



Postgraduate Dissertation coversheet & feedback form:

THIS SHEET MUST BE THE FIRST PAGE OF THE ASSIGNMENT YOU ARE SUBMITTING (DO NOT SEND AS A SEPARATE FILE)

<i>For completion by student:</i>		
<i>Student Name</i> Florian Halili <i>Student <u>University</u> Email: 2127152@student.uwtsd.ac.uk</i>		
<i>Module code: HPPH7014</i>	<i>Student ID number:</i> 2127152	<i>Educational support needs:</i> No
<i>Dissertation title:</i> Uncertainty and the Limits of Human Understanding		
<i>Supervisor: Dr. Rebekah Humphreys</i>		<i>Word count:15,475</i>
I confirm that this is my original work and that I have adhered to the University policy on plagiarism. Signed ...Florian Halili..... Email submission:if you are submitting this form via email, please tick this box ✕ (as a substitute for your signature) to confirm that you agree to the above declaration.		

For completion by the first marker:

Comments:

First Marker's Mark:

Signature:

Date:

For completion by the second marker:

Comments:

Second Marker's Mark: Signature:	Date:
Agreed internal mark: Signature 1 st marker: Signature 2 nd marker:	Date
Comments <i>(for completion by the internal markers which indicate how the agreed internal mark has been arrived at):</i>	
<i>NB. All marks are provisional until confirmed by the final examination board.</i>	

For completion by the External Examiner:

Comments:

Proposed Mark:

Signature of External Examiner:

Final Agreed Mark:

Comments (to indicate how the final agreed mark has been arrived at):

Master's Degrees by Examination and Dissertation

Declaration Form

1. This work has not previously been accepted in substance for any degree and is not being concurrently submitted in candidature for any degree.

Name.....Florian Halili.....

Date ...13/12/2025.....

2. This dissertation is being submitted in partial fulfilment of the requirements for the degree of

Name...Florian Halili

Date ...13/12/2025.....

3. This dissertation is the result of my own independent work/investigation, except where otherwise stated.

Other sources are acknowledged by footnotes giving explicit references.

A bibliography is appended.

Name..... Florian Halili

Date: 13/12/2025.....

4. I hereby give consent for my dissertation, if accepted, to be available for photocopying, inter- library loan, and for deposit in the University's digital repository

Name..... Florian Halili

Date...13/12/2025.....

Supervisor's Declaration.

I am satisfied that this work is the result of the student's own efforts.

Signed:

Date:

Uncertainty and the Limits of Human Understanding

Florian Halili

M.A. Philosophy Dissertation

University of Wales Trinity Saint David

Introduction: Uncertainty, Truth, and Human Action

Chapter 1: Probability, Uncertainty, and Related Concepts

Chapter 2: Uncertainty in Deduction and Induction

Chapter 3: Action, Causation and Uncertainty– Doing vs Observing

Chapter 4: Counterfactuals and Imagination – Realism & Antirealism

Chapter 5: Free Will and the Structure of Uncertainty

Chapter 6: A Critique of Philosophical Schools in the Face of Uncertainty

Conclusion: Conclusion: Toward a Philosophy of Uncertainty

Introduction: Uncertainty, Truth, and Human Action

This dissertation begins with a practical problem drawn from investing in the stock market and expands it to interrogate the philosophical underpinnings of uncertainty, truth, and human action. The stock market, as probably the best documented event in human history, rich with data for every second and every move in prices and governed provides an exemplary case for examining the limits of empirical and deductive reasoning.

At the heart of this inquiry is a tension between certainty and unpredictability. On the one hand, we possess universal truths that are demonstrably valid both empirically and deductively. For instance, the investing maxim "buy low, sell high" is irrefutably logical, mathematically valid, and consistently supported by historical data. It can be viewed as a categorical imperative in the Kantian sense: universally valid, irrespective of context, cultural norms or personal desire. Yet, this rule offers no predictive power regarding the specific movements of stock prices on any given day. It remains normatively true while being practically impotent under conditions of uncertainty. Thus arises a paradox: even universally validated principles fail to offer actionable guidance when faced with the future's inherent uncertainty. While the question posed here is simple, its implications are deep; are empirical methods, deductive logic, and the tools of reason sufficient to overcome uncertainty, particularly as it pertains to the future outcomes of human actions? If not, what are the implications for philosophy, especially its aspirational aim of guiding human thought and conduct?

This paradox challenges one of philosophy's central projects: the search for timeless truths capable of guiding human action. If empirical and deductive methods, which are considered among the most rigorous forms of inquiry, falter in the face of future uncertainty, then the adequacy of philosophy itself is called into question. What is the value of truth if it lacks utility in predicting our next steps? Does the concept of truth lose its normative grip when it fails to illuminate the future? These questions urge us to reexamine the assumptions underlying realism, anti-realism, determinism, ethics, and the very limits of rational agency.

I will argue that the universality of a law (be it scientific, ethical or even mathematical) does not translate into omniscience; rather, it circumscribes a narrow band of predictive utility. Similarly, ethical theories, no matter how internally consistent or normatively appealing, face the problem of application under uncertainty. A Kantian categorical imperative might demand that one tell the truth at all times, but what of situations in which doing so may lead to catastrophic consequences? A utilitarian calculus might recommend maximizing well-being, but how is one to measure future consequences with any confidence? The indeterminacy of future outcomes undermines the applicability of these moral frameworks, not necessarily their coherence. This suggests that the problem

is not with the theories per se, but with the epistemic environment in which they are expected to operate.

If we are to treat uncertainty as philosophically fundamental, then we must ask: what are its sources? I will argue that uncertainty arises both under a deterministic view of the world, as well as under indeterminism. As such, uncertainty may arise from several ontological and epistemological vectors. First, there is the problem of incomplete knowledge. We often lack sufficient data or contextual information to make confident predictions. Second, there is the issue of emergent phenomena, where complex systems give rise to behaviors that are not reducible to their constituent parts even under fully deterministic frameworks such as in mathematics¹. Third, there is the problem of sensitivity to initial conditions, as exemplified in chaos theory, where even minute variations can lead to vastly different outcomes, still under a deterministic framework². Fourth, and most philosophically troubling, is the possibility that the future is ontologically open, not merely unknown but fundamentally indeterminate. In this sense, uncertainty is not simply an epistemic limitation but a metaphysical reality. Such a view finds resonance in quantum mechanics, where probabilities do not merely reflect ignorance but are built into the fabric of reality itself.

Uncertainty, therefore, emerges not merely as a background condition but as a primary philosophical problem. It destabilizes the predictive ambitions of reason, the prescriptive aims of ethics, and the explanatory claims of metaphysics. It undermines the assurance that rules, laws, and truths, no matter how carefully constructed, can guide human behavior in a world that is not fully knowable. This dissertation, therefore, is not merely about uncertainty as a topic among others; it is about rethinking philosophy through the lens of uncertainty. It interrogates the adequacy of our epistemic tools, the applicability of our ethical norms, and the coherence of our metaphysical commitments in a world where the future is not merely undiscovered but possibly undiscoverable. It is a call to develop a new philosophical orientation, one that does not seek to eliminate uncertainty but to understand and navigate it.

In doing so, we may uncover a more honest, resilient, and ultimately more human philosophy. A philosophy that, like life itself, thrives not in the absence of uncertainty but in its very midst.

¹Godel's incompleteness theorem and Steve Wolfram computational irreducibility will be explored

² Newton's three body problem and chaos theory will be presented as further evidence of uncertainty

Chapter 1: Probability, Uncertainty, and Related Concepts

To begin any serious philosophical inquiry into uncertainty, we must first lay a conceptual foundation by exploring its cognate ideas of probability, chance, variability, randomness, risk, and error. These terms populate both colloquial and technical discourses and are often used interchangeably, yet each carries distinct philosophical implications.

Probability, in its classical form, emerges from games of chance: the roll of dice, the draw of cards, or the spin of a roulette wheel. These are paradigmatic examples where the space of possible outcomes is well-defined, finite, and amenable to enumeration. The probability of drawing an ace from a standard 52-card deck is simply $4/52$; the probability of rolling a 3 on a fair six-sided die is $1/6$. This simplicity rests on a crucial metaphysical assumption: the outcome space is known and exhaustively defined. This is not a trivial observation. The known outcome space enables a purely mathematical treatment of probability. One does not need empirical observation to determine these probabilities; they are calculable a priori through combinatorics. Yet this epistemic certainty conceals an ontological presumption: that the world, or at least the part of it we are modeling, is closed, static, symmetrical and repeatable with the same starting conditions. This is the epistemological privilege of classical probability, it presupposes a world tamed and rendered docile by human abstraction.

The frequentist interpretation of probability attempts to move from the realm of abstraction to the empirical world. Instead of relying solely on deductive enumeration, frequentism posits that probabilities can be determined by relative frequencies in repeated trials. If one rolls a die 6,000 times and the number "4" appears approximately 1,000 times, the empirical frequency approximates the theoretical probability. This approach introduces a methodological realism: it recognizes that we often lack full knowledge of the outcome space. Hence, we turn to empirical observation to infer probabilities. This is the basis of modern statistics, especially within the natural and social sciences. The frequentist model is empirical and conservative in its assumptions, it claims only what the data can justify and generally eschews metaphysical speculation.

Yet frequentism is not without its philosophical complications. Most notably, it relies on the assumption of repeatability and stability. The underlying system must be stationary, such that the statistical regularities observed in the past can be extrapolated into the future. This assumption, though often pragmatic, is epistemically fragile. In a world of flux and contingency, the past may not be a reliable guide. Indeed, as David Hume famously argued, the principle of induction, the idea that the future will resemble the past, is itself unjustifiable by reason. It is merely a habit of mind³.

³ Hume on the problem of induction will be explored in more detail in chapter 2

The Bayesian interpretation of probability steps into this breach. Unlike the frequentist model, which anchors probability in objective frequencies, Bayesianism defines probability as a degree of belief. Such view is held by Bruno de Finetti: “Probability does not exist... Probability is simply the degree of belief of a subject”⁴ and Leonard J. Savage who adds that: “The practical use of probability is in situations where unique, unrepeatable decisions must be made... The notion of long-run frequencies is at best an analogy”⁵. As such probabilities are epistemic, not ontological; they represent our credence, given the information available. Importantly, Bayesianism incorporates prior beliefs and allows for their revision in light of new evidence, a process governed by Bayes' Theorem. This inferential dynamism marks a profound philosophical shift. Knowledge is no longer static, nor are beliefs binary. Instead, we move within a landscape of probabilities that update as we encounter new data. Bayesianism is thus not merely a statistical method but a philosophical orientation: it embodies a model of rationality under uncertainty.

