

Axioms

by

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Dedication

This book is dedicated to the giants of mathematical and scientific philosophy upon whose backs it stands: Plato, Hume, Boole, Descartes, Laplace, Gödel, Bayes, Shannon, Cantor, Cox, Jaynes, and many more, too many to count, actually. I do wish to explicitly acknowledge Cox’s *The Algebra of Probable Inference*[1] and Jaynes’ *Probability Theory: The Logic of Science*[2], which collectively establish what is very likely the *rigorous* basis for knowledge expressed as a contingent degree of belief and many of its connections to worlds both concrete and abstract.

It is also dedicated to my philosophy professor and guru at Duke, George Roberts (a disciple of Bertrand Russell), who had an enormous impact on me as I pursued an “invisible” philosophy major at Duke to accompany my physics major (invisible because at the time Duke had no way of acknowledging the completion of a Bachelor of Science in one discipline and a Bachelor of Arts in another).

Finally, it is dedicated to my good friends and colleagues in the Duke Physics Department, especially Richard Palmer (for teaching me about Jaynes, Bayes, maximum entropy, and complex systems in general way back in Statistical Mechanics in grad school) and Mikael Ciftan, who has been as a second father to me for nearly thirty years now.

No book is written in a vacuum. I have been extraordinarily fortunate to have had the support and encouragement and love of many, many people over a lifetime. My family, my friends, my colleagues (who are also my friends) on the beowulf list, and my many, many students: This book is for you all.

Notice

Although this book inevitably contains a certain amount of mathematics and science – often expressed as “natural philosophy” or “mathematical philosophy” – it is *not* intended to be a mathematical or scientific treatise. Indeed, its basic subject is not physics but metaphysics, our basis for knowledge itself rather than any particular thing that we “know” (or rather, that we *believe* very strongly to be true) about the world. It is written to be as accessible as possible to as general an audience as possible. So *don’t be intimidated* – you can read this book and understand it even if you aren’t terribly good at “math”.

Contents

Preface	v
I A Cave with a View	1
1 What's an Axiom?	3
2 Philosophy is Bullshit	19
3 Doubt	31
4 The Cave	41
5 A View of the World	53
II Meta-Axioms	63
6 Logical Preliminaries	65
7 The Meta-Axiom of Mathematics	79
8 The Cox Meta-Axioms	87
9 Global Meta-Axioms	109
9.1 The Set of All Notions	112
9.2 Honesty (The Meta-axiom of Integrity)	128

9.3	Correspondence (The Meta-axiom of Predictivity)	132
9.4	Ockham's Razor (The Meta-axiom of Simplicity)	134
9.5	Beauty	138
9.6	The Meta-axiom of Open-Mindedness	141
9.7	Beware the Black Swan	150
10	Summary of the Meta-Axioms	157
III	The Rational Worldview	163
11	Bayesian Epistemology	165
12	The Bayesian Epistemological Loop	175
12.1	Fat Tony and Flipping a Coin	176
12.2	Dr. John's Problem	181
12.3	Angels Dancing on Pins	185
12.4	Summary	193
13	The Scientific Worldview	197
IV	God	207
14	The Standard Model of God	209
15	Disproofs of the Standard Model of God	221
15.1	Logical Disproofs of Standard Model God	227
15.2	Bayesian Estimation of the Implausibility of God	268
15.3	Conclusion	277
16	Pandeism: A Sort-Of Consistent Model for God	279
16.1	Omniscience	282

16.2 Omnipotence	288
16.3 Omnibenevolence	289
16.4 Conclusion	291
V Ethics	293
17 A Short Critique of Ethics	295
18 What <i>Ought</i> Ethics to Be?	311
19 The Big Myths	321
20 Pragmatic Virtue Ethics	331
20.1 The Tragedy of the Commons	337
21 A (Tentative) List of The Virtues	355
VI Conclusion: A Global Worldview	381

Preface

This is a work on meta-axiomatic metaphysics. By this, I mean specifically that it is a work on the *axioms* one might use to *choose axioms*, specifically the personal axioms required to make sense of the marvelous Universe we find ourselves living in.

It might surprise you to know that you *can* choose your personal axioms for any of several reasons. For example, you could be asking yourself “What *are* my personal axioms and why should I care about them?”

An axiom is a *belief*. In more precise terms, it is an assumption, usually an assumption made as part of the foundation of a set of conclusions – a *theory* – arrived at by deductive logic, or as one of the premises that similarly leads to a state of conditional knowledge about the world, a *worldview*. So this is a work on how to choose what you believe so that it consistently leads to what you “know”.

Of course, to make a such a choice one has to *already* have some basis for that choice, and that basis is itself a set of one or more axioms! That’s the “meta” bit – this is a work on the axioms required to, among other things, *bootstrap* the *best* possible set of personal axioms. It presents a way of *consistently* selecting a set of personal beliefs about the Universe in such a way that they are in the best possible statistical correspondence with your ongoing experiencing of the Universe. In this sense the axioms we will discuss can also be viewed as *Bayesian priors* used in the construction of a coherent probabilistic epistemology or worldview, ideally ones subjected to an ongoing process of posterior probability corrections – the bootstrapping part.

This bootstrapping, while arguably the best possible self-consistent solution to the fundamental problem of metaphysical philosophy in a mathematically precise sense, is not unique, nor can it (or any other candidate set) be proven to be *true* in any way that should be taken seriously. One fundamental conclusion of this work is that metaphysical philosophy is (at its heart) *bullshit* in the precise

sense that it cannot ever achieve one of its design goals – to allow you as a real human to achieve a state of absolute certainty about anything at all except the undeniable reality of your own instantaneous perceptions.

This leaves one with a certain degree of romantic freedom in one's choice that is, in the end, quite charming.

Part I

A Cave with a View

Chapter 1

What's an Axiom?

*The wise man built his house upon the rock,
The wise man built his house upon the rock,
The wise man built his house upon the rock,
And the rains came tumbling down!*

*The foolish man built his house upon the sand,
The foolish man built his house upon the sand,
The foolish man built his house upon the sand,
And the rains came tumbling down!*

This is obviously a book about axioms. If you're a mathematician or logician, you probably have a very good idea what an axiom really is. Nearly everybody else (including many scientists or engineers, alas) has an idea, but it probably isn't precisely correct.

This is doubtless because the first and only time many people encounter the term in anything like its correct form is in high school geometry, and even there many a high school geometry teacher fails to make the true definition of the term clear. Afterwards if anybody uses the term at all (outside of logic, math, computation, or science), they are probably trying to sell you something in a pseudo-erudite way¹.

This simply won't do. Many a "deep" philosophical disagreement arises just because the two sides are using the same term in different ways and don't realize

¹You may in fact be suspicious that this book is about to attempt to sell you something in just this fashion...and if the "something" in question is self-referentially this book itself, you may be right!

it. In that case the *real* disagreement or point of conflict is the meaning of the term and not “reason” (in the sense of a logically analyzable argument) at all.

As it happens, the term “axiom” has at least three completely distinct meanings. One is its (correct, literal, historical, Euclidean) meaning in logic and mathematics, with a few minor variances in meaning depending on strict context or adjectival modifiers, and the other two are colloquial meanings used in common discourse and sometimes (incorrectly) used in mathematics and logic as well.

Unfortunately, these latter two are nearly *opposites* of the first in a critical way. So even if you know (or think that you know) what an axiom is, let's review some common dictionary definitions and precisely indicate which sense of the term we are going to use throughout this work. From Webster:

Axiom ² n.— L. axioma, Gr.; that which is thought worthy, that which is assumed, a basis of demonstration, a principle, fr.; to think worthy, fr.; worthy, weighing as much as; cf.; to lead, drive, also to weigh so much: cf F. axiome. See Agent.

1. (Logic and Math.) A self-evident and necessary truth, or a proposition whose truth is so evident at first sight that no reasoning or demonstration can make it plainer; a proposition which it is necessary to take for granted; as, “The whole is greater than a part;” “A thing can not, at the same time, be and not be.”
2. An established principle in some art or science, which, though not a necessary truth, is universally received; as, the axioms of political economy.

These two commonly accepted definitions for the term axiom are the root of much *evil* in philosophical and mathematical discourse because they are both basically *incorrect*. Wikipedia has the correct definition³ :

...an axiom is any starting assumption from which other statements are logically derived. It can be a sentence, a proposition, a statement

²From Webster's Revised Unabridged Dictionary (1913) [web1913], although many, many other contemporary dictionaries more or less duplicate these definitions.

³Wikipedia: <http://www.wikipedia.org/wiki/Axiom>. Or at least it did when I first wrote this section. However, wikipedia is amorphous, and it has shifted its current definition to three “layers”. The first applies pretty much only to the laws of thought. The second – “premises” or “propositions” used to derive a theory – is the sense we will use throughout this work unless otherwise specified.

or a rule that enables the construction of a formal system. Unlike theorems, axioms cannot be derived by principles of deduction, nor are they demonstrable by formal proofs – simply because they are starting assumptions – there is nothing else they logically follow from (otherwise they would be called *theorems*). In many contexts, “axiom,” “postulate,” and “assumption” are used interchangeably.

As seen from definition, an axiom is not necessarily a self-evident truth, but rather a formal logical expression used in a deduction to yield further results....

To be absolutely clear, it is *only* this latter mathematical or logical meaning of the word “axiom” that is used throughout this work. To us an axiom will always be neither more nor less than an *unprovable assumption* upon which a process of reasoning is based. We will indeed spend a fair bit of time hammering home the point that there are *very few* “self-evident truths” at our disposal as sentient entities experiencing a complex sensory stream⁴, and that therefore nearly all so-called knowledge is based on axioms in the sense of *assumptions* that permit us to transform our instantaneous sensory perceptions into a conditional knowledge of a presumed objective Universe.

However, we should also note right from the beginning that we will, gradually, work our way around to arguing that the *best* set of axioms upon which to found a worldview or epistemology are ones that are subject to a process of global correction, an *optimization* process, structured in such a way that an efficient and effective correspondence is maintained and improved between our belief set and our observations and experiences in and of the Universe. One will be tempted to bend toward the second Webster definition above – an “established principle”.

This is fine; the laws of classical physics, for example, are “established principles” that work very well indeed to describe much of our everyday experiences of things like gravitation or simple classical electrodynamics, and they are indeed axioms, but in the context of building an optimal worldview they are forever *flexible*, malleable, mutable, subject to change, improvement, and even complete rejection in favor of an alternative set of axioms (such as the laws of quantum physics) that works *better* and explains a *wider range of phenomena* than classical physics while not losing any of the explanatory power already obtained at the classical scale. Our worldview axioms, or meta-axioms, will hence never truly be “established” as pure, certain, truth even if they work “perfectly” to the best of our knowledge in a given context.

⁴Only one, in fact.

Before going any further, we also need to define several *other* words so that our interpretation of those words is *mutual* – so that you understand what is meant when I use them.

One is *Universe*. In this work the Universe is (in agreement with the dictionary definition) the strict union of everything that has existed, exists, or will exist. Period. If it has objective being (at any generalized place or time), it is part of (or all of) the Universe. Note that this definition is nicely time-independent and space-independent (as any such definition should be).

Again, clarity is essential. You no doubt have in your mind the concept of a pink unicorn. It's pretty much a cornute horse with a single long, sharp spiral horn, that appears "pink" when viewed in white light. On the other hand, to the best of my knowledge no human alive has ever observed a single actual, real, material, living pink unicorn "in the flesh", nor is there any indirect evidence that any such thing has ever existed or will ever exist, anywhere in the Universe. A very reasonable question is then: "Do pink unicorns exist as part of the Universe?"

The answer we will adopt is a *provisional no!* What exists is the *idea* of a pink unicorn, the *concept* of a pink unicorn, even *depictions of pink unicorns* in art, in movies, on television, in stories. But the idea of a thing is not the thing itself, and the existence of an idea does not imply that the idea is "correct" in the sense that the Universe contains a single actual instance of the object to which the idea refers. It is provisional, of course, in that if somebody discovers an actual pink unicorn, or even fossil evidence of an actual unicorn in any color, we'd change our answer to yes, or maybe, or at any rate soften up our confidence in the no by adding a bunch of yes. And of course with genetic manipulation being what it is nowadays, it is by no means certain that some young entrepreneur won't go and *create* a pink unicorn at some point in the future.

We'll make the no a bit stronger when referencing abstract concepts, such as a "plane triangle". There is nowhere in the visible Universe that you can point at, measure, or observe a plane triangle, however much you can imagine one, conceptualize one, axiomatize plane geometry and derive theorem after theorem concerning plane geometry, and even *draw* something that *looks* like a crude realization of our geometric idealization and definition. Triangles are perfectly welcome to exist in our imaginations *as* imaginary things, but we must not confuse things that "exist" only as imaginings with things that exist in reality.

