic values like those offered by Pierce. We should adopt the framework which is verified inductively to the greatest extent. This

means that when comparing two ways of describing the world, we need to ask which one to the greatest measure suggests a "general agreement of the theory with fact." Answering this kind of question about linguistic frameworks is the job of the philosopher, which should be distinguished from the job of the scientist. In this new framework, it is the scientist that answers internal questions. After a theory has been adopted, it is she who makes the necessary empirical measurements and determines the truth or falsehood of empirical claims. The philosopher, on the other hand, must contend with the definitions and linguistic rules through which we describe what the scientist has found. It may be the case that in this view we abandon objective truth, but if that is the case then it may be all the better. We cannot reason about the world from outside our own human limitations, so instead of trying to do so we should stick to assessing the skill with which we can describe what we are observing from our limited perspective.

Conclusion

The frustration that led logical positivists to declare metaphysics as nonsense is easily understood by empiricist philosophers. If a philosophical theory purports to demonstrate some fundamental truth about the universe, what good does it do anyone if it cannot be observed? From an academic perspective, this kind of philosophy does not really seem to answer any questions since nothing that it says can be compared with evidence. From a practical, everyday standpoint, however, this philosophy is even worse. Philosophers are the members of society that instruct us on how to live. How do I make sense of myself and the world around me? What kinds of things is the universe made of? How can I know anything? These are the kinds of profound questions that the philosopher is tasked with answering, not just for herself, but for the good of humanity. If those answers have no accountability to concrete evidence, then what good is the philosopher doing? What work is Heidegger doing for humanity when he muses about the Nothing? Not all are granted the privilege of the security necessary to nurture their intellect, and those that are granted that privilege should have something to show for it. From a practical perspective, however, abstract metaphysics seems to have nothing to show. It is no wonder that empiricists wanted a principled way of showing that this kind of philosophy is unserious and should be cast aside.

The principle of verificationism thus seems natural: any meaningful sentence must be empirically verifiable if it is not analytically true. The principle also rests on a linguistic distinction that is historically very well grounded. It would seem, then, that we can clearly

delineate serious philosophy from mere metaphysics. We need to be careful in drawing this delineation, however. Analyticity and empirical verification are the two notions that provide the set of all philosophically meaningful propositions, but they are both problematic without any further qualification.

Analyticity cannot be entirely objective. Language is flexible, and the status of analytic may shift depending on the usage of terms. The utility of Carnap's work is in pointing out that every theory writes its own definitions and rules, and these are what provide the basis for analyticity. In the linguistic framework of numbers, for example, it is analytic that numbers have some reality. This does not mean that we have to be committed to the mysterious metaphysical existence of numbers, only that we have chosen to explain the world using them. In another framework, however, the reality of numbers may be genuinely questioned as a synthetic matter. When we grant an analytic truth, therefore, we must also acknowledge the linguistic framework that classifies it as such.

Empirical verification is more problematic than it seems at first glance. When has a theory truly been verified? The observable evidence might always be explainable as the result of factors other than the ones hypothesized. Strict verificationism runs into the fallacy of affirming the consequent. Instead, we should be satisfied with the notion of inductive verification. On this view, a given hypothesis must have implications to be compared with observations. Now, however, we can speak in degrees of agreement between the theory and fact rather than in a binary and conclusive sense that a theory has or has not been verified.

At this point, a natural question arises. If empiricism is relegated to degrees of confidence and efficiency of explanation, is there not a clear distinction between truth and falsehood? Indeed, the theory of verification that we are left with does seem to abandon the truth. Do not be discouraged by this abandonment, however. We do not have to deny the existence of true matters of fact. What is really happening in the universe continues to happen. What we move away from in the pragmatic shift is an assumption that we can know fully and exactly what it is that is happening. Instead, we can move closer and closer to describing what is happening from our limited perspective. The better our theories get, the more sophisticated our understanding of the universe becomes. It is frankly arrogant to suspect that we will eventually come to know, definitively, everything that the universe is made of and how it all functions. Our limitations should not stop us from trying to develop a very clever way of describing it as best we can.

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