The Emergence of Uncertainty

Having traversed the terrain of probability, we now reach a deeper conceptual watershed: the distinction between probability, risk and uncertainty. The economist Frank Knight famously articulated this distinction in his seminal work *Risk, Uncertainty and Profit*: “The practical difference between the two categories, risk and uncertainty, is that in the former the distribution of the outcome in a group of instances is known, while in the case of uncertainty this is not true, the reason being in general that it is impossible to form a group of instances, because the situation dealt with is in a high degree unique.”⁶. Risk refers to situations where the probability distribution is known or knowable. The space of outcomes is well defined we just do not know in advance what a particular outcome will occur. Much like the deck of cards, the cards are known, their probability space is known, we simply do not know which specific cards will turn up next. Uncertainty, by contrast, arises when this distribution is unknown or indeterminate. In Knightian uncertainty, we do not merely lack knowledge of the specific outcome; we lack knowledge of the possible space of outcomes.

This distinction is vital. Probability, whether frequentist or Bayesian, presupposes a defined outcome space. It may allow for unknown outcomes, but it does not accommodate unknowable ones. In the words of former United States Secretary of Defense, Donald Rumsfeld: “There are known knowns. These are things we know that we know. There are known unknowns. That is to say, there are things that we know we don’t know. But there are also unknown unknowns. There are things we don’t know we

⁴ Bruno de Finetti, *Theory of Probability* (New York: Wiley, 1974), p. 10.

⁵ Leonard J. Savage, *The Foundations of Statistics* (New York: Dover, 1972), p. 9.

⁶ Frank H. Knight, *Risk, Uncertainty and Profit* (Boston: Houghton Mifflin, 1921), p. 231.

don't know.”⁷ True uncertainty explodes this frame. It denies us not just predictability but even describability. Thus uncertainty is deeper; it is the condition in which the space of possibility itself is undefined or unknowable.

This idea is explored in detail by Nassim Nicholas Taleb in his seminal work *The Black Swan: The Impact of the Highly Improbable*. Taleb brings the concept of “unknown unknowns” to the forefront of epistemology and risk analysis. He defines these as events that lie outside the scope of regular expectations, unforeseeable, high-impact occurrences that only appear predictable in hindsight. Such events, which Taleb calls *Black Swans*, have historically shaped science, finance, and human affairs more profoundly than any planned or predictable development⁸. Taleb argues that our failure to anticipate Black Swans stems not from ignorance alone, but from the illusion of knowledge. We rely heavily on simplified models, bell-curve thinking, and the mistaken belief that the past can forecast the future. In doing so, we blind ourselves to the vast space of possibilities that lie beyond measurable risk, what he refers to as the domain of extreme uncertainty. In this space, probability distributions break down, and traditional methods of prediction become not only useless but dangerous⁹.

By contrast, in deterministic systems, what appears random may be the result of complexity or ignorance. Laplace conjectured a demon with perfect knowledge: “An intellect which at a certain moment would know all forces that set nature in motion, and all positions of all items of which nature is composed... for such an intellect nothing would be uncertain and the future just like the past would be present before its eyes”¹⁰. However, this deterministic vision has been undermined by developments in both physics and mathematics. At the heart of both mathematical logic and theoretical computation lies a humbling insight: there are limits to what can be known, proven, or predicted.

Three of the most profound expressions of this insight come from distinct but interrelated sources; Kurt Gödel's incompleteness theorems, Alan Turing's halting problem, and Stephen Wolfram's principle of computational irreducibility. Though originating in separate disciplines, all three challenge the assumption that the universe, whether logical, mathematical, or physical, is fully transparent to human reason.

Gödel's first incompleteness theorem (1931) demonstrated that any consistent formal system capable of expressing basic arithmetic contains true statements that cannot be proven within the system. Gödel stated: “For every consistent formal system F containing

⁷ Donald Rumsfeld, U.S. Department of Defense news briefing, 12 February 2002.

⁸ Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York: Random House, 2007), p. xvii.

⁹ Nassim Nicholas Taleb, *Antifragile: Things That Gain from Disorder* (New York: Random House, 2012), p. 16.

¹⁰ Pierre-Simon Laplace, *A Philosophical Essay on Probabilities* (New York: Dover, 1951), p. 4.

a certain amount of elementary arithmetic there exist propositions in the language of F which cannot be proved nor disproved in F ”¹¹. That is, truth is greater than what can be proven. There will always be well-formed mathematical assertions that are true, but for which no proof exists within the given axiomatic structure. As Gödel concluded, “Any system that is consistent and sufficient for number theory cannot be complete” (p. 146). This shattered the Laplace and Hilbertian dream of a complete and decidable mathematics, revealing a fundamental boundary to deductive knowledge.

Similarly, Alan Turing’s halting problem (1936) extended this insight into the domain of computation. As Jack Copeland one of the leading Turing scholars explains: “The halting problem is undecidable: there is no algorithm that correctly determines, for every Turing machine and input, whether the machine eventually halts.”¹². This limitation is not due to a lack of ingenuity or computational power but is a mathematically provable boundary to what algorithms can decide. Turing thus proved the existence of undecidable computational problems directly comparable to Gödel’s unprovable truths in mathematical systems.

Decades later, Stephen Wolfram articulated a parallel insight in the realm of computational systems. In *A New Kind of Science* (2002), he introduced the idea of computational irreducibility: certain processes governed by simple rules cannot be shortcut or predicted by any faster method than simulating the process itself. Wolfram demonstrates this through cellular automata, abstract machines that produce surprisingly intricate patterns from minimal rules: “Among the simplest possible cellular automata are rules that generate behavior of great complexity” (p. 26). Despite their simplicity, many of these automata evolve in ways that defy compression, exhibiting emergent behaviors that cannot be reduced to formulas. “Even though a system may be governed by definite underlying rules, its behavior can still be fundamentally unpredictable” (p. 741). In irreducible systems, no closed-form solution will suffice; as Wolfram emphasizes, “its overall behavior can be essentially arbitrarily complex” (p. 5) and “The phenomenon that I call computational irreducibility implies that there is in effect no way to shortcut the actual evolution of a system” (p. 737). Thus, even when the rules are fully known and deterministic, the outcome can remain effectively unpredictable.

In such cases, no closed-form solution or mathematical model will suffice. The system is fully deterministic but one cannot know the answer in advance as in the case of closed end formulas where one can plug the values of two variables and with confidence predict the value of the third variable at a point in time. In irreducible systems, no such shortcut exists; prediction and explanation are constrained by the need to compute each step. These systems, even though derived from very simple rules, become complex in their evolution to futures stages that their future states cannot be predicted without simulating

¹¹ Kurt Gödel, “On Formally Undecidable Propositions of Principia Mathematica and Related Systems I,” in *Collected Works*, vol. 1, ed. Solomon Feferman et al. (Oxford: Oxford University Press, 1986), pp. 145–146.

¹² Jack Copeland, *Turing: Pioneer of the Information Age* (Oxford: Oxford University Press, 2012), p. 74.

each step in full. It is as if the universe does not allow one to jump ahead in time but rather makes one comply with each step along the way to arrive at knowledge.

Gödel, Turing, and Wolfram describe systems in which determinism does not lead to predictability. Gödel's theorems expose the limitations of symbolic reasoning within formal logic. Turing's halting problem reveals the undecidability embedded within computation itself. While Wolfram's work reveals that the behavior of even the simplest algorithms may elude general prediction. These are not limitations imposed by ignorance or lack of computational power; they are structural constraints intrinsic to the systems themselves. Philosophically, these ideas converge on a shared point: not all truths are accessible to rational deduction. All three deflate the Enlightenment ideal that reason can, in principle, fully master reality. Instead, they suggest that the unprovable and the unpredictable are not marginal anomalies, but intrinsic features of any sufficiently rich system. There is no master key, no final theory, no algorithmic god's-eye view that will unlock everything.

While the above examples came from the land of formal deductive systems, moving along the spectrum of limits of knowledge we encounter chaos theory, which builds on the above related concepts but takes them from the domain of theoretical examples into the real world. For example, if we can control all the starting conditions of a coin toss, its weight, orientation, release angle, height, and the force applied, we can, in theory, determine the outcome every time. Such an experiment was produced in the paper *Dynamical Bias in the Coin Toss* by Diaconis, Holmes, Montgomery. They conclude: "With careful adjustment, the coin started heads up always lands heads up, one hundred percent of the time." showing that if you fix the initial orientation, you can force deterministic outcome. Under such controlled conditions, the coin toss becomes entirely deterministic: heads or tails can be produced with absolute consistency¹³. In this sense, probability vanishes, and chance is a byproduct of ignorance or variability, not inherent randomness. However, the real world rarely affords such precision. Minor variations in starting conditions, barely perceptible changes in force or angle, can lead to divergent outcomes. The deterministic world, while orderly in principle, gives rise to unpredictability when slight differences in input generate large differences in output. This sensitivity to initial conditions lies at the heart of chaos theory: where deterministic systems display unpredictable behavior.

This insight was foreshadowed by Newton's own struggles with his postulated laws of motion. Using these laws, he could calculate planetary positions far into the future. For two-body problems, like the Earth and Sun, the calculations yield clear and accurate predictions. But when a third body is introduced, say the Moon, the problem becomes

¹³ Persi Diaconis, Susan Holmes, and Richard Montgomery, "Dynamical Bias in the Coin Toss," *SIAM Review* 49, no. 2 (2007): 211–235.

insoluble with the same elegance. Newton himself admitted the challenge: “To determine the motions of the Moon by theory, by considering the action of the Sun as well as the Earth, is a problem... involving too much difficulty for a human mind”.¹⁴ The addition of a third mass introduces nonlinearity and chaotic behavior, rendering the system extremely sensitive to initial conditions. Only in the 19th century, did Henri Poincaré prove that no closed-form general solution exists for Newton’s three body problem. In his book *Science and Method*, he showed that the paths of three interacting celestial bodies could become tangled and unpredictable, depending heavily on their initial states. As he remarked: “One is struck by the complexity of this figure... At first sight one is tempted to say that it is unordered; and yet there is in it a sort of strange kind of order” He further noted that “small differences in the initial conditions produce very great ones in the final phenomena... Prediction becomes impossible”¹⁵. Poincaré’s work laid the foundation for chaos theory.

This idea found new life in the 1960s with Edward Lorenz, a meteorologist and mathematician at MIT. Using one of the earliest digital computers to simulate weather patterns, Lorenz made a discovery that would revolutionize our understanding of determinism. As James Gleick observes in his book *Chaos*: “Lorenz had reduced a variable from .506127 to .506. It seemed a tiny difference. Yet in a simulated weather system, the small change had a profound effect”¹⁶. To his astonishment, the resulting weather patterns diverged drastically from the original. This small change in initial conditions cascaded into entirely different outcomes. Lorenz coined the term “the butterfly effect” to describe this phenomenon. This was chaos in its purest form. Despite the equations being well understood and entirely deterministic, the system’s sensitivity to initial inputs rendered long-term prediction impossible. Lorenz had rediscovered the same problem Newton had encountered centuries earlier. Many nonlinear systems, those without closed-form mathematical solutions, must now be studied through numerical approximation and simulation rather than mathematical analytic expressions. Weather, fluid dynamics, planetary motion, and many biological systems are all governed by such principles. Their behavior is not random in the traditional sense, but their long-term future remains unknowable due to their internal complexity and sensitivity.