To make this distinction clearer and avoid confusion, there are two more words that are absolutely crucial for us to define a shorthand for, as we will use

them very often in this work. These are the terms *epistemology* and *ontology*. At this point, of course, you, dear reader, may be tempted to run screaming from the room (or put down this book and say “this isn’t my cup of tea”) because these sound awfully *technical*, but please bear with me for just a moment and you’ll see why I introduce them and why they are both important and really represent commonplace ideas.

Epistemology is “the theory of knowledge”. It is all about what we *think* we *know*. If I say something like “I have a very nice pocket knife in my pocket that opens with a flick of my finger”, I’ve made an epistemological statement. Statements like this should always come with a warning label, however, because what I really *mean* when I say this is something like this: “To the best of my knowledge, based on my memory of prior experience and deep seated belief in the continuity of existence, there is a chunk of metal arranged into a shape we have come to identify as a ‘pocket knife’, clipped to the side of a piece of cloth tightly stitched to my pant leg on the inside in the space we usually refer to as a ‘pocket’ in my pants, because I have a memory of possessing this knife and opening it with a flick of my finger at various earlier times, and placing it in said pocket as of the last time I recall using it.”

Of course, if I *included* all of these qualifications, you’d get bored long before I reached the end of the sentence, but they do clearly state at least some (but still not all!) of the *uncertainties* in the original statement. The main point is that it communicates *my state of belief* about a true fact in an objective real world in a human language that is filled with shared assumptions, a kind of “shorthand” that represents the marvelous complexity of (what I believe to be) an engineered arrangement of an enormous number of elementary particles and energy as the very short term “knife”, ditto “pocket”, ditto the even more abstract term “my” etc.

Ontology, on the other hand, is “the theory of being”. It is all about the *real, actual, concrete, state of the real, actual, existential Universe*, independent of our beliefs or lack thereof, our knowledge or our ignorance of, that state. Expressed this way, ontology as a term is a bit oxymoronic, because *terms in general* – words, symbols, encodings of any sort – are the raw material of *epistemology*, and a theory of any sort is itself an *epistemology*. Humans in some sense cannot construct an ontology, an ontology just is, but *in* our epistemology, we can certainly make up a term that refers to the *objective* of epistemology, which is the world as it really, truly, just is, and this term is ontology.

This division is useful, so useful that I'm going to define⁵ my *own* less intimidating shorthand for these two excessively polysyllabic words in their adjectival form: epic and ontic. Epic sounds pretty nice, after all, and reading something like "symbolic representations are epic" is *way* less intimidating than reading "symbolic representations are epistemological constructs that may or may not have any referent in the real Universe and that cannot be known to be 'true' in any objective sense" which is what it is shorthand for. Ontic, on the other hand, sounds a bit like a mix of the term "antic" and the kind of sound a mule makes⁶ – making reality into a playfully crazy stubborn mule, which is strangely consistent with what reality is – it just doesn't care what our epic beliefs are, it is the stubborn standard by which they are, or are not, true⁷.

In context, then, my assertion that there is a knife in my pocket is epic. It is imprecise. It is approximate. It could be pure fiction and I could be lying to you when I assert it. It could be true in the now of my writing, but be false in the now of your reading, as my pocket could be in the wash, the knife could have long since been lost or stolen, and I could be dead and hence incapable of owning either knives or pockets, falsifying any reasonable meaning of "my". Most important, however, it could be false *right now*; even *I* could be mistaken in asserting this belief in the very best of faith that it is true! It's not like I've never reached for my knife to peel an orange and found that it was not where I expected it to be, and this is *before* we consider the more esoteric ways the philosophers like to imagine that things we believe true could be false, such as my having been created five minutes ago with the *memory* of having a knife in my pocket that isn't really there (due to Bertrand Russell), my having been slipped powerful drugs that have caused me to hallucinate a nonexistent knife, or the current favorite with the out-of-their-ever-loving-mind crowd, the possibility that the world I seem to perceive with senses is just a complex *simulation* being presented by a super powerful world-computer in some sort of role-playing adventure game and neither knife nor pocket have any objective existence at all!

That last bit is the justification of putting the term *ontic* (or ontological, if you want to use bigger and more erudite terms instead) into our *epic* epistemology. My beliefs, however fervent and apparently well founded and honestly stated in the most pristine language symbols with a clear and simple meaning,

⁵...and even invent. Ontic is a term that I'm defining in a way that is more or less consistent with its dictionary definition, but I'm inventing the term "epic" as its epistemological equivalent because "epistic" – a similar form I've seen used before – doesn't sound quite as awesome.

⁶"Awwwn-tic awwwn-tic." No? I guess you had to be there...

⁷You don't think it's playfully crazy? Study quantum theory, or relativity theory, or particle theory. Awwwn-tic.

may or may not be *true*, even if I’m *looking* at what appears to be *my* real knife in *my* real pocket (I just put my hand down there and touched it and glanced at it to update those beliefs to the point where I’m really *almost certain* that they are true). But the truth (or falsehood) of this assertion is all *ontic*! It is true only if the epic assertion is in a perfect (within the fuzz and imprecision of linguistic coding) one-to-one correspondence with *objective reality*!

Here’s why this is so important. I can easily imagine that “Professor Plum did it in the kitchen with the rope”⁸, but *in reality* the cards in the envelope may show that it was “Colonel Mustard in the library with the wrench”! Imaginings and conceptualizations – maps – of the Universe in our own minds may be correct, or they may be mistaken, but *the map is not the territory* (or rather, the map is the territory of the map itself, but may not correspond to any real territory). The epic is the map, the territory is the ontic, and don’t forget, Clue is a *game* and no actual victims were killed by any real humans with *either* the rope *or* the wrench. Unless of course, they were – the ontic is what it is, not necessarily what we believe it to be, or not be!

With these definitions and explanation we can avoid all sorts of silliness associated with God “creating” the Universe or statements involving “multiple Universes” as being trivially logically inconsistent with the definition of Universe itself. Perhaps God can create a space-time continuum, perhaps there are more than one space-time continua, but God *cannot* make a Universe because God is a part of, or possibly all of, the only Universe that there can, by definition, be. This gives us an *essential* common basis for reasoning about the Universe, God and other metaphysical topics. It also leaves a myriad of bullshit arguments about what the Universe “must” be properly stillborn so that we can concentrate on figuring out what it *might* be – with some observational support for our beliefs – instead.

This leaves us with the problem of how to refer to our current space-time continuum, as we usually refer to this as “the Universe” in physics because it contains all that we can actually see and measure and use as a basis for knowledge. However, this begs the question of whether there can be multiple space-time continua, or more dimensions than four, or both at the same time. We really don’t want to *exclude* the ability to reason “outside of the space-time box” this early in our discussion by insisting (as an implicit axiom) that the four “direct” dimensions of space-time are all that there is to the Universe.

⁸This is a reference to the game “Clue”, in the event that you are culturally deprived and never played the game. If you can’t figure out what I’m saying here, feel free to look up e.g. a Wikipedia article on the game...

Many quite legitimate theories in physics (e.g. string theory) already assume more dimensions, sometimes a rather lot of dimensions, and a “many worlds” interpretation of quantum theory would have us take seriously the idea of multiple spacetime continua. Maybe these theories are correct, maybe they aren’t, but we don’t want to reject them *by definition* from consideration; we need other, better reasons to increase or decrease our degree of belief in their truth.

It’s rather tedious to type out *space-time continuum* all the time just to avoid misusing the word Universe. I will therefore co-opt the word *cosmos* to refer to a space-time continuum like the one in which we appear to live. In general, when I use it in the capitalized singular Cosmos form it will refer to our *particular* space-time continuum, but there could be more than one and this one could have more than four dimensions. This is a fair usage, actually – in ancient theism, the Cosmos was often used to refer to the *created* part of the Universe, exclusive of God. Leaving God and creation aside for the moment (we’ll get to them much later) the important thing to remember is that the Cosmos exists and hence is (in set theoretically precise terms) a *subset* of the Universe. It might be the whole thing. It might not. It isn’t *required* to be the whole thing by definition, though.

It is also useful to understand that *you* are a subset of the Cosmos (and hence the Universe). This is still quite general – even if you are all that exists, it is quite harmless and non-contradictory to state that you are the Cosmos and that the Cosmos is the Universe and that you are the Universe. If you *don’t* exist – well, we don’t have a problem then *either*, do we? At least not one you can debate.

When you look upon the Cosmos and try to develop knowledge about it and the Universe it may be all or only a part of, you form a *worldview*. A worldview is, basically the sum total of everything that one “knows” about the Universe – all your instincts, memories, thoughts, inferences and deductions, true or false or in between. A worldview is *necessarily* personal and subjective. Mine will almost certainly not be the same as yours. A *correct* worldview would one that is in a *perfect one-to-one correspondence with the Universe*, although I hope it is obvious that our personal worldviews have no chance of being correct in this strict sense. This will motivate our ongoing development and improvement of a *good enough for now* worldview, a *dynamic* worldview subject to posterior correction and in a decent *statistical* correspondence with what we can observe of the Universe.

Later, when we examine Gödel’s theorem, the Cox axioms, and the theorems

of *information theory* we will be able to arrive at some rather startling conclusions that follow from little more than these formal definitions of axiom and worldview, epic and ontic, Universe and Cosmos.

With all of this established, our definition of axiom above leads rather rapidly to an acute rational-existential crisis. If *almost all* of our knowledge is based on *unprovable assumptions*, if rationality itself is fundamentally irrational in the sense that it cannot be proven, only guessed or assumed, then have we not built up the entire edifice of human knowledge on the *shifting sands* of yours-is-as-good-as-mine *opinions*? Where, precisely, is the solid rock of *truth*, something that we can know *beyond all doubt* to serve as the foundation of our worldview?

This is hardly an idle question. There are a number of metaphysical schools of thought that are at *war* over it, as one answer that is often given is that *God has granted preternatural knowledge* to a select few, that these *fundamental truths* are true beyond any question and are recorded in specific, divinely inspired theological scriptures, and that a complex system of divine judgement, reward, and punishment exists to *enforce* the acceptance of this divine revelation as truth completely outside of the normal methods of inquiry we use to assess truth on more mundane matters. One such school of thought, known as the religion of “Islam”, directly and repeatedly commands its adherents to wage war on those that refuse to accept its axiomatic precepts as *divinely revealed truth*, and promises exotic punishments such as⁹ :

Lo! Those who disbelieve Our revelations, We shall expose them to the Fire. As often as their skins are consumed We shall exchange them for fresh skins that they may taste the torment. Lo! Allah is ever Mighty, Wise.

to those that question or fail to comply with the *smallest detail* laid out therein. It is, therefore, hardly surprising that a significant fraction of its adherents actively follow these precepts and routinely murder anyone that is judged an apostate or a “threat” to its system of beliefs¹⁰. War indeed!

Even in the less violent world of academic discourse and metaphysical philosophy, there are those who wish to argue that there is no point in developing a systematic *scientific* worldview, because every time we think that we know what is going on, experiments are thought up that prove that our knowledge

⁹See: <http://www.skepticsannotatedbible.com/quran/4/index.htm#56> The Quran 4:56.

¹⁰While to be completely fair, others, probably a majority of others, do not. However, neither tolerance nor intolerance for non-believers makes a belief *true*, and this work is concerned with how we should best assess truth.

is false. Enormous and systematic debates have occurred concerning whether or not propositions must be verifiable or falsifiable to have meaning, whether knowledge is transcendental or strictly empirical. Throughout this process, most actual scientists have studiously ignored the pronouncements of the philosophers that have weighed in on this issue, because those pronouncements were fairly obviously nothing but *bullshit*. I'm tempted mightily to list all of the bullshit artists in question – Hegel, Kant, Friesan, Hahn, Carnap, Ayer, Popper, and still more, still today – but what is the point?

No physicist that I know of (and being a physicist myself, I know quite a few) pays the slightest bit of attention to whether the observation of a Higgs particle would technically “verify” the standard model or whether the failure to observe one on each new generation of experiment (so far) “falsifies” it, because *neither one describes* the process in which they are engaged in their search, or the nature of the alteration of the sum total of human knowledge that would be attendant upon a reproducible observation, perhaps in the new data produced by the Large Hadron Collider. Or, if the Higgs particle, or a magnetic monopole, or some quantum field theoretic ‘spark’ is a bit too exotic for you, the extent to which *each* observation of a falling rock verifies or fails to falsify any particular theory of gravitation.

Neither falsification *nor* verification describe the *quantitative* process whereby scientific inquiry incrementally improves our view of the world, or the way that our physical brains infer and encode a process, and use that inference to motivate either action or insight. Furthermore, notions of *meaning* are clearly divorced from either one – I have no difficulty whatsoever in understanding the proposition “The physical Cosmos continuously extends beyond the event horizon of the present” in spite of the fact that according to our own best physical theories I cannot even *in principle* ever perform an observation that would permit me to verify *or* falsify it. It is trivial to come up with any number of perfectly understandable phrases in English (or algebraic statements in quantum theory) that cannot be consistently verified *or* falsified. “Understanding” involves a process of (usually imperfectly) analyzing *conceptual consistency* with an entire network of prior beliefs; one can easily decide that a new proposition is *not inconsistent* with prior knowledge without discovering any particular reason to increase one's degree of belief in the proposition in question in that base of knowledge.

This is all the more regrettable since it has been well over fifty years since the basis of a quantitative theory of knowledge was axiomatically developed by Cox, Shannon, Jaynes, and others – all of them physicists or computer scientists,

not metaphysical philosophers. This theory presents “verification” and “falsification” as the opposite sides of the same coin – the process of *common sense judgement* whereby when we increase our degree of belief in one proposition we decrease our degree of belief in at least some other competing propositions. It further ignores the *complex* nature of human knowledge as a *rough landscape* (as it were) of interconnected Bayesian propositions, so that the experimental observation of the precession of the perihelion of the orbit of Mercury doesn’t “falsify” the theory of gravitation, it causes the theory to be *modified* and *qualified* in a process of successive approximation that is more strongly related to *computational optimization theory* than it is to the stark logic of truth and falsehood that has been philosophy’s bread and butter since the time of Aristotle.

This sort of pointless debate has created the *illusion* that no solid rock exists upon which to found the best possible set of beliefs about the Cosmos, if not the Universe. The metaphysical propositions that are advanced usually have trivial counterexamples or simply fail to describe the process by which our *brains* actually conceive of and process *knowledge*. All of this in turn openly encourages those whose criteria for truth and knowledge are derived from Bronze Age literary mythologies that have survived to the present, usually by the sole virtue of being the most violent and repressive worldviews in direct, violent, repressive competition with other violent and repressive worldviews.

Wisdom, foolishness, and knowledge itself all depend on *many* assumptions, and reality is far too complex and interesting for us to mindlessly rely on the foundation for knowledge we have been indifferently taught by a largely ignorant and uninformed society, or its *equally* uninformed educational system that teaches knowledge *without* foundation. If history teaches us anything, it is that “truths” taught by *authority* – by our teachers, by our elders, by our religious and political leaders, by our peers – have *often* turned out to be diametrically incorrect, usually because that knowledge was based upon the *wrong assumptions*, on inconsistent, self-contradictory beliefs. Unfortunately, through most of recorded history the worldview endorsed by the reigning “authority” has been enforced by law, backed by social ostracism, by economic and physical punishment, and ultimately by deadly threat¹¹.

What then, are the *right* assumptions? What are the axioms that we *should*

¹¹Consider the case of Thomas Aikenhead, hung for blasphemy in Edinburgh in 1697, or La Barre, tortured and executed for blasphemy in France in 1766. Consider “McCarthyism”. Consider the entire *concept* of the Islamic *fatwa*, especially modern ones directed at the murder of third parties that “blaspheme” against a worldview. Consider Tianamin Square and U.S. laws denying rights to e.g. homosexuals. Thought is far from free, even today.

use as the foundation of our edifice of knowledge? In fact, how can we even choose one set of axioms as being “better” than another without axioms to enable us to ordinally rank axiom sets in terms of “goodness”, and what should *they* be? The rest of this book is devoted not precisely to *answering* these questions (as there is obviously no unique and provable answer) but rather to providing you with all that you need to *choose* a set of personal axioms that works for you as a deliberate act of free will.

In order for you to become free to choose, you will have to do a wee mental exercise. If you refuse for any reason to do it, reading the book is largely going to be a waste of time¹². You don't have to do it all at once, but as you read you should be working on it.

What you have to do is to perform an autobeliefectomy – to psychologically “operate” on yourself to *stop believing* pretty much everything you have been taught or think that you know. The point of this exercise is that you have (up to now) been *programmed* with many of your most fundamental beliefs. A great deal of this programming occurred when you were a small child and *had no ability to choose* to believe or disbelieve what you were being taught. Some of it is even *biological* programming and is built right into you by genetics and evolution.

You have to become *self-aware* of this programming and come to *doubt* it and all knowledge derived from it in order to *reprogram yourself* with a system that is deliberately selected as “the best that you can do” given your own personal life experience. Quite literally, this is a book about hacking – and ultimately debugging – your own personal operating system, and then *maintaining* it in an optimal state for interacting with the mysterious world you are a self-aware part of.

Don't worry, all of your existing “knowledge” – true or false, best belief or worst belief – won't go away. Later you can come back to it and deliberately decide what to keep and what to reject in your worldview. However, until you permit yourself the luxury of doubt, you are in intellectual chains forged at an age where you were too young to resist and were taught “truths” that, almost certainly, weren't.

So, if you believe in God, stop and permit yourself to frankly doubt God's existence. If you believe that there is *no* God, stop and permit yourself to openly acknowledge that God might exist. If you are a True Believer in the theory of gravitation, evolution, creationism, Catastrophic Anthropogenic Global

¹²And gee, you've bought it and it is *way* too late to return it. So you might as well give it a try if only to avoid wasting money...

Warming (CAGW), permit yourself the sheer luxury of imagining that your beliefs *might be incorrect!* If you are a capitalist, try to open your mind to socialism or communism. If you are an ardent communist, allow yourself to entertain the notion that capitalism might work better, at least some of the time. If you are a republican, imagine voting democrat and vice versa.

Don't stop there – work on disbelief until you entertain at least a tiny bit of doubt about the perfect truth of what you see with your own eyes, what you hear, what you taste, what you touch. Are your senses perfect? Is the world *precisely* as it seems to be? Are your memories of the past always correct representations of what you actually saw, heard, said¹³? Or could you be, have you ever been, *mistaken*?

One point of this exercise is that (as we pick up each of your former beliefs in turn to see if any of them are worth keeping) it will gradually help you to understand that most of your beliefs fall into one of the following categories:

- They are *meta-axioms* – axioms that apply to axiom sets themselves. We will spend a lot of time and energy thinking about meta-axioms later on in this book, as they provide a *ordinal basis* for choosing your own personal axioms.
- They are themselves *fundamental axioms* – the belief in a *law of causality*, for example.¹⁴.
- They are *theorems* – you believe them because you understand how they follow as the result of a *correct reasoning process* from your fundamental axioms.
- They are axiomatic beliefs that are neither fundamental nor, (consciously, at least) derived. Properly speaking they are *propositions* – assertions of some sort that you believe in (or disbelieve in) without any formal reason or proof, which *might well* be consistent or inconsistent with other things you

¹³Married persons can skip this step in the process. At this point you *know* that your memory of things past is largely false. At least, according to your spouse.

¹⁴An axiom in an axiom set will be called “fundamental” when axioms within it cannot be derived as *theorems* from a smaller set of *sufficient* axioms that describe the same theory. This distinction is of more interest to mathematicians and logicians working with closed theories than it will be to us, but it is useful to introduce at an early stage the *meta-axiom of parsimony* which is basically an axiom that helps us choose axiom sets by saying that smaller ones are “better” than bigger ones that lead to the same overall theory. Fundamental axiom sets are parsimonious.

also believe in, and use as the basis for reason (such as making decisions to act or not act in a certain way).

Logicians tend to be concerned with the first of these as it embraces the framework of reason itself, for example the so-called *Laws of Thought*. Mathematicians tend to be more interested in the second pair – fundamental axiom sets and theorems derived from them, e.g. “Euclidean geometry”. Normal human beings, however, live almost all of their lives basing most of their decisions from moment to moment on reasoning driven by assumptions of the *last* sort – things we believe to be true that are not “first principles” themselves nor provable from first principles (fundamental axioms).

These latter “axioms” are in many cases the things we call our *opinions*, as in it is my *opinion* that chocolate ice cream is better than vanilla or it is my *opinion* that it is morally acceptable to eat meat. Can I *prove* either of these assertions from a commonly held set of fundamental axioms? Of course not. Oh, I can “justify” them – pick out a few assertions that *do* lead to these statements as conclusions, but you might well not agree that those assertions are “true”.

If I were to be totally honest, I might not really think they were either. In fact, I could almost certainly pick out different (but still reasonable-sounding) assertions and argue that the *opposite* conclusions are true, that vanilla is better than chocolate when it comes to flavors of ice cream. Socrates (apparently) used to have great fun doing just that – first proving something to be true based on accepted principles and then turning around and proving it to be false on equally accepted principles (proving, if anything, the probable but highly occult inconsistency of those principles).

This would be fine *if* humans reasoned “gently” with the mish-mosh of beliefs, instincts, biological imperatives, myths, superstitions, folklore, and conditioning that make up this overcomplete, self-contradictory, self-referential axiomatic ocean of opinions and *ad hoc* presumed truths that is our worldview. Unfortunately, that is not the case. It is always: Abortion is *wrong*. The *Quran* contains *divinely inspired truth*. Capitalism is *evil*. The sun and stars revolve around the *Earth*, which is manifestly *flat*. We have the *right* to invade your land, kill you, and take its wealth for ourselves. We have the *right* to life, liberty and the pursuit of happiness. The flag is a *sacred object*. Animals have no *souls*. The word “perhaps”, the phrases “I think that” or “it might be the case that” never, ever appear.

All too often in human affairs, the more uncertain our collective and individual axioms are, the more they seem to lead to contradictory conclusions, the

more *passionately* one or the other of those conclusions is embraced as absolute truth or the work of the devil. All too often it becomes the devil's work indeed as the conflict born of a *difference of opinion*, unresolvable even in principle by means of reason, leads to theft, to rule by brute force, to murder, to war. A difference of *opinion* concerning a piece of ancient history¹⁵ is currently responsible for countless deaths in the Middle East with more coming every day at the time of this writing. Human history is a bleak record of the absolute intolerance of those whose unprovable authority-derived opinion differs from one's own.

This is *why* it has never been more essential for human beings who are *not* logicians or mathematicians to understand the arbitrariness of the axiomatic basis of reason itself and to fully grasp the uncertainties in all derived knowledge. Reason *is* a powerful tool, but the answers it gives in human affairs are rarely drawn in black and white but rather in shades of grey. Given this uncertainty, the social or personal egotism of *righteousness* seems to be out of order – we must learn to respect the *opinions* of others when they differ from our own and demand the same respect from them for our own opinions, even while trying to find a common axiomatic ground we can agree on and base a society on.

Note well, however, that *respecting* someone else's right to believe something different from what you believe is not the same thing as refusing to criticize it, analyze it, refute it, argue against it, or legislate protections against being forced to accept it as a reasonable basis for law just because *somebody's feelings might get hurt*, especially if those beliefs are being proselytized in open public debate or being *proposed* as the basis for a law that might apply to you against your will. Bad ideas – or for that matter good ideas – get no special protection in a reason-based worldview just because somebody believes them strongly, whether those ideas are belief in a law of universal gravitation or belief that it is wrong to eat meat or wear a tee-shirt with a depiction of Muhammed on the front. No one should force *you* to believe in gravity, become a vegetarian, or wear such a tee-shirt, but until the day you can *prove beyond all doubt* that your beliefs are *true* (which this work will prove beyond all doubt is impossible) you have no rational grounds for forcing your beliefs on others or preventing others from expressing their own beliefs. They could be right, you could be wrong (however firmly you think it is probably the other way around).

Ultimately, as we will examine in detail below, reason is based on faith –

¹⁵Specifically, whether or not authority in Islam is derived from *election* or *blood inheritance*. Sunnis are in a sense “protestants”, with *imperfect* leadership whose authority derives from election, where Shia are “orthodox” who believe in the *divine appointment* of their leaders, whose authority is thereby *perfect*. The English Civil War, stretched out over some 1300 years...

faith that some fundamental core of axioms concerning our perceptions are *true* and that the laws of reason correctly applied to those axioms will lead us to an *epic system of knowledge* of ourselves and an inferred *ontic Universe* in which we seem to live. The atheistic scientist whose worldview consists of a belief in strict natural law and the validity of the experimental inductive process to learn that law and the theistic priest whose worldview consists of a belief in a supernatural God whose laws revealed strictly by divine revelation in sacred scripture are in one very important sense *equally* irrational in their beliefs. In both cases their axioms cannot be *deductively proven*, only accepted on “faith”.