The above insights, leads one to conclude that determinism does not guarantee predictability. The presence of exact laws does not imply that their outcomes can be precisely foreseen. In systems marked by nonlinearity and chaos, even infinitesimal differences in input can lead to exponentially divergent futures. What emerges is not the

¹⁴ Isaac Newton, *Philosophiæ Naturalis Principia Mathematica*, Book 3 (London: 1687), p. 408.

¹⁵ Henri Poincaré, *Science and Method* (New York: Dover, 1952), pp. 67–68.

¹⁶ James Gleick, *Chaos: Making a New Science* (New York: Viking, 1987), p. 16.

absence of order, but a deeper realization: that in some systems, uncertainty is born not from epistemic ignorance, but from the very structure of the laws themselves.

Further up the spectrum of uncertainty comes quantum mechanics, which suggests that at the subatomic level, randomness is intrinsic, not merely epistemic. Quantum mechanics revolutionized the scientific worldview by revealing that uncertainty is not merely a product of human ignorance, but a fundamental feature of the physical universe. At the heart of this revelation lies Heisenberg's uncertainty principle, which asserts that certain pairs of physical properties, most famously position and momentum, cannot be known simultaneously with precision. The more accurately we determine a particle's position, the less precisely we can know its momentum, and vice versa. Heisenberg states: "In the sharp formulation of the law of causality, If we know the present, we can calculate the future, it is not the conclusion that is wrong but the premise. We cannot know, as a matter of principle, the present in all its details"¹⁷. This is not due to technological limitations, but to the ontological structure of reality itself at the quantum level. Unlike classical systems, where uncertainty arises from chaotic behavior or incomplete data, quantum uncertainty is irreducible. Quantum systems exist in superpositions, states that are probabilistically distributed across multiple possible outcomes until measurement collapses the system into a definite state. This leads to a fundamentally probabilistic description of the world: we can only predict the likelihood of events, not the events themselves. In Newtonian mechanics, if one knew all positions and velocities at a given time, the future and past could be precisely calculated. In quantum mechanics, even with perfect knowledge of the wavefunction, only probabilities emerge, not certainties. The indeterminacy is not in our tools or theories, but in nature itself. Laplace's demon would have no chance of mastering the subatomic world. Quantum mechanics invites a vision of reality in which uncertainty is not the residue of ignorance, but a constitutive element of being. Far from a defect, this uncertainty reveals a dynamic, open-ended cosmos, one that resists total specification and remains perpetually contingent. In this way, quantum theory does not merely revise classical physics; it reconfigures our metaphysical expectations and epistemological ambitions.

The insights from these leading scientists have profound implications for how we think about knowledge, science, and human reason. In mathematics, we must accept that certain truths lie beyond formal derivation. In physics and computational modeling, we must admit that some outcomes can only be known through simulation, not through close end formulas. In both domains, the future is not always deducible from the past, even when governed by deterministic rules. Thus, computational irreducibility and incompleteness both describe epistemic asymmetries: between what exists and what can

¹⁷ Werner Heisenberg, *Physics and Philosophy: The Revolution in Modern Science* (New York: Harper, 1958), p. 16.

be known, between what is true and what is provable, between what is computable and what is explainable. They serve as reminders that uncertainty is not always a mark of ignorance, but a structural feature of the systems we inhabit. Rather than undermining the value of logic or science, these ideas invite a more nuanced and mature epistemology, one that recognizes the limits of deduction without abandoning rigor, and one that embraces simulation, exploration, and imaginative reasoning as legitimate modes of understanding in the face of irreducible complexity and uncertainty.

Chapter 2: Uncertainty in Deduction and Induction

This chapter explores how uncertainty infiltrates both deduction and induction. Deduction is celebrated for its certainty: from established premises, it yields conclusions that cannot be otherwise if the reasoning is valid. Induction, by contrast, represents a more contingent, probabilistic method: it extrapolates general principles from particular observations, and thus invariably invites the specter of uncertainty. Philosophers from Aristotle to Hume to Karl Popper have wrestled with these differences, often treating deduction as the bastion of certainty and induction as its fragile cousin. Yet this binary conceals a deeper tension. For deduction itself only appears certain because it excludes uncertainty at the level of its premises. And induction falters precisely because the world itself resists closure: new observations, black swans, or chaotic systems subvert the futures we predict and generalizations we construct.

To deepen this analysis, I turn to two towering figures of twentieth-century thought: Ludwig Wittgenstein and Kurt Gödel. Wittgenstein, in both his early and late philosophy, regarded mathematics as tautological or rule-bound, a closed system immune to contingency, yet detached from empirical truth. As explored earlier, Gödel, demonstrated that mathematics harbors true statements that escape formal proof, thus introducing radical uncertainty into the very heart of logic. Their conflicting visions reveal the paradox of deduction: it aspires to certainty, but its very structure discloses an inescapable incompleteness. By situating Wittgenstein's tautological conception of mathematics against Gödel's incompleteness theorems, I argue that uncertainty haunts both deduction and induction, albeit in different modalities, and that their separation is more a matter of temporal orientation than epistemic or ontological kind.

In deduction if the premises are true and the logical form valid, the conclusion follows with necessity. From the syllogism of Aristotle ("All men are mortal; Socrates is a man; therefore Socrates is mortal") to modern formal logic, deduction embodies a structure of inevitability. When we examine its foundational assumptions, uncertainty reappears. Deductive systems rests on axioms or postulates, which themselves are not deduced but posited. For example, Euclidean geometry relies on axioms such as "parallel lines never meet." Within that system, deductions are certain: the sum of the angles in a triangle equals 180 degrees. Yet if the axiom is altered, as in non-Euclidean geometry, the entire deductive edifice shifts, the sum of the angles in a triangle equals less than 180 degrees.

The certainty of deduction thus depends on the provisional acceptance of premises that are themselves open to revision. The strength of deduction lies not in its freedom from uncertainty but in its strategic containment thereof.

In the *Tractatus*, Wittgenstein sought to clarify the limits of language and thought. Logic, he argued, is tautological: its truths are necessary, but only because they are empty. They do not describe reality; they merely show the structure of thought. He argued that mathematics is a form of tautology: “Mathematics is a method of logic”, “The propositions of mathematics are equations, and therefore pseudo-propositions” (6.2–6.21) and “The propositions of logic are tautologies” (6.1)¹⁸. Deduction secures certainty only because it says nothing about reality. As Robert J. Fogelin observes, “the truths of logic and mathematics are tautologies, and hence say nothing about reality; they reveal only the formal scaffolding”¹⁹. Anthony Kenny similarly notes that for Wittgenstein, “a tautology is empty of content; it provides certainty, but at the cost of saying nothing about how things are in the world”²⁰.

Mathematics, on this account, is an extension of logic. Equations like “ $2+2=4$ ” are not empirical discoveries but formal identities which express nothing about the world but rather codify rules of symbol manipulation. The certainty of mathematics is guaranteed precisely because it is disconnected from empirical reality. In this sense, mathematics is immune to uncertainty but only because it is irrelevant to the contingencies of the world. Deduction is not a discovery of reality but a computation given starting condition. This view resonates with the traditional image of deduction as unassailable. Yet it also exposes its hollowness. If mathematics is tautological, then its certainty comes at the cost of content. It is a game of symbols, not a discourse about reality. Deduction, under this interpretation, secures certainty by vacating itself of relevance and by squashing uncertainty by fiat.

However, the later Wittgenstein changed course. In the *Philosophical Investigations* (1953), he reconceived mathematics not as a set of eternal tautologies but as a human practice embedded in language-games. He states: “Mathematics is not a discovery, it’s a human activity” (PI, §124)²¹. As Hans Sluga explains, “proofs no longer mirror timeless logical necessity, but belong to language-games, to forms of life”²². Crispin Wright makes the same point: “Wittgenstein does not regard mathematical truth as discovered, but as constituted by human activities of proof and calculation”²³. Therefore,

¹⁸ Ludwig Wittgenstein, *Tractatus Logico-Philosophicus* (London: Routledge, 1922), Proposition 6.1–6.21.

¹⁹ Robert J. Fogelin, *Wittgenstein*, 2nd ed. (London: Routledge, 1987), p. 45.

²⁰ Kenny, Anthony. *Wittgenstein*. Harvard University Press, 1973, p. 41

²¹ Ludwig Wittgenstein, *Philosophical Investigations*, trans. G. E. M. Anscombe (Oxford: Blackwell, 1953), §§185–201.

²² Hans Sluga, *Wittgenstein* (Chichester: Wiley-Blackwell, 2011), p. 112.

²³ Crispin Wright, *Wittgenstein on the Foundations of Mathematics* (Cambridge, MA: Harvard University Press, 1980), p. 12

mathematical truth is not discovered in a Platonic realm but constituted by rule-following within forms of life. On this account, certainty in mathematics arises not from metaphysical necessity but from communal agreement. What counts as valid is what our practices sanction as valid. This later view shifts the ground of certainty. Mathematics is no longer a detached realm of tautology but a socially embedded activity. Yet uncertainty still lurks. Rules themselves require interpretation, and their application can generate disagreement. What appears as unshakable certainty is, at bottom, the stability of practices that could have been otherwise.

Despite the differences between the earlier and new Wittgenstein, for our purposes the common denominator of his view remains, the price of deductive certainty, then, is ontological sterility. Deduction cannot tell us what exists; it only reveals what follows from assumptions. In this sense, the certainty of deduction is conditional: it is valid only within a framework of accepted assumptions. It excludes uncertainty by refusing to speak about anything uncertain, namely, the contingent, the empirical, the future. Seen in this way, deductive reasoning is a closed system designed to escape the open texture of reality.

If Wittgenstein's early view sterilized mathematics into tautology, Kurt Gödel's incompleteness theorems (1931) shattered the dream that mathematics could ever be complete and self-contained. As previously discussed, Gödel's first incompleteness theorem showed that in any sufficiently powerful formal system (capable of expressing arithmetic), there exist true statements that cannot be proven within the system. His second incompleteness theorem demonstrated that no such system can prove its own consistency. The implication is profound: even in the most rigorous domains, truth exceeds proof and there are true but unprovable statements. Deduction cannot capture all that is true; it is constrained by the assumptions itself cannot justify and the human observer has to transcend and go beyond that is provable to reach to truth.

These results introduce radical uncertainty into the very heart of deduction. If deduction were purely tautological, as Wittgenstein claimed, it should secure certainty. But Gödel revealed that deduction cannot close itself. There will always be truths beyond proof, always assumptions whose certainty cannot be guaranteed.

Induction and the Unruliness of Experience

Induction, by contrast, embraces uncertainty. It is the logic of discovery, of extrapolation, of learning from the world. From the observation that the sun has risen every day in living memory, we infer that it will rise tomorrow. From a series of experiments in a laboratory, we induce a general law of nature. But induction, as Hume famously noted, lacks logical necessity. The conclusion of an inductive argument can never be guaranteed

by its premises. This problem has plagued philosophy for centuries. How do we justify the move from the observed to the unobserved, from the particular to the general, from the past to the future? Hume's unsettling answer was that we cannot, at least not by reason. He states: "All inferences from experience suppose, as their foundation, that the future will resemble the past... But this conclusion is not founded on arguments of any kind, but entirely on custom or habit."²⁴ Our belief in the uniformity of nature is not itself rationally demonstrable; per Hume, it is a habit formed by repeated experience.