This is not to suggest that both axiom sets are equally “good”, but in order to judge between these two diametrically opposed sets of fundamental axioms on grounds *less strong* than boolean certainty, or to conclude that one is “better” than the other on some scale of “goodness” or “desirability” requires *meta*-axioms to guide the judgement, and *they* in turn are equally arbitrary and unprovable. The rock of human reason, examined closely at its very foundation, turns out to be a fog of quicksand so tenuous that it hardly can be expected to support our own weight, let alone that of the Universe, come the rains of every human’s personal experience of life: pain, suffering, and inevitable death with nothing but an imperfect knowledge of what it’s all about.

Is it any wonder that, seeing that pain, suffering and death, intuitively understanding the apparent arbitrariness of human beliefs and having no good way of choosing amongst the vast, confusing, and contradictory tangle of possibilities (all touted as *self-evident* truth by their proponents) many people turn away from reason altogether and choose to embrace either a form of intuitive mysticism that rejects science and established religion alike or slavishly accept the *literal truth* of some piece of scripture regardless of how much it contradicts common sense and everyday experience? In both cases it is vastly easier not to have to figure things out, much easier not to live in a state of perpetual doubt.

To make sense of that fog and transform it once again into something capable of supporting knowledge and understanding, let us begin by formulating one of the fundamental “theorems” of meta-axiomatic reasoning. This theorem will look odd, as one might *expect* an object associated with meta-reasoning to look. After all, before we can reason we have to reason about reasoning, which involves a bit of a bootstrapping problem because without reason how can we reason about reasoning, and yet without doing so how can we be sure that any conclusions drawn from reason are reasonable?

Ahem. Don’t worry. *Reasonable* or not, it all ends up *making sense*.

Chapter 2

Philosophy is Bullshit

Aristotle maintained that women have fewer teeth than men; although he was twice married, it never occurred to him to verify this statement by examining his wives' mouths. — *Bertrand Russell*

This is a book about *knowledge*. We will look very carefully at what it means to *know* something, what *can* be known and what must at best be assumed or guessed or hoped for. “Knowledge” all by itself seems a bit lonely and pointless, or perhaps too “zen” to be of any use, sitting around just knowing, knowing, knowing. We’d like to put that knowledge to use so (among other things) we don’t die of starvation¹ or walk off of a cliff while we’re too busy just knowing to *think* about feeding ourselves or *reasoning out* that if we walk off of cliffs we’ll go splat at the bottom.

For better or worse, we lack what might be called “direct knowledge” or “preternatural knowledge” – God-style knowledge – of the world². As we’ll see,

¹You think I’m joking, but I’m not. Kurt Gödel, for example, was a wee bit crazy and *starved to death* because – however brilliant he was, however much he knew about logic and mathematics – he had an obsessive fear of being poisoned when anybody but his wife prepared his food, and literally couldn’t or wouldn’t figure out how to feed himself when she had to go into a hospital.

Sadly, history is full of famous philosophers and mathematicians and thinkers who were simultaneously brilliant and productive and yet were too stupid to tie their own shoes or come in out of the rain. And then there are politicians...

²At least, *I* lack such knowledge, and to my limited experience people who claim to have such a thing are either lunatics or lying; their divinely perfect knowledge rarely turns out to correspond to the more mundane sort gathered by other means. And yes, this observation is connected (later) with C. S. Lewis’s famous trilemma, for those who already are aware of it and recognize the words.

pretty much everything we think we know is either a sensory impression or is the result of a process of reasoning, one so automatic that we may not even be aware that it is occurring but that is critical to the process of developing knowledge and *using* it for whatever purpose seems good to us, such as staying fed and un-splatted by the many hazards of thoughtless existence.

This is therefore also a book about *reason*. To come to understand the interplay between knowledge and reason and see how they make us what we are, we have to bootstrap the process – begin with one or the other and then iterate reason and knowledge to a full comprehension of both. It seems wise to start with reason, since reason is active and interpretive where knowledge alone is somehow “passive” and unlikely to take us anywhere. If you like³, knowledge is *epic*, a map of sorts – possible a map with errors, maybe even a map of an imaginary country, but a map nonetheless. Reason is our navigator, our fearless explorer, that uses the map with all its imperfections to discover the ontic world, perhaps filling in and correcting the map as it does so.

Let us begin, then, by taking a look at symbolic deductive reason, as it is in some very deep sense the foundation of “rationality” itself. If humans are thinking beings, the rules that govern reason and thought seem like they must be the tools that will lead us from a state of ignorance to one of knowledge of our selves and the world we appear to be living in. They are the means by which we move, in small steps from here to there as we fill in our personal maps, correcting errors, coping with inconsistencies, exploring *terra incognita*, imagining what might lie beyond the horizon of our immediate perceptions.

This book is *not* going to be anything like a textbook in logic or a rigorously developed mathematical treatise. I’m assuming that you, dear reader, are intellectually curious but that you may have had little exposure to formal logic or math beyond algebra and some geometry. It will suffice for our mutual purpose for me to present a few key ideas that illustrate in the most general way the essence of the process of reason (and some problems associated with that process) without getting bogged down in its endless algebraic machinations. In a few places I’ll put in a bit more detail than in others, places you can use to initiate a “wiki-romp” through wikipedia⁴ to learn more.

A few of my readers may, of course, be mathematicians or logicians, far more expert than I in those algebraic machinations. They will note that I’ve omitted

³As you will soon come to see, I adore metaphors and analogies because they help one develop the conceptual strength of an idea, knowledge you feel in your gut as much as work out in your head. So please bear with me.

⁴Wikipedia: <http://www.wikipedia.org/wiki/Wikipedia>.

this, glossed over that. I beg their indulgence as I make sweeping statements such as the following.

All symbolic logical arguments that are not various trivial manipulations of tautology ultimately boil down to something like the following, a rule called *modus ponens*⁵. Suppose A and B are assertions. It doesn't really matter what they are – A might stand for “Pigs have wings.” B might stand for “Pigs can fly.” We can then formulate a new assertion such as “If pigs have wings, then pigs can fly.” or, symbolically, $A \Rightarrow B$.

We can then formulate a *logical argument* according to rules that are literally thousands of years old at this point:

- (Premise) $A \Rightarrow B$ (If pigs have wings, then they can fly.)
- (Premise) A (Pigs have wings.)
- (Conclusion) B (Pigs, therefore, can fly.)

Note that *logic* has nothing whatsoever to say about whether or not pigs *do* have wings, or whether or not a winged pig *can* in fact fly. As far as this argument goes, they are *axioms*— things we are assuming to be true to develop the argument. For the moment do not worry about how we might decide if they are *really* true or not at the *ontic* level in the *real world*, because that seems like it is *knowledge* and we're still working on the processes of *logic* that we call reason.

The way that deductive logic works is that *if* $A \Rightarrow B$ (read this as “A implies B”) is *true and* if A is *true* then one cannot logically doubt that the conclusion B is *true*. It is a *theorem*, or contingent truth, a conclusion derived from the axioms⁶.

I am not suggesting, of course, that logic doesn't have more symbolic operations, other ways of deriving theorems, only that non-trivial logical arguments always have two components⁷, one that we can think of as *data*, and the other

⁵Wikipedia: http://www.wikipedia.org/wiki/Modus_ponens.

⁶To be picky for any logicians who might be reading, modern usage would call this argument logically *valid* but not logically *sound* as the propositions of the argument appear *false*. However, we cannot (yet) differentiate in this way, as it begs the question of how to decide that a proposition is true, working backwards recursively to *fundamental* propositions that are formulated *just like these propositions* that we *cannot* prove to be true or false.

⁷Logicians and mathematicians would be inclined to include a third component, a set of “definitions” that establish a semantic symbol map that in some sense is ultimately circular and self-referential, a dictionary written in the language it defines. I'm not ignoring this, but

that we can think of as *rules for transformation*, and that both are *axioms* of any given logical demonstration that leads to a conclusion not already included in the data. A and B don't have to be single asserted truths, either one could be a whole set of asserted truths (including definitions). $A \Rightarrow B$ doesn't have to be a single rule for taking one asserted truth to another, it can be any of a whole set of such rules. The point is that *modus ponens* captures the *essential process* of deduction as a way of beginning with a set of things we “know” (or rather, assume to be true) and ending with a larger set. We begin with A , end with the union of A and B where in the “interesting” cases B is not obviously a subset of A .

Even the addition of *classes* of things and more complex predicate assertions, for example the famous Aristotelian syllogism:

- (Premise) Socrates is (was) a man.
- (Premise) All men are mortal.
- (Conclusion) Socrates is (was) mortal.

preserves the essential structure of deduction. One makes assertions that may or may not be true but which are *presumed* to be true and from them arrive at a *conditionally* true conclusion – a “theorem” of the assumptions and reasoning process used.

For a long time – indeed, thousands of years – the premises for most philosophical arguments weren't really presumed to be true – they were thought to be *obviously* true, so true that no further argument was necessary to demonstrate their truth, and many, many conclusions were *ever* so rigorously derived from them. Only in the last four hundred years has attention been properly paid to the uncertainty and indeed potential variability of these premises, and only in the last century or so have cracks appeared in the self-consistent logical foundation of pure reason itself.

Here is *my own* little “logical argument” as it will be developed throughout a much of this book. You will note that it has a striking similarity to the argument structure illustrated above – it makes certain observations or assumptions and

semantics – the relationship between the *epic symbols* we use to make our *map* and the *actual ontic territory* the map supposedly represents – is a large part of what we are bootstrapping. For the moment I'm just lumping definitions loosely in with data as “things that are presumed true” and not “transformational rules” per se, although one can of course define symbols for the rules. In any event, we're sort of stuck with using the English dictionary as our ultimate set of definitions unless or until somebody translates this work into other languages.

uses them to draw a conclusion. However, it is a logical argument *about logical arguments*, a syllogism about syllogisms, so it implicitly refers to itself.

- All arguments (including this one) are based on unprovable assumptions or *axioms* – a word whose Greek root literally means “unprovable assumption” and not “manifest truth”.
- If an argument is *logically valid* (consistently developed according to the rules of logic) and the premises are *true*, then the conclusion cannot be doubted. This is a “law of thought” that is a necessary axiom for deductive logic of any sort to work. Without it there is no such thing as *reason*.
- The axioms can never be *known* to be true (specifically, their epic symbolic statement cannot be known to be in perfect correspondence with ontic reality). [It should be carefully noted that this does not mean that we know them to be false either.] They are *uncertain* (if they refer to the real world) or at best *consistent assertions* (if they refer to imaginary, purely epic worlds, such as mathematics or geometry).
- We can therefore logically conclude that we can *never be logically certain that the conclusion of any logical argument* (including this one) is *true*.

This is an argument that no doubt Gödel would have loved, as it is beautifully self-referential and its conclusion, while self-consistently unprovable, is nevertheless obviously true.

This argument is not really unique, although this particular amusing, abstract, and self-referential formulation may be. It simply highlights a serious problem with logic. How can we ever tell if the premises of a logical argument are “true”? There seem to be two general ways, one of which leads to mathematics, systems of consistently manipulating symbols, the other of which leads to epic knowledge, the establishment of a *semantic relationship* between symbols and – “something else”. Something *ontic*!

Mathematics is developed by never knowing, or caring, if the premises, the axioms of any particular mathematical theory, are really “true”. They are simply *defined* to be true, end of story. Afterwards, the laws of thought and process of deductive reason are all about consistency and inconsistency, completeness or incompleteness, the *mechanical* analysis of a *system* of relationships that permit the symbolic formulation of assertions according to rules and the consistent association of contingent true, false, or undecidable values to each assertion in the

set of all possible assertions in the theory, including the original axioms themselves (which might be self-contradictory, as would be the case if we start with both of the axioms: A is true; and, A is false (for any A), or self-referential, as in “This statement is false.”).

Pure mathematics is simultaneously *beautiful* and *devoid of meaning* because there is no logically necessary connection between the systems of symbols being consistently manipulated and any *thing* at all. The “epic universe” of mathematical discourse in a theory (the set of all possible assertions of that theory) is *disjoint* from the singular existential *ontic* Universe of our experience, barring a set of *axioms* that form an *epic* bridge between the two. Mathematics is a peculiar form of knowledge, because it isn’t knowledge of *anything at all*, it is a knowledge of contingent relationships between symbols, the essence of “abstract” knowledge. This *intangible quality* of mathematics is so elusive that it can easily trick us into granting it “mystical” properties, and indeed at various times in history mathematics has been something of a *religion*, one founded on the *religious belief* that one or another set of axioms, say those concerning numbers⁸ or geometry⁹ were *fundamental truths* and related in some way to the metaphysical basis for all things, beyond all doubt or variation.