Induction gains further complexity when we consider two distinct forms: (1) induction from observation to universal rule, and (2) projection from present data into future expectation²⁵. The former is descriptive; it seeks to characterize how the world has behaved. The latter is predictive; it aims to anticipate what the world will do. The former undergirds scientific generalizations; the latter underwrites decision-making.

These two forms of induction share a common vulnerability: they require the assumption that observed patterns persist. Whereas deduction attempts to squash uncertainty by fiat assumptions of what is true, induction attempts to manage uncertainty by the assumption that patterns persist overtime. Yet this assumption is not logically necessary. Every generalization risks encountering a black swan. As Karl Popper states: "no matter how many instances of white swans we may have observed, this does not justify the conclusion that all swans are white"²⁶. For Popper, scientific reasoning proceeds by falsification, not by inductive certainty. Every forecast may be disrupted by a chaotic perturbation.

The second form of induction, moving from the past (observed data) to the future (unobserved events), introduces a temporal axis of differentiation between deduction and induction. Deduction often concerns what is logically entailed, irrespective of time. Induction, on the other hand, is temporally situated. Both involve reasoning from premises to conclusions; what differs is the temporal status of the premises and the nature of the conclusion. Deduction is retrospective and conditional; induction is prospective and uncertain. From this perspective induction while attempting to discover fundamental cause and effect relationships or laws of nature is nothing more than a correlation of events with probability projection between two events one following the other. As Nelson Goodman writes: "The difficulty is not in drawing inferences but in distinguishing those that are valid from those that are not."²⁷ . In other words, we could model and project possible outcomes, but we face uncertainty in deciding which outcome will play out. The fragility of inductive reasoning is not a defect but a reflection of our

²⁴ David Hume, *An Enquiry concerning Human Understanding*, §V, pt. 1, p. 46, ed. Tom L. Beauchamp (Oxford: Oxford University Press, 2000).

²⁵ O. Quine, "Two Dogmas of Empiricism," *The Philosophical Review* 60, no. 1 (January 1951): 20–43.

²⁶ Popper, Karl. *The Logic of Scientific Discovery*. Hutchinson, 1959, p.27

²⁷ Nelson Goodman, *Fact, Fiction, and Forecast*, Harvard UP, 1955, p. 64

epistemic condition: we are finite beings embedded in a temporally evolving world. The arrow of time introduces a fundamental asymmetry. The past is fixed; the future is open.

This asymmetry is not merely epistemic but may be metaphysical. We cannot act upon the past, but we can act upon the future. Thus, the future is the domain of freedom, risk, and moral responsibility. Induction, insofar as it engages with the future, must grapple with the full weight of uncertainty. Seen this way induction has practical ramifications for every domain in which decisions must be made under conditions of uncertainty. We do not act based on deduction alone. We act based on expectations, probabilities, and assessments of possible outcomes. In this context, the concept of expected value becomes paramount. A decision is not judged solely by whether it aligns with a general rule, but by whether it yields favorable outcomes given uncertain information. Induction is the logic of wagering. It is the process by which we estimate the unknown and act upon that estimation. As such, it is not reducible to formal logic. It requires judgment, prudence, and an appreciation for the limits of knowledge. In a world where the future is open, where not all truths are derivable from axioms, induction allows us to navigate. Indeed, science is largely built upon the scaffolding of induction: hypothesis formation, testing, falsification, and the iterative updating of models in response to empirical data. These are not deductive processes; they are probabilistic, abductive, and fallible.

Along these lines, Charles Sanders Peirce presents an alternative view by the introduction of *abduction*, often referred to as “inference to the best explanation.”²⁸ Peirce argued that deduction and induction alone could not account for the full process of inquiry as neither explains how new hypotheses or explanatory ideas first arise. For this gap, Peirce proposed abduction. Abduction is the mode of reasoning by which we generate hypotheses in response to surprising facts. When confronted with an observation that does not fit our current understanding, we naturally seek an explanation. Abduction provides this: it posits a possible cause or principle that, if true, would render the surprising fact intelligible. For example, if one wakes to find the lawn wet, deduction cannot conclude that it rained, nor can induction guarantee it. But abductive reasoning suggests, as a plausible hypothesis, that it likely rained overnight. The hypothesis is not certain but rather a provisional guide for further testing.

Peirce emphasized that abduction is the only logical operation that introduces new ideas: “Abduction merely suggests that something may be. Its justification is that it offers a possible explanation for the facts. Induction verifies the hypothesis; Deduction applies it.”²⁹ This triadic structure reveals inquiry not as a closed system of certainty, but as a dynamic process shaped by uncertainty, surprise, and the continual search for better explanations. In recognizing abduction, Peirce expanded the philosophy of reasoning

²⁸ Charles Sanders Peirce, “A Guess at the Riddle,” in *Collected Papers of Charles Sanders Peirce*, vol. 1, ed. Charles Hartshorne and Paul Weiss (Cambridge, MA: Harvard University Press, 1931), §1.68.

²⁹ Peirce, “Pragmatism as the Logic of Abduction,” *Collected Papers*, vol. 5, §5.189

beyond mere formal logic and empirical generalization, grounding it in the creative yet fallible human response to the unknown.

Perhaps the incompleteness of such philosophical attempts is itself instructive. It suggests that the uncertainty we face is not merely a matter of incomplete knowledge but may be irreducible. The world does not always present itself in the tidy form of premises and conclusions. It offers, instead, data, irregularities, anomalies, and surprises. Our reasoning must be commensurate with this complexity and recognize that deduction is the logic of a world already made; induction is the logic of a world in the making. In recognizing this, we reorient philosophy from the pursuit of certainty to the navigation of possibility. We ought to embrace uncertainty as the condition of creativity, freedom, and moral responsibility. In this light, ethical and existential questions emerge: how should we live, decide, and act in a world that refuses to be fully known?

Chapter 3: Action, Causation and Uncertainty– Doing vs Observing

The philosophical discourse on causation has historically oscillated between metaphysical inquiry and empirical observation. What does it mean to say that one event causes another? Is causation a feature of the world, or a construct of the mind imposed upon experience? Within this long-standing debate, the distinction between "doing" and "observing" introduces a critical axis along which causality may be reinterpreted. In this chapter, I argue that the act of intervention, of doing, fundamentally alters our epistemic and metaphysical relationship to causation. To observe is to receive information passively; to act is to impose structure upon the world. These are not symmetrical modes of inquiry. They constitute distinct ontological commitments and epistemological regimes

Observation has long been the cornerstone of empirical science. From the Baconian method to modern data science, the systematic collection and analysis of observable phenomena is held to be the gateway to objective knowledge. Observation allows us to infer patterns, establish correlations, and formulate hypotheses. At this observational level, correlation becomes the primary tool. Correlation matrices allow us to measure the degree to which variables co-vary. A strong positive correlation between ice cream sales during summer months and drowning incidents, for instance, may lead to speculation, but it does not, by itself, establish a causal link, that increased ice cream sales lead to more drownings. The limitations of observation lie precisely here: observation permits description but not explanation. As explored in the previous chapter, this limitation has been well understood since the time of David Hume. According to Hume, all we ever observe are "constant conjunctions": the regular succession of one event by another. We never observe causation itself; we infer it. The belief in causation arises from habit, not reason. As such, causation remains epistemically underdetermined by observation.

The epistemic fragility of observational data has prompted a turn toward interventionist accounts of causation. The central insight of interventionism is that to understand causation, we must do more than passively observe; we must actively intervene. This is a view held by Judea Pearl in his book “Causality: Models, Reasoning and Inference” and further advanced by philosopher James Woodward in “Making Things Happen”. In Pearl's formalism, this is captured by the distinction between seeing (observing a variable) and doing (actively setting the variable to a certain value). To observe that smoking is correlated with lung cancer does not entail that smoking causes lung cancer. But if we intervene to cause someone to smoke and subsequently observe a change in cancer rates, we move closer to causal inference³⁰. The difference lies not in the data, but in the structure of the inquiry.

Intervention collapses the probability function inferred from observation and replaces it with a new distribution conditioned on action. This is a radical epistemological move. It changes the counterfactual landscape. Where observation tells us what is likely given the structure of the world as is, intervention tells us what would happen if we acted differently. For example, if we observe the data and come up with a correlation matrix of the lawn sprinkler systems being on/off with rainy/non-rainy days we could come up with some expectation based on correlation of expected weather and sprinkler systems being on/off. However, if we intervene in the system via a “do” operation(Pearl’s language) and turn the sprinkler system on/off at our own volition then this act of intervention has completely changed the probability space. Pearl formalizes this distinction via his “do-calculus”. Unlike traditional probabilistic inference, which deals with conditional probabilities of the form, what is the probability of Y event given X event has occurred, do-calculus introduces the operator of action, $do(X)$, producing expressions like what is the probability of Y if we do X. This captures the idea that by doing X, we actively alter the system. The resulting distribution reflects a different causal structure. Doing is not a special case of observing; it is an epistemically superior mode of inquiry when it comes to understanding causation.

The implications of this are profound. Correlation is symmetric and non-directional: if X correlates with Y, then Y correlates with X. Causation is asymmetric and directional: if X causes Y, then it is not necessarily the case that Y causes X. This asymmetry cannot be inferred from correlation alone. It must be imposed by a model, justified by background knowledge, or demonstrated through intervention as in the example of smoking causing cancer above. In this way, interventions allow us to distinguish spurious correlations from genuine causal relationships. They provide the epistemic traction necessary to move from passive description to active explanation. To do something is to exert agency and to move beyond mere reaction and into intentional transformation. Doing implies control, manipulation, and the exertion of will. It is, therefore, inseparable from questions of

³⁰Pearl, Judea. *Causality: Models, Reasoning, and Inference*.

autonomy, responsibility, and freedom. To do is not simply to cause, but to cause intentionally. This intentionality sets human causation apart from natural regularities. A stone falls due to gravity; a person jumps by choice. The interventionist framework thus dovetails with broader philosophical questions about agency and moral responsibility. If I am the author of an intervention, then I bear some responsibility for its consequences. Doing is therefore not only a scientific act but also an ethical one. Furthermore, doing introduces a temporal orientation. To act is to alter the future. As James Woodward explains: “Interventions are acts. They are temporally oriented toward the future and reflect the agent’s intentions to change a system’s state.”³¹ Observations look to the past or present; intervention projects forward. Doing operates in the domain of the possible, not the actual. It is an exploration of counterfactuals, of what might be, rather than a documentation of what is. As Donald Davidson succinctly puts it, “An action is something an agent does that makes a difference in the world. It looks forward to consequences and binds the agent to them”.³²

A useful schema for organizing these insights is Pearl’s Ladder of Causation. It delineates three levels of causal understanding: first level is Association (Seeing), second level is Intervention (Doing) and third level is Counterfactuals (Imagining). Seeing captures correlations and statistical dependencies. It is the domain of traditional statistics and machine learning algorithms trained on observational data. Intervention (Doing) involves manipulating variables to observe their effects. It is the domain of randomized controlled trials, experimental science, and causal inference. Counterfactuals (Imagining) is the highest level and concerns hypothetical scenarios: what would have happened if things had been different. It is the domain of explanation, responsibility, and moral reasoning³³.

These levels are hierarchical. Each requires the capacities of the level below it but introduces a qualitatively new form of reasoning. One cannot reach Level 2 merely by collecting more data at Level 1; intervention introduces a new epistemic tool. Similarly, one cannot reach Level 3 without a model capable of representing counterfactuals or imagining what if scenarios. This hierarchy challenges the assumption that data alone is sufficient. Data without intervention is descriptive but impotent. Data with intervention becomes explanatory. Data with counterfactual reasoning becomes meaningful. Thus, causation is not merely a statistical pattern but a conceptual scaffold for making sense of action, responsibility, and possibility. To do something is to bifurcate the world into what is and what could be. The act of intervention does not merely change the state of the system; it creates an alternative trajectory. This is why counterfactuals are central to

³¹ Woodward, James. *Making Things Happen: A Theory of Causal Explanation*. Oxford University Press, 2003, pg. 93

³² Davidson, Donald. “Actions, Reasons, and Causes.” *The Journal of Philosophy*, vol. 60, no. 23, 1963, pp. 685–700.

³³ Pearl, Judea, and Dana Mackenzie. *The Book of Why: The New Science of Cause and Effect*. Basic Books, 2018.

causal reasoning. They allow us to compare actual and possible worlds. From a metaphysical standpoint, this aligns with the modal realism of David Lewis, who argues that possible worlds are just as real as the actual world; we simply inhabit one of them³⁴. Interventions, in this light, are the means by which we traverse or instantiate possible worlds. Every act is a selection among alternatives. This metaphysical framing underscores the profundity of doing: to act is to instantiate one future among many.

Yet our ability to do is constrained. We do not control all variables; we are not omniscient. What if our intervention was in a chaotic system where even a small change in conditions leads to huge divergence down the road? As we explored earlier, most human activity is too complex for such relatively simple interventionist experiments to yield successful reusable results. Thus, interventions are inherently risky. They may produce unintended consequences. This introduces the concept of uncertainty not merely as a lack of knowledge but as a structural feature of action. To do is to wager. Thus, if actions have consequences, then agents are accountable. As Aristotle notes, “Voluntary acts are those of which the moving principle is in the agent himself, he being aware of the particular circumstances of the action”³⁵. But accountability presupposes some degree of causal understanding. One cannot be held responsible for outcomes that were unforeseeable or unavoidable. Ethical responsibility depends not only on intention but on the knowledge of causal pathways. Ignorance may mitigate blame, but it does not eliminate causal influence. Thus, our moral frameworks must grapple with degrees of knowledge, control, foreseeability and uncertainty.

Furthermore, moral reasoning often relies on counterfactuals. We assess not only what happened but what could have happened. This is the essence of regret, remorse, and justification. To know is no longer merely to observe; it is to intervene, to model, to imagine. As humans grapple with the world, predicting, wagering, taking action, intervening complex feedback loops are created, akin to chaotic systems, introducing uncertainty of outcome, and a certain type of human made volatility and randomness in our societal organizations, politics, economics and even climate.

Ultimately, causation is not merely a feature of the world, it is a structure of human engagement with the world. To act is to wager and to cause. To cause is to bear responsibility. To bear responsibility is to be free. In this triad, action, causation, and freedom, we find the ethical and existential stakes of a philosophy of uncertainty. For the above to be true one has to assume that to act, is based on free will. Daniel Dennett puts it plainly: “Freedom evolves not from exemption from causation, but from the capacity to anticipate, evaluate, and control one’s actions through reason”³⁶. Even under uncertainty, we act, imagine, and bear responsibility for the futures we create. As Thomas Nagel

³⁴ Lewis, David. *Counterfactuals*. Harvard UP, 1973

³⁵ Aristotle. *Nicomachean Ethics*. Translated by Terence Irwin, 2nd ed., Hackett Publishing, 1999.

³⁶ Daniel C. Dennett, *Freedom Evolves* (New York: Viking, 2003), p. 177.

reminds us, “Wherever luck intervenes, responsibility seems to diminish, yet we cannot escape holding people responsible for outcomes beyond their control”³⁷.

A fully deterministic philosophical view might challenge this assertion. If our acting in the world is not our own, or of our own volition, but simply a reaction to neurons firing then the arrow of causation still remains the same, the uncertainty of outcome still rules, but the volition and intention of the actions are called into question. Volition and intention are tied to decision making, to choice, which in turn are tied to being able to imagine configurations of the world not simply as it is but as it could be, as it could develop and change, or even under a deterministic view as it could possibly develop and unfold in chaotic future stages.

Chapter 4: Counterfactuals and Imagination – Realism & Antirealism

Realism, Anti-Realism, Imagination, and Counterfactuals: Ontology and Epistemology in a World of Possibilities

The philosophical confrontation between realism and anti-realism remains one of the most consequential debates in metaphysics and epistemology. Its implications stretch across the structure of scientific inquiry, the metaphysics of truth, and the nature of human knowledge. But to truly probe the nuances of this confrontation, we must turn to a critical but often under-theorized domain: the role of imagination and counterfactual reasoning. Imagination, as the cognitive faculty of entertaining possibilities, and counterfactuals, as the linguistic and logical structures for expressing them, constitute the discursive terrain where realism and anti-realism most vividly collide. This chapter will explore the ontological commitments of realism and anti-realism, examine how imagination and counterfactuals destabilize or reinforce these commitments, and ultimately argue for a framework in which imagination becomes the bridge between epistemic inquiry and ontological seriousness while recognizing the importance of uncertainty in exploring possible configurations of the world.

Realism, in its broadest philosophical sense, is the claim that there exists a mind-independent reality that can be known, at least in part, through our cognitive and perceptual faculties. Scientific realism extends this to claim that theoretical entities posited by science (like electrons, black holes, or genes) exist and behave as described by our best theories, even if they are unobservable by our senses. By contrast, anti-realism denies that such claims can be justified. For the anti-realist, truth is not correspondence with an independent reality but rather coherence within a conceptual or linguistic framework. Hilary Putnam once summarized anti-realism as the view that truth is warranted assertibility under ideal epistemic conditions. He states: “Truth is idealized rational acceptability” and “What we call ‘truth’ is simply the ideal limit of rational

³⁷ Nagel, Thomas. “Moral Luck.” *Mortal Questions*. Cambridge University Press, 1979, pp. 24–38.

inquiry.”³⁸ The debate thus revolves not just around metaphysical claims, but also around the semantics and pragmatics of our truth-talk.

The tension becomes especially acute when considering future events, theoretical entities, or counterfactual scenarios. Realists assert that statements about unobserved or unobservable phenomena can still be true or false independently of our capacity to verify them. Anti-realists contend that such talk is unintelligible unless grounded in the norms of our practices, languages, or models. But this dichotomy, while theoretically sharp, collapses under the pressure of practical reasoning. When one examines how we reason about what could have happened, what might happen, or what should be inferred from what is not directly observable, the boundary between realism and anti-realism becomes porous. Here is where the role of imagination, counterfactuals and uncertainty becomes critical.

Counterfactuals are conditional statements of the form: "If X had been the case, Y would have followed." They are not merely grammatical constructions but epistemic tools for exploring causality, moral responsibility, scientific prediction, and theoretical inference. David Lewis's theory of counterfactuals, as presented in *Counterfactuals* (1973), redefined the logic of hypothetical reasoning by anchoring it in possible worlds semantics. In a counterfactual conditional of the form "*If A had happened, then B would have followed*", A is the antecedent, the condition we imagine to be true, and B is the consequent, the projected outcome. For Lewis, the truth of such a counterfactual depends not on what actually happened, but on what happens in the closest possible worlds where the antecedent holds. He states: "We need not suppose that these other worlds exist in space and time; they are not concrete realms but ways things might have been."³⁹ Lewis's central innovation was to introduce a rigorous notion of similarity between worlds: counterfactuals are evaluated based on what happens in the most similar worlds to ours where the antecedent is true. This requires us to engage in modal reasoning, reasoning across possible worlds, not merely logical deduction. The antecedent functions as a gatekeeper, filtering the set of possible worlds to those in which that imagined condition is true, and the truth of the counterfactual is judged by what follows in that constrained space.

This brings counterfactuals into intimate dialogue with the concept of uncertainty. When we imagine counterfactual scenarios, we are often navigating realms of epistemic and metaphysical indeterminacy. A counterfactual statement is a response to an implicit uncertainty about causality, responsibility, or possibility as in the statement "If I hadn't spoken, would the outcome have changed?". We do not know the answer, but we probe the structure of possibility to estimate what might have occurred. This is not mere

³⁸ Hillary Putnam *Reason, Truth and History*, Harvard University Press, 1981, p. 55 & 56

³⁹ Lewis, David. *Counterfactuals*. Harvard University Press, 1973. p. 84.

speculation; it is a disciplined attempt to chart the contours of the unknown. Unlike deterministic prediction, which presumes that the future unfolds from the present in a computable fashion, counterfactuals grapple with what did not happen and what might have, requiring a deeper engagement with modal uncertainty. They acknowledge that uncertainty is not merely about the future, but also about the past, about causality, and about moral responsibility. In fact, much of our moral and legal reasoning is counterfactual in structure: guilt, negligence, and duty often hinge on what “would have happened otherwise.” Moreover, counterfactuals rely heavily on imagination. In Lewis’s framework, we simulate alternate realities not through empirical observation, but through mental projection. This makes counterfactual reasoning a kind of imaginative inference under uncertainty. It is not arbitrary: it is constrained by laws, logic, and plausibility. Yet it remains fundamentally an act of navigating non-actualized possibilities, a venture into the unknown, structured by known rules. Thus, Lewis’s counterfactuals formalize what uncertainty demands: a way of thinking not only about what is, but about what could be, and what might have been. In this way, they become tools for reasoning within systems where knowledge is partial, causality is opaque, and the future is not fully determined.

This means counterfactuals allow us to ask not only what is, but what could be or could have been. This capacity is crucial for ethical deliberation (“If I hadn’t lied, they wouldn’t have been harmed”), scientific modeling (“If we increased dosage, recovery rates would rise”), and historical reasoning (“If Archduke Ferdinand had not been assassinated, World War I might have been avoided”). But such reasoning often involves positing scenarios and entities that are not, and perhaps never were, actual. Does this mean we are venturing into anti-realist territory? Or does our ability to reason meaningfully about such possibilities suggest a deeper kind of realism, one that takes possibility as seriously as actuality?