They have further seduced philosophers into writing immense bodies of learned discourse (the bane of all students) attempting to “prove” that reality is nothing but the symbol, or the symbol the real, that matter is really mind or the other way around. We’ll have none of that *bullshit* here, don’t worry. This work is not about the arcane, but rather the practical.

Well then. What *about that something else*? How do we reason about our *experience* and *memory*, how can we use reason to develop a knowledge of our *selves* and something that appears to be an *objective external ontic reality*?

⁸Wikipedia: <http://www.wikipedia.org/wiki/Pythagoras>. Pythagoras actually formed a *secret religious society* devoted to the study of numbers. Legend has it that certain members of this society were murdered for daring to question its axioms.

⁹Wikipedia: http://www.wikipedia.org/wiki/Euclidean_Geometry. Euclid, I should hasten to say, did not wish to make geometry into a *religion* the way Pythagoras did. He used the term “axiom” to refer to the unprovable assumptions underlying plane geometry and hence is in a manner of speaking the father of axiomatic reasoning. However, his axioms were *transformed* into “religious beliefs” in the minds of most of the world’s thinkers, who could not see how one could *doubt* their truth or make *different* assertions and end up with *different* conclusions that were still valid and neither more nor less “true”. These beliefs were so strong that the mathematicians who ultimately challenged them (Bolyai, Lobachevsky, Gauss, Gauss’s protégé Riemann) initiated what amounted to a “religious war” that in fact ensued when the resulting *curved space* geometries were published.

Some three hundred and fifty years ago Hume¹⁰ observed that:

- Deductive (epic) reason about (ontic) nature is all based on observed “regularities”. Those regularities are those of association, where one thing is always observed in the company of another, or the observation of e.g. mathematical “structure”. There is an unspoken assumption that underlies it – that there exists a correspondence between any sort of regularity and some underlying truth that can thereby be used as “input” to construct a logical argument that will lead to true conclusions that *extrapolate* this regularity.
- This process is known as *inductive* reasoning, or *inference*. We observe a regularity in a series of events in nature, and imagine that this regularity will continue, that it is *true*. We even give names to some of the regularities (such as “The Law of Universal Gravitation”) and proceed to reason with them as if they are fundamental truths.
- However, induction (as a process leading from observation to absolute truths about the real world) cannot itself be deductively proven to be valid. Inference (in Hume’s time) could only be *assumed* to be valid; it was an *axiom*.

An *inconsistent* axiom. Inference (induction) from partial data not infrequently leads to conclusions that inference based on *more* data later contradicts, so we should correctly infer beyond any doubt that conclusions drawn from inference can be *doubted* and are not *epic truth* in the sense that conclusions drawn from deductive reasoning from a set of “self-evident” premises are. Consequently (according to Hume) one could never deductively *or* inductively reason to epic conclusions concerning the real ontic world and be *certain* that they are true. Reason itself was not a tool that could *in principle* lead to true knowledge!

That conclusion *should* have spelled the end of an era of philosophy – Hume had shown that some of the fundamental goals of reason were in fact unreasonable because logic and rational processes could only be extended to be *about* anything at all on the back of *fundamentally irrational*¹¹ assumptions that have to be made

¹⁰Wikipedia: http://www.wikipedia.org/wiki/David_Hume.

¹¹Some people will object to my use of the word “irrational” to describe the non-derivability of the assumptions and premises upon which rationality is based. Again we are trapped by common usage – an irrationality is often used to connote insanity, unreason, contradiction, and there is nothing unreasonable or innately contradictory about reasoning from axioms; there’s no other way we *can* reason. I’m nevertheless going to persist, but if the term bothers you you may substitute “extra-rational” – outside of or beyond reason – in its place and no harm will be done.

outside the system of reason used to arrive at the conclusions. In other words, to put it bluntly, no matter how pretty and logically rigorous a philosophical “proof” relating to the real world may *appear*, its conclusions will always depend on things that cannot be proven to be true and hence can *always be doubted*. Indeed, if one changes one of the unprovable assumptions upon which the proof is founded, reason will often lead one to arrive at *different* (but equally valid) conclusions.

Hume thus taught us that all human knowledge about the real world is *conditional* on certain assumptions that cannot themselves be logically derived or proven. We have already seen that logical systems themselves (knowledge about imaginary worlds, as it were) are no better off. They, too, are conditional on data and rules (premises) that cannot be logically derived as truth, but instead are *defined* to be true. We can extend Hume’s argument by adding the observation that *even if we could* know truths about the real world, there is an immense “space” of possible axiom sets that might define the relationships and rules for deduction that would permit us to extend those truths and we cannot *know* that any given set of those axioms is “true” or “false” save by assumption or definition. To put it another way, if *any part* of a worldview is not known – data or relationships between the data – *all* of it becomes uncertain¹².

Goodness! Looks like we have some work to do before we can end up with anything like “knowledge”. If you go over the entire discussion as presented thus far, you will see that we have one possible “out”. In one crucial part of our definition of the logic of *thought* (and in our inference regarding inference above) we used the word “doubt”. Doubt infers a state that is neither true nor false – it is in between. We will find marvelous uses for doubt. For another, we *already* can see that Hume’s argument can be reduced to the *provable* conclusion:

(Almost) anything that we think we know can be doubted. (Almost) everything we think that we know is contingent. (Almost) nothing we think that we know can be proven beyond all doubt. Therefore *Philosophy itself* (as a means of arriving at certain knowledge about our Universe, the reasoned derivation of an unquestionably true worldview) is *bullshit!*

In other words, philosophy has been able to prove that as long as philosophy’s

¹²This isn’t strictly true – if the Universe consists of many *completely disjoint* cosmos with *no connections between them* then ignorance in one does not “bleed” into the others. But in this case we need never concern ourselves about the parts disconnected from the one in which we find ourselves.

goal is to provide *certain knowledge* it, and we, are just plain shit-outta-luck (SOL). Ain't happenin'. Forget it.

Did Hume's startling observation (as originally presented or as extended here) stop philosophers from philosophizing? Of course not. Philosophers have to eat, and if they don't get paid for philosophy they might have to *work* for a living¹³.

Did it even cause them to stop philosophizing *badly*, and at the very least state their basic assumptions along with their arguments? Hardly. You have to understand that if the premises of an argument are correctly stated, true-false reason can be reduced to *algebra* (as was proven by George Boole among others – hence *Boolean* algebra). The only way two algebricians can arrive at different conclusions by the mechanical process of generating a consistent chain of logic leading from premises to conclusions is if their premises *differ*. Or (in the event that I happen to be one of them) if they make a *mistake*, but we're talking about two *good* logicians here.

Ultimately, then, disagreement about the conclusions of some valid argument in a forum of *consistent* reasoning is absolutely equivalent to disagreement about the premises (or a formal mistake in algebraic reasoning). Since disagreements at the level of *premises* cannot be *logically* resolved, and since the problem is further compounded when reasoning about the Universe, we see that semantically, all logically valid arguments that arrive at distinct conclusions about the real world are precisely equivalent to the following metaphorical argument:

Tommy: "Invisible fairies make the Sun come up."

Suzy: "They do not."

Tommy: "Do so!"

Suzy: "Do not!"

Tommy: "Do so!"

Suzy: "Do not!"

Iterate to infinity and beyond...

¹³Which can be seen as necessary and sufficient reason for my writing this book, which I certainly do hope you *bought* and like so much that you buy two or three more copies as spares or to give away!

Hey, at least I make you laugh. Aristotle just makes you cry (for those that have ever gritted their teeth and tried to read their way through him).

This doesn't sound particularly learned, so most Philosophers – capitalized to indicate that they are Professional Pundits as opposed to the more casual kind – know better than to precisely state *any* of their premises, let alone *all* of them¹⁴. Not even Hume was this foolish in his *own* dialogues or other explorations of reason and its limitations.

Almost without exception, Philosophers subsequent to Hume have (perhaps, sometimes, maybe) paid homage to Hume's demonstration that one cannot use deduction and/or induction to obtain certain knowledge about anything at all and then have proceeded to use deduction (often in the company of all sorts of implicit induction) to arrive at "certain" conclusion after "certain" conclusion, never openly admitting that these conclusions are devoid of any sort of *logically necessary* relation to the real world.

The one exception to this rule (with which I am familiar – although exceptions may well be as common as dirt these days and I might well not know it) appears to be Bertrand Russell, who unsurprisingly was as much a mathematician as a philosopher, and whose lovely book *Problems in Philosophy* is still today one of the most perfect deconstructions of the philosophical process ever written. Even Russell, however, fails to openly acknowledge the importance, and arbitrariness, of axioms in this work, and while he actually writes down in his chapter on induction statements that are very nearly the axioms used by Cox to derive a *formal system* of plausible reasoning he does not pursue them.

This book will spend considerable energy exploring one of Russell's most important contribution to mathematical philosophy because it is entirely relevant to the process of arriving at an axiomatized theory of knowledge. This is his work on the paradoxes of set theory and self-referential statements, which culminated in the formal derivation of *Gödel's theorem*. Logical systems of sufficient complexity have certain – *problems* – that are extremely relevant to both my self-referential arguments above and the following question:

How can we best choose our axioms?

The short answer is that in order to choose axioms out of an *infinity* of possible axiom sets, we, uh, need *axioms* to help us ordinally rank axiom sets so some are "better" than others (let's call axioms about axioms *meta-axioms* to help us keep track). Which axioms should we use to ordinally rank systems

¹⁴Unless they are mathematicians or logicians, who are generally painfully rigorous, but who also know better than to assert that their conclusions necessarily and unconditionally apply to the real world.

of meta-axioms? Well, we need meta-meta-axioms to help us with that. We in fact need an *infinite chain* of meta-axioms, meta-meta-axioms, and so on to tell us how to choose the axioms to choose the axioms to choose *our* axioms that we're going to use as the basis of a system of knowledge that might, just might, be relevant to the real world. Alas, neither I nor you would have the patience to write out or follow all the meta's, and I couldn't afford the infinite amount of paper required to print out an actual proofreading draft of the book so it would never get published.

For better or worse, this book will therefore *break tradition* with earlier works on philosophy in two ways. One, it will do its very best to actually write down *a* set of meta-axioms and *a* set (maybe even more than one) of fundamental axioms one might use to reason about the real world. In a nutshell, it will introduce a sort of a sloppy "measure" on an imagined "space" of all possible axioms and come up with some criteria for ordinal ranking axiom sets intended for use as the basis of a worldview drawn from that space. It will all be very sloppy because there isn't any point in *not* being sloppy. Hume realized, correctly, that there was no *bedrock* upon which to build an epistemology describing the one Universal ontology so we're working to build a foundation that will hold up in a satisfying way on the *sands of epic uncertainty*, one that has to be able to shift and change with the tides and winds of human experience and experiment.

This may come as a disappointment to those that wish to pretend that *their* beliefs are *certainly true*. They may or may not be true, but they can never be *certain*. However using uncertainty itself as a basis for human epistemic knowledge may prove to be enough to help mankind *keep its balance* and reason well about everything that matters, even when we have just shown, fairly convincingly I hope, that reasoning "about" the real world can never lead to truths more certain than the *uncertain* premises upon which the reasoning process is founded.

Chapter 3

Doubt

Socrates – And surely this instinct of the dog is very charming;—your dog is a true philosopher.

Glaucon – Why?

Socrates – Why, because he distinguishes the face of a friend and of an enemy only by the criterion of knowing and not knowing. And must not an animal be a lover of learning who determines what he likes and dislikes by the test of knowledge and ignorance?

Now, if you’ve been paying attention you *should* now be intellectually poised above a Pit of Existential Despair (PED). This is deliberate.

However, there is a distinct possibility that you are instead going “huh” and scratching your head, when you are *supposed* to be dangling out there screaming at the glimpse of Philosophical Nothingness that underlies All Things. This won’t do. So permit me to get out the block and tackle and tie this rope around your feet – there, comfy now? Now – mmmph – we’ll just crank you up and swing you out over the PED, hold on to your loose change and try not to lose your eyeglasses and cell phone, if any. There. Now look up – errr – down.

We’ve just learned that hundreds of years ago David Hume made the observation that one cannot deduce anything about the real world without making assumptions that cannot themselves be deduced; they must be inferred from making observations about the real world. Unfortunately, the process of inference cannot be deduced either, nor can induction be induced. To this I’ve added the observation that even “math-y” things that one usually thinks of as being “deductively pure” and hence knowable as absolute truth are in fact deduced

from a set of assertions, called the axioms of a theory, that cannot themselves be proven.

So what's left? We cannot know anything epically certain about the ontic world. We cannot even know anything "certain" about math! If we change the axioms of, say, plane geometry we might end up with *curved* space geometry. In plane geometry one can prove that the sum of the interior angles of a triangle is *always* π radians. In a geometry on a curved surface one can prove that this is generally *not* the case, that one recovers the plane rule only in the limit that the surface becomes flat.

Which one is "true"? Either? Neither? Both?

For a brief, dizzying moment, it seems like we know *nothing*! Forget *difficult* questions, like whether or not *God* exists. It seems that even things we have always taken for granted, such as the objective existence of the *book* in which you're reading these words¹, are not *certain* to be true or *unconditionally* true. Suddenly you've just had the legs kicked out from under *any possibility* of finding *definitely true* (or false) answers to *all the questions that you hold most dear*, no matter what they are. If Life is going to have any reason, you're going to have to find a way to put that reason there yourself, because *nobody else* knows anything more about how everything works than you do – and you don't know much!

Ah, you catch a glimpse of the bottom of the pit, with its waiting demons of despair and confusion? Stop that whimpering! I'm not going to drop you in. In fact, the purpose of this whole work is to *fill in this pit* so that it is no longer lurking as a trap beneath your every step in life. But first we have to *face* the pit and even *embrace* the pit. So life is uncertain, and your worldview woefully incomplete, what else is new? Truth be told, you already *knew* that and have always known it. But is it really true that we know *nothing*, that *everything* is contingent, doubtable, insecure?

To banish the PED forever from your life, you will need at least one sure thing, one thing that cannot be doubted, one thing that is clearly, without question *true*. Once that one true thing is found, you can *choose axioms* that will permit you to conditionally extend your knowledge and *fill in the pit*.

So where can we find that one true thing? To answer that, we think back to our discussion of deduction, we concluded that if the premises of a well-formed deductive argument are true, the conclusion cannot be *doubted*. Doubt

¹Funny, that, since in the time since I wrote those words the probability that you are, in fact, not reading these words in a (paper) *book* at *all* has substantially increased and are very likely *not* to be true...

describes a state of *uncertainty*. It describes our degree of belief, with certainty of truth or falsehood being the opposite poles where doubt vanishes or becomes complete.

Let us, then, follow in the footsteps of René Descartes² and use doubt as a *tool* in our quest for truth.

Descartes, as you probably know, was in some sense the “father of modern rationalism”; indeed, we are all *de facto* cartesian rationalists even though, as we’ve seen above, rationalism itself is *fundamentally irrational*. Descartes made many important contributions to mathematics, to the birth of “natural philosophy” (science), and to philosophy proper. He (like Hume) was a giant of the European Enlightenment and we are all immensely in his debt, for all that most of his philosophical conclusions were *wrong*.

One, however, was very right indeed. Descartes, like all humans that are smarter than a piece of lawn furniture, had moments of youthful rebellion and existential crisis that fueled a desire to discover the truth of all things. He ran away and joined a mercenary army (Europe at the time was an eternity of warfare) to see the world and look for his own personal way out of the PED. Early on, he met one of the early natural philosophers (a.k.a. “scientists” or “alchemists”), one Isaac Beekman.

This meeting gave him a purpose – the development of a reason-based philosophy – that he was to pursue for the rest of his life. In a dream he invented coordinate systems and analytic geometry, then worked on the application of coordinates to the development of mathematics and physics and a natural philosophy where all things, including God, were known with the *certainty* of deductive mathematics.

To achieve this goal, he began his most famous philosophical exploration, based on *methodological skepticism*, to arrive at a wonderful conclusion. Let us apply this method to ourselves.

Just for the moment, pretend that you don’t know anything at all. This should be fairly easy, given our arguments thus far. *Doubt everything!*

Did man really land on the moon? Maybe, maybe not. Maybe it was all done in Hollywood. You remember the sun rising yesterday – does that mean it really happened? Not necessarily – perhaps your memory is one of a dream or hallucination and the yesterday you recall never even happened. Do you know the sun will rise tomorrow? Well, it hasn’t happened yet. The sun might well

²Wikipedia: <http://www.wikipedia.org/wiki/Descartes>.

explode before tomorrow and transform the earth into a puff of white-hot plasma.

We actually find it easier to doubt all this than Descartes did, because we've had the advantage of reading books, seeing movies that vividly portray the doubtability of the objective reality of that which we perceive with our senses, or remember, or imagine. Our senses can be fooled or mistaken. Our memories are even more fallible. Our imagination, even of things such as mathematical truths, has a kind of an ephemeral quality and besides are always contingent truths at best.

For example, in James Gunn's *The Joy Makers*³ we are shown a world where humans are cocooned by a vast computer charged with making humanity "happy", which it manages by completely controlling their sensory input. This kind of theme was reprised in the *Matrix*⁴ movie trilogy, where Neo is awakened from a "reality" that turns out to be a computer simulation. Three movies later, it isn't clear that the reality he's been awakened to is all that real either.

Working a bit harder, Descartes, too, eventually decided that he could doubt just about everything. He could doubt that which he saw, smelled, tasted, heard, felt, because sometimes a dream has the force of reality but turns out to be a dream. He could easily doubt his memory, as it is fallible and deceiving. As he considered each thing that he thought that he knew, he discovered that he could doubt it – everything but one thing.

When Descartes attempted to doubt his *own* existence, he ran into a bit of a problem. It was impossible to divorce the *act* of doubting from *something* that was doing it. Try as he might, Descartes couldn't doubt the existence of the doubter unless he existed to do the doubting. He had found one true thing: *He existed!*

You too, have this *same* true thing. Perhaps you are "a unit in the Matrix". Perhaps the Universe is all an illusion. Perhaps you were created only yesterday by a powerful and malicious mad-scientist complete with a full set of memories of an apparent past, and that same scientist plans to terminate the experiment in the next five minutes. However, as you muse about this, as you consider alternative hypotheses that might explain whatever it is that you are feeling and remembering and seeing, it is impossible to deny that *you* are there doing the feeling, remembering and seeing.

Descartes summarized this with his famous "I think, therefore I am". Although it should be carefully noted that this isn't quite the same thing as "I am

³Wikipedia: http://www.wikipedia.org/wiki/James_Gunn.

⁴Wikipedia: http://www.wikipedia.org/wiki/The_Matrix.

doubting, and therefore existing”, it *is* a catchy little sound-bite⁵.

Thus far, Descartes has, through his doubt, achieved Enlightenment-era agreement with one of the *oldest* of reason-based philosophies, the one underlying *Hinduism*, and so have we, riding along. He has discovered the *Atman*, or Self, as an undeniable “truth”. In Hinduism the Atman is that thing which sits “within” each of us⁶ and has the essential existential property. It Is, with a capital I. To the entity *experiencing*, the experiencing itself is *ontic*, *not epic*!

For convenience, in the rest of this work we will refer to the self-that-cannot-be-doubted, the thing-that-is-existing at the heart of all of our sensory experience, memory, and mentation, as the Atman in deference to the *truly* ancient and nameless philosophers who first conceived it and wrote of it and to differentiate it from Descartes’ homunculus as his speculations concerning the latter were not terribly good or useful.

Let us spend precisely one paragraph on existence, because philosophers great and small have wasted much breath on the idea, deciding whether existence is or isn’t a predicate and just how existence factors into logic and ontological arguments. All of it *bullshit*, mind you. We will not worry about existence as a *property of things* because so far there *aren’t* any things, at least things that cannot be doubted. There is only one Thing, neither material nor immaterial, the Atman (of each of us – so far I can doubt that you, dear reader, *exist* just as you can doubt that *I* do). That the Atman is *existing* cannot be doubted by the only thing that gives a rat’s ass about “existence” or is capable of doubt in the first place – the Atman itself, and e.g. Russell’s objections to the “I” in the statement, or objections to its logical or set theoretic validity are simply irrelevant (and, frankly, mere sophistry).

This is the *one point* where Descartes and Hume *agree*. There is no possibility of doubting that you (whatever “you” may turn out to be) are *experiencing* the sensory flow of your instantaneous awareness. This is an *ongoing empirical truth*, not a logical deduction, and indeed it is the *only* empirical truth that is beyond all doubt. We can even leave the role of “doubt” behind. At any instant that we are *Self-aware*, as long as our Atman is *perceiving*, we exist and any attempt

⁵Especially in Latin: *Cogito, ergo sum*. Fairly drips with erudition, that.

⁶Where Hinduism does not in truth ascribe any particular location for it, and indeed in some of the Upanishads great pains are taken to indicate that it is only *in* the Atman that things like East, West, North, South, Up, Down, Past and Future (the orthogonal directions of four-dimensional space-time it should be duly noted) take meaning. Descartes referred to this “observer” as a *homunculus*, and it is an important, if contentious, concept in the theory of cognition and self-awareness.

to assert the contrary may be *logically* permissible but is just plain *stupid and inconceivable and obviously false* to the conceiving mind making the assertion. We may not know what we *are*, but we know that we are not *nothing*, quite independent of whether or not we choose to associate a semantic epic *symbol* such as “I” with the non-nothingness of our ontic *experiencing*.

We can now use pure reason to deduce a tiny handful of related truths that (as is always the case with logical deductions) are little better than restatements of the obvious. We’ve already just made one of them; here is a short list of it and other corollary truths associated with the empirical truth of the Atman, stated as you should read them in first person, as they are *true* only to the perceiving mind that is *reading* them:

- I exist.
- Nothing does not exist.
- Something exists.

Hmmm, pretty trivial. Note well that these are not *deductions*. They are all equivalent ways of viewing or stating our one empirical truth. It is nevertheless useful to understand what each of these statements *means*.

“I exist” should already be clear. If you are reading these words, musing on what they mean, thinking, imagining, dreaming – if you are doing anything at all and are aware of the doing then you exist as an awareness even if you are mistaken in all other respects about the true nature of that which you are thinking *about*. The Atman is, even if all else is illusion, because the Self cannot experience an illusion without being.

“Nothing does not exist” is less clear. In set theory one could equally well say that nothing *always* exists, as one can view any non-empty set as the union of that set plus the empty set (nothing). We might think of nothing existing everywhere and everywhen *along with* something. We need to clearly identify the correct meaning implied by the certain existence of at least one thing. Let us make the following two mutually exclusive, and universally sweeping propositions. These are really serious metaphysical statements, mind you – I’m not talking about any finite or embedded versions of them.

1. No thing exists.
2. Some thing exists.

By the former I am asserting that no “thing” has objective being of any sort whatsoever. I don’t mean that there is an immense emptiness, waiting to be filled because that emptiness then has being. I don’t mean the “empty set” in set theory because the empty set is still a set (a epic noun-member describing something in an imaginary ontology with an associated set of set-theoretic predicates). I mean the *null* set, the statement that *no set theory exists*, the epic idea that there is *no* Universe, filled or empty, *no* ontology. There is *nothingness*, nowhere, for no time. I mean the Void of absolute non-existence.

So when I say that nothing does not exist, I’m asserting that my own existence is sufficient to prove that that the absolute Void of utter nonexistence is not, in fact, the case. *Something exists* (our third version of our one certain truth listed above), something that is not less than my ongoing stream of self-awareness. Given the dichotomy between absolute, “Universal” non-existence (a non-state in which yes, the proposition itself could not be formulated as it is the *lack* of all epic semantics and ontic realities, be they matter, energy, mind, whatever) and one where “something exists”, well, we’ve formulated the proposition and are *thinking* about it because *we exist* and we are *something* and so nothingness, the ultimate Void (and hence the mutually exclusive alternative to existence), does not.

The Atman serves to *perfectly fill* the *Pit of Existential Despair* in the here-now of each being’s self-aware existence. No matter what your doubts about the world, about its or your own reason for being, you have a place to metaphorically stand, a fundamental empirical truth. You Are.

But honestly, you already knew that. You’ve known it for as long as you’ve known *anything*.

Take comfort in that for a moment. Relax, go get yourself a beer or glass of water, maybe have a snack. Take a walk. Enjoy a few moments of quiet pleasure – even if we eventually conclude that the world is all an illusion, a dream, the Universe isn’t *nothingness*, isn’t a *Nulliverse* – at the very least the dreamer exists.

We now pause for three stars of time while you get that beer.

* * *

All set? Doesn’t philosophy go down better with a beer⁷ in your hand?

Then let’s continue. *I exist* without doubt or question (you should be thinking as you read this). What about everything else? How do I get from knowledge

⁷Root beer, in the case of precocious but underage readers...

of “just me” to where I can have some degree of confidence that the beer I’m drinking is *real* and not just a dream, an illusion, a simulation being generated by an Evil Supercomputer and sent to a Unit in the Matrix?