From a realist perspective, this can be troubling. If imagination creates alternative worlds, does it follow that we are merely playing language-games? Not necessarily. If reality includes modal structures (possibilities, propensities, potentials), then imagination is not projecting onto reality but accessing dimensions of it. Imagination becomes not a fiction-making device but a mode of epistemic reach. Anti-realists, by contrast, often see imagination as reinforcing their case: what we treat as real is contingent upon our practices, our ways of world-making. The imagined world is not discovered but constructed. Yet even this view grants imagination a kind of ontological productivity that blurs the line between construction and discovery. To imagine is not simply to dream but to mentally instantiate alternative configurations of the world. In science, imagination constructs thought experiments; in ethics, it models alternative moral worlds; in personal identity, it generates counter-narratives and counter-lives.

This tension leads to an intriguing possibility: a temporally bifurcated ontology. Perhaps we are realists about the past because it is fixed, knowable, and empirically anchored, but

anti-realists about the future, which is indeterminate, unknowable, and under construction. As Michael Dummett summarizes the antirealist position regarding statements about the future: “Statements about the future lack determinate truth-value until their truth is manifest.”⁴⁰ Counterfactuals and imagination live in this liminal space, half tethered to actuality, half floating in potentiality. Consider how we reason about moral responsibility: we invoke counterfactuals about what someone could have done differently. This implies that the past was, in some sense, open at the moment of choice. Likewise, when we plan for the future, we simulate various outcomes based on incomplete knowledge and projections. Moral realism, then, must be open to a modal dimension of truth: not just about what is, but what ought to have been. This form of counterfactual ethics resists both the fatalism of hard realism (which insists that only what happened matters) and the relativism of hard anti-realism (which suggests all alternatives are equally constructed). These activities do not fit neatly into either realism or anti-realism. Instead, they suggest a dynamic ontology: the past is closed, the future open; the actual is fixed, the possible is unfolding.

Ludwig Wittgenstein famously claimed that “what can be said at all can be said clearly, and whereof one cannot speak, thereof one must be silent”⁴¹. But counterfactuals, uncertainty and imagination strain the limits of what can be said clearly. They describe non-actual states of affairs, often with incomplete or hypothetical parameters. This does not render them meaningless, but it does complicate their semantics. Model-based reasoning offers a solution. In science, in economics, in climate modeling, we build formal systems to simulate non-actual scenarios. These models are neither strictly true nor strictly false; they are useful, probabilistic, and counterfactual in nature. They create a spectrum of realism; models are not the world, but they represent possible worlds and possible futures yet to unfold.

What emerges from this exploration is the need for a modal epistemology: an account of knowledge that includes not only what is, but what could be, what might have been, and what might still become. Such an epistemology would integrate imagination and counterfactuals as legitimate sources of understanding, not merely rhetorical or heuristic devices. To this end, a realist anti-realism may be the best framework: being a realist about the past and the structure of possibility, and an anti-realist about the future. This hybrid view allows us to take seriously not only hard evidence and data but also counterfactuals without committing to the existence of an infinity of worlds, and to value imagination without succumbing to relativism. Such a view best equips a moral agent to deal with the inherent uncertainty of an open future. The interplay between realism, anti-

⁴⁰ Dummett, Michael. *Truth and Other Enigmas*. Harvard University Press, 1978, pg. 23-24

⁴¹ Ludwig Wittgenstein, *Tractatus Logico-Philosophicus*, proposition 7, trans. C. K. Ogden (London: Routledge & Kegan Paul, 1922)

realism, imagination, and counterfactuals reflects our condition as beings suspended between what is and what could be, tethered to reality yet oriented toward possibility. Counterfactuals are not merely linguistic curiosities but logical tools for grasping causality, responsibility, and alternative histories. Realism, when it takes possibility seriously, becomes less dogmatic; anti-realism, when it admits the weight of the evidence of the possible, a possible that might be actualized in reality, becomes less dissolutive.

Chapter 5: Free Will and the Structure of Uncertainty

The previous chapters have discussed uncertainty, determinism, action and imagination, all leading to the idea that ultimately at the core lies a fundamental question about human agency: are we the true originators of our actions, or are our choices mere nodes in a vast deterministic web? Traditionally, the debate has revolved around metaphysical positions with the most prominent being determinism, libertarianism, and compatibilism. Yet, when reframed through the lens of uncertainty, the free will problem reveals new dimensions. This chapter argues that uncertainty is not merely a background condition for the exercise of free will but may be its enabling grounds.

As explored in previous chapters, classical determinism, backed by Newtonian mechanics, holds that every event is the necessary outcome of preceding conditions and unchanging laws of nature. If all variables are known, the future is as fixed as the past. This worldview famously culminates in Laplace's demon. Benedict de Spinoza embraced the view that every decision, however subjectively experienced, is but the effect of prior causes and anything that we experience as contingent is the result of human ignorance⁴². Within such a framework, free will is illusory and the self becomes an epiphenomenon, a locus of conscious awareness, but not of causal initiation. Yet, this mechanistic determinism has been fundamentally challenged. Quantum mechanics has shown that at the subatomic level, probabilistic indeterminacy replaces causal certainty via the famous Heisenberg Uncertainty Principle.

However, randomness is not freedom. The intrusion of chance into physical processes does not confer agency upon human beings. Randomness is not choice; it is indifference to reasons⁴³. Hence compatibilism enters the picture attempting to reconcile determinism with free will by redefining what freedom entails. To act freely, on this view, is not to be uncaused but to act in accordance with one's own reasons, desires, and intentions. If my actions are not externally coerced and reflect my internal deliberations, I am free. Daniel Dennett, a prominent defender of compatibilism, emphasizes the evolutionary and psychological origins of decision-making. He writes: "We are virtuoso novelists, inventing continually, not only the characters we are, but the circumstances in which we

⁴² Benedict de Spinoza, *Ethics*, I, prop. 29 schol., in *The Collected Works of Spinoza*, vol. 1, ed. and trans. Edwin Curley (Princeton: Princeton University Press, 1985), E1p29s.

⁴³ Peter van Inwagen, *An Essay on Free Will* (Oxford: Oxford University Press, 1983), pp. 55–56.

act. We are choice machines”⁴⁴. Yet this model, while functional, seems to lack existential depth. Moreover, if the internal causes of our decisions are themselves determined by factors beyond our control, then the notion of “authorship” remains elusive⁴⁵.

Libertarianism, in contrast, insists that free will requires genuine indeterminacy. To be free is to be the ultimate source of one’s actions. Roderick Chisholm articulates this as “agent causation.” In his words: “If we are responsible, and if what we do is up to us, then we must be the causes of certain events. We must be, in a very real sense, prime movers unmoved”⁴⁶. Similarly, Robert Kane introduces the notion of “self-forming actions.” He explains: “In cases of conflict... the outcome is not determined until the resolution occurs. Such undetermined self-forming actions are the sources of our ultimate responsibility”⁴⁷. These theories seek to preserve a robust sense of agency, though they encounter formidable challenges.

Here, uncertainty offers a new frame. Perhaps the key is not to locate free will in an ontological gap within the causal chain, but in the structural conditions under which decisions must be made. Uncertainty is the space in which freedom operates. To choose is to face alternatives, and to face alternatives is to be uncertain about outcomes, it is to wager. If all consequences were known in advance, the burden of freedom would vanish. But the world is not so obliging. Outcomes are rarely certain, variables are often hidden, and the future is perpetually opaque. As Nassim Nicholas Taleb remarks: “Randomness will regularly deliver the highly improbable... the world is not only stranger than we think, it is stranger than we can think”.⁴⁸ This aligns with existentialist insights, particularly those of Jean-Paul Sartre, who saw freedom as a condition of radical responsibility: “Man is condemned to be free; because once thrown into the world, he is responsible for everything he does”.⁴⁹ As we explored in previous chapters, the distinction between past and future enters into this analysis. The past is determined and known; the future is open and uncertain. When we reflect on the past, we see necessity. Even if we imagine counterfactuals, we do so with the recognition that the actual is irrevocable. By contrast, the future is undetermined, to act is to help constitute the future.

⁴⁴ Daniel C. Dennett, *Elbow Room: The Varieties of Free Will Worth Wanting* (Cambridge, MA: MIT Press, 1984), p. 134.

⁴⁵ Derk Pereboom, *Living without Free Will* (Cambridge: Cambridge University Press, 2001), pp. 112–114.

⁴⁶ Roderick M. Chisholm, “Human Freedom and the Self,” in *The Lindley Lecture* (Lawrence, KS: University of Kansas, 1964), p. 25.

⁴⁷ Robert Kane, *The Significance of Free Will* (New York: Oxford University Press, 1996), pp. 127–128.

⁴⁸ Nassim Nicholas Taleb, *Foiled by Randomness: The Hidden Role of Chance in Life and in the Markets* (New York: Random House, 2001), pp. 5–6.

⁴⁹ Jean-Paul Sartre, *Existentialism Is a Humanism*, trans. Carol Macomber (New Haven: Yale University Press, 2007), p. 29.

The recognition that freedom emerges in the context of uncertainty also reshapes our understanding of ethics. Most ethical theories presume that agents can predict consequences or adhere to universal rules. But under uncertainty, these presumptions falter. Consequentialist theories depend on accurate forecasts, while deontological systems presume unambiguous duties. Bernard Williams shared the view that the world is too complex for simple rule based ethics: “In practice, our reality is filled with partial knowledge and unpredictable outcomes”⁵⁰. Instead, what might be needed is not a rule-based ethics but a wager-based ethics: a way of acting that accounts for uncertainty, balances risks, and aims to minimize harm and maximize flourishing. Free will, in this light, is not about being right or wrong in one’s decisions, but about navigating a world that does not yield certainty. Thus, free will is the name we give to the capacity to choose amidst unknowns, to project possible futures, and to bear responsibility for what unfolds. Determinism still haunts our models; randomness still threatens our agency; the fixity of the past casts free will as illusory. Yet uncertainty offers a new vantage point: one in which freedom is understood as existential navigation. In a world without guarantees, freedom is not the power to control outcomes, but, as Sartre insisted, “the courage to choose despite not knowing them”⁵¹. In acknowledging this, we cultivate the virtues needed to act wisely in the absence of certainty.

Chapter 6: A Critique of Philosophical Schools in the Face of Uncertainty

This chapter critically evaluates major philosophical schools, from empiricism and rationalism to linguistic philosophy, logical positivism, realism, anti-realism, and constructivism by considering the challenges posed by uncertainty.

The recognition of uncertainty as a fundamental condition of existence necessitates a shift in philosophical orientation. Rather than viewing philosophy as the search for immutable truths, perhaps it should be seen as a framework for navigating uncertainty. This does not mean abandoning the search for truth, but rather situating that search within a more dynamic, adaptive, and probabilistic paradigm. In this framework, knowledge becomes less about possessing immutable facts and more about managing degrees of belief. This reconceptualization also impacts ethics. Instead of asking what one ought to do in a vacuum of certainty, the question becomes: what is the best course of action given what is known and what is uncertain? Here, expected value becomes a more relevant metric than deontological or consequentialist purity. This is not to reduce ethics to mere utility, but to recognize that moral decision-making under uncertainty demands a different kind of rationality, one that is probabilistic, flexible, and deeply aware of its own limitations.