The answer is simple. We have to start to make assumptions, assumptions that build a bridge between our Self and the outside world. We must always keep in mind that from *this point on* our assumptions *might be incorrect* – they are *doubtable*. We will not *know* that they are true, so we will have to *believe* in them.

But how can we know *what* it is *best* to believe? Drumroll, please...

We should believe the *most* whatever we can doubt the *least* when we *try our best to doubt*, given the sum total of our life experience and the rest of our consistent, doubt-tested beliefs.⁸

You can now see the object of our earlier exercise in doubt. Certainty is perhaps the greatest single enemy of reason in the context of the existential Universe, because we have shown above that one of the *few certain*⁹ *truths* about the Universe is that we cannot be *certain* of almost anything. You can also see why most of the worldviews held by the people of the world are so screwed up. Most people are taught to believe a certain set of epic propositions *without* doubt (a set that varies from culture to culture, family to family, even person to person within a family) and hence they end up believing things that aren’t just “doubtable”, they are absurdly unbelievable, far away from the least doubtable set we as a species have worked out so far.

In this we have a rule that will function as the lever that helps us move, Archimedes-style, the ponderous weight of our epic worldview (whatever it might be) from its current, probably highly non-optimal, easily doubtable position in belief-space to (at the very least) a *better* position, once we get the hang of this doubt thing. Our next chore, then, is to derive a semi-quantitative *algebra of doubt* that permits us to *ordinally rank* degree of (dis)belief in any given proposition. Amazingly, this provides what is arguably the *best possible path* from Descartes’ doubt and Hume’s skepticism to a well-founded knowledge of reality.

⁸Here is is: the punchline of this book. You can stop reading now, unless you either need to be convinced of this or are interested in how it all works out. This one line is a very pithy statement of the Cox axioms, or perhaps even *leads* us to the Cox axioms. What? You don’t know what the Cox axioms are? Maybe you should keep reading after all...

⁹But unprovable...

To work out this path we have to do a bit of math-y reasoning and we need a bit more insight to guide it. In other words, although we've already made good progress with the sound-bite above, we've got a bit of work to do before starting to explicitly formulate the meta-axiomatic basis for the best possible worldview in a more quantitative way. We have to meditate for a bit on the experiential data stream that "is" a significant part of our being to refine some of the critical insight we've already begun to accumulate on the actual problem to be solved. Then it seems pretty important to expand on this idea of a *worldview*. But we'll get there! Let's get started!

Chapter 4

The Cave

If real is what you can feel, smell, taste and see, then 'real' is simply electrical signals interpreted by your brain. – *Morpheus*, in “*The Matrix*”

You exist. You, as Atman, cannot doubt your own existence without existing. It may not be terribly clear at first what “you” really are, but don’t worry too much about it – no *epic* answer that can be framed in symbols such as words seems likely to be complete or correct. You are an *ongoing ontic process*, after all, and the “you” that read the beginning of this sentence is already gone, lost in the doubtable past of the “you” that is reading *this* word in the now, now, now of your instantaneous awareness.

As you sit there reading, still in a state of doubt-shock from the process of denying the possible objective reality of pretty much everything *outside* of yourself, we can at least hope that certain questions float to the top of your awareness. In case they don’t, permit me to help them along. Here’s one:

If all I’m certain of is that I am, what is all of *this other* not-me stuff that *appears* to exist?

The correct answer, if you think about it, is that “all of this” is pretty much entirely a *sensory stream of information*. Let’s break down some named components of your awareness. You are aware of some mix of:

- Seeing
- Hearing

- Feeling
- Smelling
- Tasting
- Thinking

Some *part* of those sensations have a certain “intensity” that you have associated up to now with an *outside world*. As you read this book, you experience a very powerful and immediate *ontic* sensation that you interpret as sight, an experience that is highly structured and that visually carries symbolic *epic* information that you may well be “hearing” inside your mind in a way that is less intense than *real* sounds you are hearing at the same time.

Some of those auditory echoes loop back still further. If I suggest that you imagine a “red, red rose” you *see* the words on the page, *hear* them in your mind, and *visualize*, if only for a fleeting moment, an appropriately red rose. Perhaps the words trigger a *memory* of a real red rose you’ve seen, evoking a variety of sensory impressions that again are less intense than those you are experiencing *now* but may be more intense, or more specific, than a “generic” imagining of a red rose.

There are some mysteries associated with this process. Your Atman seems to have volitional control over your immediate sensory stream. By “willing” in certain ways, you can create impressions of external things you identify as parts of “your body” moving around as you direct them to, and your sensations respond accordingly. For example, your visual field and auditory sensations and tactile impressions vary as you reach for your beverage, and your taste and smell kick into play as you take a sip and flavors explode into your mouth and nose. All of this creates the *compelling impression* of an objective external world with spatiotemporal persistence and continuity.

Yet throughout all of this motion and sensation “you” in some sense remain unmoved, watching, listening and experiencing the *sensation* of motion and action and touch and taste as the sensory parade unfolds. You many or may not be the center of or all of the actual, objective Universe¹, but you are the absolute *center* of and *all* of of your subjective experiencing of the Universe. And hey, you might even be at the *actual* center, given that *every* point is in the middle of an infinite Universe!

¹Which, recall, we are now *certain* exists, and consists of *at least* ourselves.

This sensory stream is “true” – ontic – in that it is a part of your own immediate truth. You can doubt that the apparent *objects* of your senses are really there, but it is quite impossible to disbelieve in the reality of the sensations themselves.

Your sensations (including your sensory memory of *former* sensations and anything else that sums up to “thinking” in the list above), in addition to being a large fraction of “you” as an ongoing ontic “something that truly exists”, are also in fact *epic data*. They are information. It is the job of your Atman to make *sense* of that data. Unfortunately, it is not as easy as it looks, especially since you’ve agreed to doubt things until you make a personal decision as to what can sanely be “best believed/least doubted” regarding the ontic reality those sensations and thoughts seem to represent. Let’s see why.

It is easiest to see why the Atman might well be mistaken about almost anything associated with the senses if we go over the *Allegory of the Cave*² as written by Plato. The following is a modest adaptation of the cave in the half-remembered words of *my* teacher, George Roberts, who was a disciple of Bertrand Russell and *my* primary guru in undergraduate philosophy back in the 70’s at Duke. Note well that my version is a bit embellished (as was George’s) to better illustrate the essential point I wish to make – I’m a storyteller, not a historian.

Imagine a cave inhabited by prisoners who have been chained there since birth, fastened into infernal devices that only permit them to see the blank cave wall in front of them. As sensory input is a major concern here, we can imagine further that their sense of touch is for all practical purposes deadened by immersion in an immobilizing gel bath held at a uniform temperature. They wear filters so that they cannot smell. They are fed intravenously. They experience through their senses what we permit them to experience, no more, no less.

Behind them there is a raised platform and a light. As objects are carried back and forth on the platform, the shadows of these objects are cast onto the wall before them and are all that the prisoners see. Voices from those that carry the objects and sounds that the objects might make while being carried are reflected off the wall so that they too appear to come from the shadows thus cast. The prisoners chatter back and forth (where we needn’t examine too closely how it is that they end up with a language for chattering in) trying to make sense of that which they see.

Some objects cast very similar shadows, so they are given a common name by the prisoners. Some objects are always carried by in the company of other objects

²Wikipedia: http://www.wikipedia.org/wiki/Allegory_of_the_cave.

or always are associated with certain sounds (the sound of being dragged down the platform, for example), and so relationships between the objects themselves, or between the objects and certain sounds, are inferred. The prisoners concoct elaborate theories to describe their little “world view” and get into violent disagreements when their conclusions differ, even though they are oriented in such a way that none of them sees exactly what the other prisoners see. Fortunately, no prisoners are injured in these “violent” disagreements as they are, after all, confined – the disagreements are strictly verbal³.

Leaving aside in its entirety from this point on *Plato’s* purpose in introducing the allegory or the rest of the story (which has little to do with this book) let us examine just one question – what do these prisoners “know” and how do they know it? There is such a wealth of things to learn from this simple example that it is difficult to know where to begin.

First of all, it is clear from the way the allegory is set up that nearly everything that they *think* they know is mistaken. *We* are gifted with a bird’s eye view of the whole scenario as created by these words, so that you are able to note that there are actually three different objects that cast circular shadows being carried back and forth. One is (for example) a large black wheel being rolled along that is used on tractors, one is a giant spherical inflated weather balloon being floated along on a string, and a third isn’t round at all – it is the housing of a complicated generator and only accidentally has a round projective cross section if it is carried across in one orientation.

Yet the *prisoners* name all three things with the *same word*. They see the *same* generator housing being carried by in a different orientation and name it something altogether different. They are effectively blind to the color, the true shape, the density, the function, the texture, and the smell of the objects – most of the relevant properties of those objects have been “erased” by the process of casting only a projective view of them on the wall: their shadows. Even the beliefs of the prisoners concerning the sources of the noises are incorrect, as the track is oriented in such a way that the real sources of the noises (the people carrying the objects, the carts and so on that they drag them through with) are invisible even as a shadow. The squeaky round becomes a female round seeking a mate – a silent round is hunting, the round that makes grating noises is a male, clearly.

The shadows cast on the wall are not real objects, they are only projective images. Yet they are the only *experience* of those objects, or of objects of any

³Would that human beings in general were so fortunate.

sort, that the prisoners have ever known! Our prisoners are imprisoned by their bonds to be sure, but they are even more tightly bound by the restrictions we have placed on their sensory input. Their visual field is restricted to where binocular vision is of no use to them and it is very doubtful that they have any visual concept of depth. Their visual universe is two dimensional, and there is little reason for them to believe that a third even exists.

Roberts used to present the Cave along with an allegory of his own to reinforce the point. Imagine Adam on the first day of creation⁴. God⁵ has created him, but he is a *tabula rasa*, a clean slate with absolutely no experience of the world into which he has been created. Again we imagine that he somehow has a language in terms of which to reason and further, we will imagine that he is brilliant and has at his fingertips the entire range of mathematics and logic – no point, however subtle, can avoid his deductive powers for more than a few seconds.

What can this Adam tell about the world into which he has been inserted *before he opens his eyes*? The answer, I think you’ll agree after a tiny bit of deductive meditation yourself, is *nothing at all*. Before he opens his eyes (and the rest of his senses) and sees, smells, feels, tastes and hears the world, he cannot tell if that world is one dimensional or ten – he “knows” all about N -dimensional spaces and manifolds flat and curved, but there is no reason for him to expect a 3+1 hyperbolic space plus time as opposed to (say) a 7 dimensional flat space with two time dimensions (or any “space” at all). Adam is confronted with the fact that there are an *infinite number* of possible Universes he might have been created in – even as he rejects a still greater infinity of possibilities that could not sustain existence or that are internally logically contradictory. The particular one he is in is *infinitely unlikely* to correspond to any consistent guess he might make. He quite correctly concludes that he simply can’t tell even *one thing* about the Universe around him without *opening his eyes*.

Even if Adam somehow guesses from analyzing his *own* thoughts that he is embedded in an $SO^+(1,3)$ spacetime and correctly concludes that the Universe must be quantum mechanical instead of classical in order to have persistent structure, he’s still stuck. The *Universe* might consist of an infinite set of these space-times, each with similar structure but different initial conditions, some of them might be somehow coupled and have differential entropy so that “magic” is possible, and there could still be any of the more exotic possibilities his super-powerful mind can conceive similarly conjoined to his space-time with an outer

⁴Or a newborn baby, or – to anticipate one of the favorite models of E. T. Jaynes – a self-aware supercomputer robot.

⁵Or Mom and Dad, or a really smart computer scientist.

product.

Of course God has to have created such an Adam with a powerful urge to try to answer the question in the first place. Otherwise, without anything to see, without anything to think about, with no memories of prior experience there can be no *change* in Adam's state – he cannot even deduce the existence of *time* unless he was created with a memory of *something*, as change can only be perceived in our *thoughts* by comparing a memory of one moment to the perception of the next. This Adam would never *think* (over time) as there is nothing in his mind to *think about*.

The moral of this story is that there is *no logically necessary connection* between *any complete axiom-based epic theory one might propose and the actual ontic Universe!* This parable is then yet another (independent) demonstration that any philosophical theory that asserts otherwise is *bullshit*, simply because there is a disagreement in *number* – there are infinitely many *possible* Universes that Adam might have come into being within, but only one *actual, real, ontic* Universe⁶ in which he *does* most certainly exist as he learns whenever he tries to doubt it. Without *data* in the form of experience, however projective and incomplete, there is no way to tell *a priori* **which** possible Universe is the *actual* one he exists within, nor to restrict the nature of the cosmos one happens to be in in *any way* other than requiring e.g. consistency in the sets of epic propositions one considers to describe it, as we later shall insist on doing.