⁵⁰ Bernard Williams, *Ethics and the Limits of Philosophy* (Cambridge, MA: Harvard University Press, 1985), p. 118.

⁵¹ Jean-Paul Sartre, *Being and Nothingness: A Phenomenological Essay on Ontology*, trans. Hazel E. Barnes (New York: Philosophical Library, 1956), p. 487.

Moreover, uncertainty may serve as the hidden engine of philosophical pluralism. The multitude of schools, doctrines, and theories may not reflect a failure to converge on truth but rather an implicit acknowledgment of the world's complexity and indeterminacy. Competing theories may each capture partial truths or provide pragmatic guidance in specific contexts, even if they cannot be universally applied. This recognition does not entail relativism or nihilism. Rather, it challenges the hubris of totalizing theories and instead embraces a philosophy that is iterative, adaptive, and responsive to the unknown. It reimagines truth not as a static endpoint but as a dynamic process, forever provisional and subject to revision.

Scientific realism posits that the world exists independently of our perceptions and that science aims to provide a true description of that world. This view is attractive because it grants epistemic authority to science and affirms that inquiry can yield objective knowledge. Yet realism faces a formidable challenge in the form of the underdetermination of theory by data. Multiple, empirically adequate theories can describe the same set of observations, revealing the fragile bridge between data and interpretation. The history of science, replete with paradigm shifts and theoretical upheavals, demonstrates that even our best explanations are provisional. Thomas Kuhn, in *The Structure of Scientific Revolutions*, famously argues that science does not progress toward truth but shifts between incommensurable frameworks⁵². Moreover, in the face of uncertainty, the realist assumption that the world has a fixed, discoverable structure becomes problematic. If the future is not merely unknown but unknowable and if emergence and complexity render prediction unreliable then the realist confidence in convergence toward truth appears naïve. Even under determinism, computational irreducibility makes it impossible to accurately project a conclusion until it is revealed at the step of calculation. Realism presupposes stability; uncertainty reveals flux.

Likewise, empiricism, the doctrine that all knowledge derives from sensory experience, appears *prima facie* well-positioned to deal with uncertainty. It relies on observation, testing, and inductive generalization to construct beliefs about the world. However, empiricism often presumes that data, once acquired, is sufficient to ground truth claims or inform decisions. Logical positivism, spearheaded by the Vienna Circle, attempted to cleanse philosophy of metaphysics and ground it in empiricism and the verification principle: a statement is meaningful only if it can be empirically verified or is tautologically true. The goal was a purified, scientific philosophy based on logic and observation. However, this presumption collapses in the face of uncertainty. As David Hume warns: “The contrary of every matter of fact is still possible... That the sun will not rise to-morrow is no less intelligible a proposition, and implies no more contradiction

⁵² Thomas S. Kuhn, *The Structure of Scientific Revolutions*, 2nd ed. (Chicago: University of Chicago Press, 1970)

than the affirmation, that it will rise”⁵³. Uncertainty, as we have seen, is not merely the absence of data but the absence of a well-defined outcome space. No amount of empirical observation can uncover possibilities that lie outside the domain of what has already occurred. This limitation echoes Karl Popper’s critique of verificationism: “The criterion of the scientific status of a theory is its falsifiability, or refutability, or testability”⁵⁴, no finite set of observations can confirm a universal law. Inductive generalization always leaves us vulnerable to black swans, events that are rare, unexpected, and massively consequential⁵⁵. Moreover, Quine argued in "Two Dogmas of Empiricism," the distinction between analytic and synthetic statements is untenable, and no observation confirms a single hypothesis in isolation: “Our statements about the external world face the tribunal of sense experience not individually but only as a corporate body”⁵⁶. Along the same lines, A. J. Ayer went further, claiming: “A proposition is said to be verifiable... if its truth could be conclusively established by experience”⁵⁷. Therefore, our theories face the tribunal of experience as a whole. Fundamentally, the verificationist ideal cannot accommodate uncertainty. In probabilistic domains, most of our knowledge is partial, fallible, and non-verifiable in the strict sense. Hypotheses are not simply true or false; they are more or less supported by evidence. In uncertain conditions, verification is replaced by plausibility, and knowledge becomes a continuous negotiation with the unknown. In a world governed by complex, non-linear dynamics, past data may be a poor guide to future events. The empiricist assumption that observation converges toward truth breaks down when systems are sensitive to initial conditions or when feedback loops change the very structures being observed. Hence, empiricism without a theory of uncertainty becomes an exercise in naïve realism.

Anti-realism, in contrast, emphasizes the constructed nature of knowledge. Truth, for the anti-realist, is not correspondence with an independent reality but coherence within a conceptual scheme. This view finds expression in pragmatism, constructivism, and post-structuralism. Anti-realism highlights the role of interpretation, context, and power in shaping knowledge. It guards against epistemic certainty and acknowledges the provisional character of understanding. But taken to extremes, it risks collapsing into relativism. If all truths are relative to schemes, and all schemes are socially constructed, then the distinction between truth and fiction erodes. Uncertainty is weaponized here as a justification for nihilism. This is epistemically unsatisfying and politically dangerous. If

53 David Hume, *An Enquiry concerning Human Understanding*, ed. Tom L. Beauchamp (Oxford: Oxford University Press, 2000), p. 26.

54 Karl Popper, *Conjectures and Refutations: The Growth of Scientific Knowledge* (London: Routledge, 1963), p.37.

55 Nassim Nicholas Taleb, *The Black Swan: The Impact of the Highly Improbable* (New York: Random House, 2007)

56 W. V. O. Quine, “Two Dogmas of Empiricism,” *The Philosophical Review* 60, no. 1 (1951): p. 41.

57 A. J. Ayer, *Language, Truth and Logic* (London: Gollancz, 1936), p. 14.

no truth claim is more valid than another, then the difference between medicine and superstition, science and conspiracy, disappears.

Both realism and empiricism, in their classical forms, seek security where there is none, while anti-realism risks surrendering to indeterminacy. What is needed instead is a framework that recognizes uncertainty not as a failure of knowledge but as its generative horizon. Uncertainty does not negate truth; it situates it. Facts exist, but their meaning is never final. Our understanding of the world is provisional, evolving, and constrained by both the limits of observation and the openness of reality itself. Truth, in this view, is not a static correspondence but a dynamic approximation, an unfolding negotiation between what is known, what is observed, and what remains perpetually beyond our grasp.

Contrary to empiricism, rationalism, with its confidence in reason, logic, and deduction, seeks to transcend the flux of sensory experience by grounding knowledge in innate ideas or a priori principles. The rationalist tradition from Descartes to Leibniz treats the intellect as a sanctuary of certainty. But the Cartesian demand for indubitable foundations turns out to be ill-suited for a world that resists such stability. Reasoning, while internally consistent, often masks the fact that it depends on assumed premises. As we noted earlier, deduction is tautological: it cannot generate new truths unless we supply it with inputs. These inputs, whether axioms in mathematics or premises in ethics, are typically unverified and often unverifiable. Gödel's incompleteness theorems deliver a devastating blow to the rationalist dream. They demonstrate that no consistent formal system capable of arithmetic can be both complete and self-contained. This result reveals the structural limitation of any purely rational system: it must leave something out. That "something" is often the very uncertainty it attempts to negate. Rationalism and deduction rely on squashing uncertainty by fiat, by simply assuming it away. Rationalism, for all its elegance, is haunted by its incompleteness.

An innovative solution to the above problems of philosophy, was brought about in the twentieth-century linguistic turn, as embodied in the work of Wittgenstein, Austin, and Quine, redirected philosophical attention from metaphysical claims to the language in which those claims are expressed. Language was not merely a medium of communication but the very horizon of thought. Philosophy became a matter of clarifying language games, exposing category mistakes, and refining semantic distinctions. Wittgenstein's later philosophy, especially in *Philosophical Investigations*, emphasized that meaning is use, and that language is embedded in forms of life: "for a large class of cases... the meaning of a word is its use in the language"⁵⁸. This view, while deeply insightful, tends toward quietism and bypasses some of the core problems raised by uncertainty. If philosophical problems are just linguistic confusions, then uncertainty is not a

⁵⁸ Ludwig Wittgenstein, *Philosophical Investigations*, trans. G. E. M. Anscombe, P. M. S. Hacker, and Joachim Schulte, 4th ed. (Oxford: Wiley-Blackwell, 2009), §43.

metaphysical condition but a semantic artifact. This response, however, underestimates the materiality and existential impact of uncertainty. Uncertainty is not reducible to vagueness or ambiguity in language. It arises from the indeterminacy of the world itself. The failure to predict a pandemic, a market crash, or a political upheaval is not merely a failure of grammar. It is a failure of models to anticipate the real. Language can describe uncertainty but cannot dissolve it.

Other philosophical schools that face serious criticism in the face of uncertainty include classical moral theories developed by such thinkers as Immanuel Kant, Jeremy Bentham, John Stuart Mill and modern thinkers like Peter Singers and Richard Hare. These moral theories while internally coherent and normatively ambitious, often presume a world of epistemic clarity and moral calculability that contrasts sharply with the structurally uncertain framework developed in this essay⁵⁹.

Immanuel Kant's moral philosophy, centered on the categorical imperative, asks us to act only according to maxims we would want to be universal laws. This formal, principle-driven framework abstracts from context, emotion, and consequence, assuming a rational moral agent capable of logical evaluation independent of empirical content. Yet under conditions of epistemic uncertainty, agents cannot always foresee the implications of their maxims, nor evaluate their universalizability. When causal chains are non-linear and outcomes unpredictable, as shown in chaos theory and modal epistemology, the categorical imperative demands a level of foresight and structural knowledge that simply may not exist.

Likewise, Jeremy Bentham's utilitarianism, which holds that actions are right if they produce the greatest amount of pleasure and wrong if they produce pain, assumes that pleasure and pain can be measured and aggregated. However, under complex systems governed by emergent behavior and unknown unknowns, the utilitarian calculus becomes speculative. The premise that consequences can be confidently predicted and quantitatively compared breaks down when outcomes are probabilistic. John Stuart Mill sought to improve upon Bentham by introducing a qualitative distinction between higher and lower pleasures, valuing intellectual and moral pleasures above mere physical gratification. While this introduces a normative hierarchy that makes utilitarianism more sensitive to human complexity, it does not escape the deeper problem: assessing outcomes still requires a degree of predictive certainty that is unavailable in complex or chaotic environments. Knowing which action will produce the "higher" pleasure often depends on variables that cannot be forecasted with accuracy.

⁵⁹ While this essay does not undertake a comprehensive engagement with the major literature on moral theory, it is important to highlight how uncertainty challenges these frameworks and to suggest directions for future work to explore their implications more fully.

Modern schools like, Peter Singer's preference utilitarianism reorients the ethical focus from maximizing pleasure to satisfying preferences⁶⁰. This modern variant attempts to circumvent hedonic quantification by appealing to what agents actually want. But in real-world contexts, preferences are unstable, inconsistent, and often opaque. Actions taken to satisfy preferences may produce unintended or delayed harms, as we have seen in chaotic systems such actions could lead to truly unpredictable outcomes, revealing the fragility of ethical reasoning that leans too heavily on today's known preferences of agents. Furthermore, Richard Hare attempted to synthesize deontological rigor with consequentialist flexibility through universal prescriptivism⁶¹. Moral reasoning, in his view, involves prescribing actions that could be universalized and that maximize utility. This hybrid model is commendable in bridging theory and practice, but it still relies on the assumption that agents can identify stable principles and anticipate the results of rule-following in complex, evolving systems. In settings marked by rapid change and irreducible uncertainty, such prescriptions risk becoming obsolete or even harmful.

Despite the shortcomings we've identified in these moral theories, none of this critique should be mistaken for a dismissal of the ethical insights these thinkers offer. Pointing out that traditional ethical frameworks fail to account for uncertainty doesn't invalidate their normative force, nor does it license a slide into moral hedonism or nihilism. What it should do, rather, is return us to the basic problem that launched this whole discussion: even rules that are universally true, logically, empirically, or mathematically, don't offer any predictive power on how to act when confronted with an uncertain world. Moral rules often function in much the same way. Whether we invoke the Golden Rule or a deontic command like "always tell the truth" or any other seemingly universal principle, we face the same structural limitation. The rule may be timelessly valid, but its validity doesn't translate into predictive power over the consequences of following it. Ethical principles describe what would be right given a world already known. What they cannot do is guarantee that acting on them will produce the outcomes we hope for in a world we cannot foresee. A timeless rule is still practically inert when the world refuses to disclose its next move.

In fact, it may be precisely this feature, the willingness to act on principle despite uncertainty, that makes adherence to such rules admirable. Ethical agents are not commendable because they can guarantee the best outcomes; they are commendable because they commit themselves to principled action without any assurance that the world will cooperate. Their virtue lies in choosing the rule even when the surrounding conditions remain opaque, volatile, or hostile.

⁶⁰ Peter Singer, *Practical Ethics* (Cambridge: Cambridge University Press, 1979)

⁶¹ M. Hare, *Moral Thinking: Its Levels, Method, and Point* (Oxford: Oxford University Press, 1981)

Seen this way, the value of moral rules isn't in their predictive utility but in the integrity they demand. Their force doesn't come from mapping future states of the world, but from shaping the character of the agent who must act within it.

Conclusion: Toward a Philosophy of Uncertainty - Reimagining Philosophy

This dissertation has taken as its central premise that uncertainty is not merely an epistemic inconvenience or a technical obstacle to knowledge, but a fundamental condition of the world and our engagement with it. From the epistemology of probability to the metaphysics of causation, from the structure of counterfactuals to the experience of free will, and from the history of philosophical systems to the prospect of ethical action, uncertainty has emerged as the thread that weaves through all domains of human inquiry and agency.

The thesis began with a deceptively simple observation: even principles that are logically, mathematically, and empirically sound, such as the empirically testable stock market maxim of "buy low, sell high", often prove impotent in the face of future unpredictability. This gap between normative truth and practical guidance illuminates the central paradox of philosophy. Our finest tools of logic, reason, and observation may describe the world elegantly, but they falter when tasked with anticipating it. Thus, we turned our attention not to how uncertainty may be eliminated, but how it may be understood, navigated, and integrated into our conception of knowledge and action.

The cumulative argument of this dissertation is that uncertainty is a condition to be embraced. This demands a reimagining of philosophy itself: not as the discovery of eternal truths but as a process of continuous orientation, re-evaluation, and adaptive navigation. Uncertainty undermines the illusion of omniscience, humbles the arrogance of total systems, and exposes the fragility of certitude in human endeavors, while opening the door to curiosity, creativity, and a deeper form of wisdom, not of definitive answers, but of well-formed questions, nuanced discernments, and thoughtful wagers. Philosophy must shift from the pursuit of certainty to the cultivation of judgment, resilience, and humility. This does not mean abandoning rigor, clarity, or truth. It means recognizing that these values must be pursued within, not in spite of, the uncertain structure of reality.

This reimagined philosophy resists both dogmatism and nihilism. It calls for being a realist about the past and an antirealist about the future. It recognizes that truth may be provisional, but not arbitrary; that reason may be fallible, but not futile; that knowledge may be bounded, but still actionable. In the place of certainty, it pursues coherence under constraint. In the place of predictive mastery, it cultivates adaptive judgment. In place of metaphysical guarantees, it embraces the ethics of the wager. Moral action is not about optimizing outcomes according to fixed rules but managing risk, responding to emerging information, and sustaining the possibility of both future flourishing and pitfalls. This

philosophy encourages pluralism without relativism, commitment without dogmatism. It situates human cognition within a world that is both resistant and responsive. It allows for truth, but as something emergent, partial, and provisional.

Works Cited

- Ayer, A. J. *Language, Truth and Logic*. Dover Publications, 1952.
- Aristotle. *Nicomachean Ethics*. Translated by Terence Irwin, 2nd ed., Hackett Publishing, 1999.
- Bentham, Jeremy. *An Introduction to the Principles of Morals and Legislation*. 1789.
- Chisholm, Roderick. "Human Freedom and the Self." *The Lindley Lecture*, University of Kansas, 1964.
- Copeland, B. Jack. *The Essential Turing: Seminal Writings in Computing, Logic, Philosophy, Artificial Intelligence, and Artificial Life plus The Secrets of Enigma*. Clarendon Press, 2004.
- Davidson, Donald. "Actions, Reasons, and Causes." *The Journal of Philosophy*, vol. 60, no. 23, 1963, pp. 685–700.
- Dennett, Daniel C. *Elbow Room: The Varieties of Free Will Worth Wanting*. MIT Press, 1984.
- Dennett, Daniel C. *Freedom Evolves*. Viking, 2003.
- Diaconis, Persi, Susan Holmes, and Richard Montgomery. "Dynamical Bias in the Coin Toss." *SIAM Review*, vol. 49, no. 2, 2007, pp. 211–235.
- Dummett, Michael. *Truth and Other Enigmas*. Harvard University Press, 1978.
- Earman, John. *A Primer on Determinism*. Reidel, 1986.
- Finetti, Bruno de. *Theory of Probability*, Vol. 1. Wiley, 1974.
- Fogelin, Robert J. *Wittgenstein*. 2nd ed., Routledge, 1987.
- Goodman, Nelson. *Fact, Fiction, and Forecast*. Harvard University Press, 1955.
- Gleick, James. *Chaos: Making a New Science*. Viking, 1987.
- Gödel, Kurt. "On Formally Undecidable Propositions of Principia Mathematica and Related Systems." *Collected Works*, vol. 1, Oxford University Press, 1986.
- Hare, R. M. *Moral Thinking: Its Levels, Method, and Point*. Oxford University Press, 1981.
- Heisenberg, Werner. *The Physical Principles of the Quantum Theory*. Translated by Carl Eckart and Frank C. Hoyt, Dover, 1949.

- Hobbes, Thomas. *Leviathan*. Edited by Richard Tuck, Cambridge University Press, 1991.
- Hume, David. *An Enquiry concerning Human Understanding*. Edited by Tom L. Beauchamp. Oxford: Oxford University Press, 2000.
- Kane, Robert. *The Significance of Free Will*. Oxford University Press, 1996.
- Kant, Immanuel. *Groundwork of the Metaphysics of Morals*. Translated by Mary Gregor, Cambridge University Press, 1998.
- Knight, Frank H. *Risk, Uncertainty, and Profit*. Houghton Mifflin, 1921.
- Laplace, Pierre-Simon. *A Philosophical Essay on Probabilities*. Translated by Frederick W. Truscott and Frederick L. Emory, Dover, 1951.
- Lewis, David. *Counterfactuals*. Harvard University Press, 1973.
- Lorenz, Edward. "Deterministic Nonperiodic Flow." *Journal of the Atmospheric Sciences*, vol. 20, no. 2, 1963, pp. 130–141.
- Mill, John Stuart. *Utilitarianism*. Hackett Publishing, 2001.
- Nagel, Thomas. "Moral Luck." *Mortal Questions*. Cambridge University Press, 1979, pp. 24–38.
- Peirce, Charles Sanders. "The Fixation of Belief." *Popular Science Monthly*, vol. 12, 1877, pp. 1–15.
- Pearl, Judea. *Causality: Models, Reasoning, and Inference*. 2nd ed., Cambridge University Press, 2009.
- Poincaré, Henri. *Science and Method*. Translated by Francis Maitland, Dover, 1952.
- Popper, Karl. *The Logic of Scientific Discovery*. Routledge, 2002.
- Putnam, Hilary. *Reason, Truth and History*. Cambridge University Press, 1981.
- Quine, W. V. O. "Two Dogmas of Empiricism." *The Philosophical Review*, vol. 60, no. 1, 1951, pp. 20–43.
- Rumsfeld, Donald. "Department of Defense News Briefing." U.S. Department of Defense, 12 Feb. 2002.
- Sartre, Jean-Paul. *Being and Nothingness*. Translated by Hazel E. Barnes, Philosophical Library, 1956.

- Sartre, Jean-Paul. *Existentialism Is a Humanism*. Translated by Carol Macomber, Yale University Press, 2007.
- Savage, Leonard J. *The Foundations of Statistics*. Dover, 1972.
- Singer, Peter. *Practical Ethics*. 3rd ed., Cambridge University Press, 2011.
- Sluga, Hans. *Wittgenstein*. Wiley-Blackwell, 2011.
- Spinoza, Benedict de. *Ethics*. Translated by Edwin Curley, Penguin, 1996.
- Taleb, Nassim Nicholas. *The Black Swan: The Impact of the Highly Improbable*. Random House, 2007.
- Taleb, Nassim Nicholas. *Antifragile: Things That Gain from Disorder*. Random House, 2012.
- Taleb, Nassim Nicholas. *Fooled by Randomness: The Hidden Role of Chance in Life and in the Markets*. 2nd ed., Random House, 2005.
- Turing, Alan. “On Computable Numbers, with an Application to the Entscheidungsproblem.” *Proceedings of the London Mathematical Society*, vol. 2, no. 42, 1936, pp. 230–265.
- van Inwagen, Peter. *An Essay on Free Will*. Oxford University Press, 1983.
- Williams, Bernard. *Ethics and the Limits of Philosophy*. Harvard University Press, 1985.
- Wittgenstein, Ludwig. *Philosophical Investigations*. 2nd ed., Translated by G. E. M. Anscombe, Blackwell, 1958.
- Wittgenstein, Ludwig. *Tractatus Logico-Philosophicus*. Translated by C. K. Ogden, Routledge & Kegan Paul, 1922.
- Wolfram, Stephen. *A New Kind of Science*. Wolfram Media, 2002.
- Woodward, James. *Making Things Happen: A Theory of Causal Explanation*. Oxford University Press, 2003.
- Wright, Crispin. *Wittgenstein on the Foundations of Mathematics*. Harvard University Press, 1980.