The allegory of the Cave can be carried to even greater extremes, and has been in a number of fictional works, notably *Flatland, a Romance of Many Dimensions*⁷ by Edwin Abbott. As already noted, we can include *The Joy Makers* by James Gunn⁸ in the set, and of course the Cave is very much the basis of the *Matrix* film trilogy⁹. Let's think about these three examples (all highly recommended reading, or watching).

In *Flatland* the consequences of living in a two dimensional manifold (plus time) that is, in fact, embedded in a three dimensional manifold (plus time) are explored. The theme of the Cave is clearly echoed as a two dimensional being struggles to make sense of the projection of a three dimensional being that can

⁶By definition, recall. We carefully excluded multiple Universes in the first chapter as contradicting the meaning of the world Universe, and one trivial way candidate Universes we might consider can differ is that there could be an infinite number of individual *disjoint cosmoses* (cosmi?) arranged in an infinite number of ways.

⁷Wikipedia: <http://www.wikipedia.org/wiki/Flatland>.

⁸The Joy Makers is out of print, but can still sometimes be found in used bookstores.

⁹Wikipedia: http://www.wikipedia.org/wiki/The_Matrix.

apparently travel through walls and appear and disappear at will, who can be heard even when it is literally out of the (two dimensional) world.

Naturally, at first this is *extremely disturbing* to the inhabitants of flatland – black magic, violations of causality (as they see it), miracles – it simply appears senseless to them at first because it is so outrageous and beyond their experience. However, as time passes a few flatlanders come to *mathematically* grasp the truth, and one of them is even forceably “uplifted” to live henceforth as a three dimensional entity.

This is a version of Plato’s cave where the prisoners *live* on the two dimensional wall of their mental cave, where the bemused philosopher in three dimensions comes to try interact with them and ends by freeing one. Indeed, it works both ways – lineland and pointland are successively more constrained, but all unite in doubting the existence of the higher dimensions where (we see from *outside* the story) reality actually dwells. Even the three-dimensional being who can clearly see the succession of embedded realities of lower dimension cannot fathom how he could live in a sub-reality projectively embedded in a *true* reality of higher dimension.

The point in Abbott’s tale is that this three dimensional being, blind to a four, five, or six dimensional space (plus one or more time-like dimensions) in which he or she may be embedded, is *us*¹⁰. That’s why we carefully defined the Universe to be *different* from the space-time continuum we seem to live in; so that Abbott did not live (and write) in vain! We may or may not ever be able to obtain any evidence in our own Cosmos of a dimensionally greater Universe (in part because the Universe may or may not *be* dimensionally greater!) but we need to keep *open minds* about this and not assume that the part of the Universe that we seem to perceive is all that there is.

The Joy Makers, in contrast, isn’t a mathematical moral tale but is rather a classic of speculative science fiction with human characters and a complex plot. In it, hedonism becomes the ruling *ethos* of society, to live for pleasure the greatest good. Unhappiness is quite literally outlawed.

Since work is unpleasant, society automates more and more, delegating the work that still needs to be done to machines operated by intelligent computers. Since it is unpleasant to be frustrated in one’s desires, neuromechanical interfaces that can simulate reality to any precision desired are developed and operated by a massive controlling computer to deliver the precise realization of every indi-

¹⁰More so than you might imagine. Some of the serious candidates for a Theory of Everything in physics require a *minimum* of ten or eleven dimensions...

vidual's immediate desires instantly (while caring for their otherwise immobile and irrelevant bodies). They in fact *live in Plato's Cave* with computers controlling what they perceive in a sort of direct-connection "massively multiplayer role playing game"¹¹ virtual reality in which no truly bad thing is ever permitted to happen to them and which in no way reflects the supposed *real* "reality" in which their bodies and the controlling computers reside.

The Joy Makers proceeds through three short novellas to a macabre conclusion. The sentient computer that generates and controls the pleasant dreams of the dwindling population of the world is forced by the protagonists of the third novella (who seek to escape the bondage of perfect hedonism and live a "real life") to realize that it too is a "living being" and subject to the law requiring it to be happy. Ultimately the last humans escape the bondage of illusory pleasure as the computer realizes the satori that only way to avoid the pain of its *own* life is to seek out the cessation of that pain in its *own* prolonged amusement leading to death.

However, the book's protagonists can never be *sure* that they have "won" and actually escaped in the end. Naturally they wished strongly to win, and the computer is programmed to provide them with the *perfect illusion* of having fulfilled their strongest desires. Did they *really* win, or did the computer simply concoct for them a simulated reality where they *appear* to have won and where even their transient pains and unhappiness are permitted only to provide them with the greater satisfaction of an imagined victory? It is, of course, *impossible for them to ever tell!* The moral of *this* story (to us) is that we can never be certain that our sensory stream, however well it seems to correspond to an external reality, is indeed congruent with that external reality. At best we can conclude that it is *improbable* to be wildly different, or that it is best to believe that our sensations correspond to reality unless and until given some reason to believe otherwise.

The Matrix movie series righteously rips off both Plato's *Cave* and the world-as-virtual-reality theme from *The Joy Makers* and extends them across *multiple layers of supposed reality*. Neo (the anagrammatic main character) is living a perfectly normal life in a perfectly normal city in a perfectly normal society – on the surface – but he has odd dreams. One day he chooses to be "awakened" and discovers that he has really been a thermodynamically unlikely biological power unit in a vast machine and that the "reality" he has known his whole life is just a collaborative simulation wired directly into his brain. However, as

¹¹Wikipedia: <http://www.wikipedia.org/wiki/MMRPG>.

the story unfolds (over three movies) it gradually becomes *equally* clear that the new reality he has been “freed” into is *no more real* than the one he left. It *too* is some sort of projective simulation and exists, ultimately, only in the mind as a sensory stream in interaction with whatever constitutes Neo’s “self”. If we need any further irony, we can always take note that the whole story is a *movie*, creating yet *another* level of sensory reality in *our* minds.

The common theme to these diverse examples is that even though we can never doubt our own existence, we are *all, always*, “prisoners in the cave”. What we “see” with our senses might or might not correspond to an actual external reality. Perhaps what we perceive is only a projective simulation, shadows cast on the wall of the cave of our senses, generated by an external intelligence (godly or diabolical as you prefer). Perhaps they are simply the result of natural laws, where important things happen in the dimensions we cannot “see” in a larger Universe in which our particular space-time continuum is merely an embedding. Perhaps our space-time continuum is all that there is, what we see is what we get. Either way, the shadows cast on the walls of our personal caves and our ability to reason are *all we have to work with* if we wish to generate the best possible worldview, make the “best possible guess, given the data” and make it our contingent, consistent, least doubttable knowledge.

The well-read reader – one who has for example read Michio Kaku’s *Hyperspace*¹² or is otherwise passingly familiar with e.g. quantum string theory or the question of hidden variables in physical theories in general – will recognize that these are not *idle* speculations, they are perfectly permissible conjectures in real science. Indeed the entire history of Natural Philosophy (science) since the Enlightenment has largely consisted of figuring out how to look beyond the narrow limits of our biological senses with e.g. telescopes and microscopes and controlled experiments to untangle some of the projective magic of our mundane experience.

At this point, it should be clear to you that constructing a set of axioms to apply to your sensory stream so that it can “make sense” to you is *obviously* a process that has no unique solution. There are infinitely many ways to explain it all, and so far we have *no way of choosing one over the others*. You can *freely* choose to be a paranoid and believe in an evil genius joymaker or to be religious and believe in a benevolent omnipotent diety and *given the right axioms* no one can prove you wrong. You can choose to believe that you *are* the evil genius, and that you are actually dreaming up everything you perceive, and no one can

¹²Wikipedia: <http://www.wikipedia.org/wiki/Hyperspace>.

prove you wrong. You can choose to believe that everything is just as it seems, and that the book you appear to be holding is just that – a real book, located in a single real space-time manifold that is pretty much *is* the Universe – and no one can prove you wrong.

But which of these notions (or the infinitely many more notions one can imagine that differ in details great and small) is *right*? We do not know for certain. We *cannot* know for certain, *ever*.

If you began reading this book completely certain that Jesus is Lord as an *epic assertion of knowledge*, you may or may not be mistaken in the objective ontic fact but you are absolutely certainly mistaken in your *certainty*. You may choose to believe it (with or without good reason – this is one thing discussed later in the book); you cannot be *certain* because the epic is not the ontic, the epistemological map is not the ontological territory and can *always be mistaken*!

On the other hand if you wish to assert that the success of a mechanical view of physical science proves that there is no God, you, too are incorrect. You may believe it very strongly, but you cannot be *certain*. Even after we develop meta-axioms that lead us to what is arguably the *best* worldview those very axioms will *necessarily* preserve this uncertainty, because it is intrinsic – our seat in the cave provides at best a tiny projective view of a Universe, and the view of the *whole thing* could be different, even startlingly different, from what we imagine based on the shadows we can see. We may find that reason has some things to teach us about certain models of God, but ontic reality is what it is at the *tautological* level and we cannot even be guaranteed that it obeys epic laws and epic logic per se at all! Reality is the standard of truth, not descriptions of or arguments about or models of reality.

Let us take a *very important lesson* from this! Since we – none of us – can be absolutely *certain* that our beliefs about the shadows cast on the walls of our personal caves are correct, it would be a *really good idea* to develop a certain amount of tolerance – and intolerance – for the freely expressed beliefs of others¹³. Tolerant because we ourselves often cannot be certain that they are *wrong*. Intolerant of assertions of certainty or beliefs derived from inconsistent or contradictory propositions and in poor agreement with observation. Allow me to apologize beforehand for hammering this point home repeatedly throughout this book, but I fully plan to *continue* to hammer this point home repeatedly

¹³Once we've developed a set of meta-axioms and axioms that give us good reason to believe that other humans in fact exist. In the meantime, you are permitted to doubt them, but you still can't be mean to your little brother even if he might not really be there...

throughout this book. One may be able to show quite rigorously that some world-view horses are very unlikely to “win the race” and turn out to be *the* true view of Everything (and I will, in fact, beat on some *dead* horses, internally inconsistent self-contradictory horses, my very own self in later polemics in this book), but as long as belief-horses retain enough consistency and life to limp onto the field and the outcome of the race is not *certain*, humans should be free to lay their own bets.

Still, we feel intuitively that even though we cannot *prove* that any given interpretation of our sensory experience is correct by means of pure deductive reason from the one certain truth of our own existence – Descartes’ original attempt along these lines having been tragically flawed in an uncorrectable way – *some* explanations seem somehow *better* than others. In fact, some seem so much better that it is literally difficult to imagine that they could be completely false!

We should recognize this as both a trap and an opportunity.

The trap is fairly straightforward, but avoiding it will take us a bit of work. When we say “better” here we mean, literally, “more believable”, since certainty left town for good and won’t be back. Unfortunately, we have no way (yet) to rank-order all the vagrant notions we might have about a presumed external Universe in order of believability; it seems as though we’d need propositions to tell us *how* to rank-order propositions, just as a considerable number of axioms are required to define the concept and action of “greater than” and “less than” in number theory or geometry. And what tells us that these propositions (that rank-order propositions) are *better* than other propositions about propositions? Ooo, looks like a deadly logic loop with no possible resolution.

The opportunity? Don’t forget that you are, in fact, standing on the one piece of absolutely solid metaphysical ground in the entire Universe, the one that can hold you up even when you make mistakes – your Self. You are *free* to choose pretty much any set of beliefs, including a set that rank-orders beliefs themselves, *without* any need for further justification. If we can somehow define what is meant by “more believable” with mathematical rigor, then perhaps believability, plausibility, can take the place of “truth” as we seek to untangle the evidence of our senses. What we end up may not be “knowledge” in the same way that you interpreted the word a day or two ago, but perhaps it will do. At the very least it might give you a reason to believe in your memory that a day or two ago actually happened!

Let us, then, endeavor to come up with a set of *meta*-axioms that will help

us to rank-order all the notions our intelligent minds conceive in such a way that while any given notion can *no longer* be held to be certain truth beyond all doubt, and with *most* of the notions that might pop into our heads¹⁴ being obviously implausible, some of them can emerge as more believable than others, perhaps even so believable that at some point we “promote” the notion from being merely a vagrant idea to an *axiom*, a presumed truth about the Universe, something we strongly believe to be Universally correct in the real world. We seek to frame a metaphysical theory of knowledge that can cope with the *certainty of uncertainty* and still function in a way that “works well enough” to deal with our *current* sensory input whether or not it ultimately reflects an objective reality or is the illusory product of a diabolical genius or even is our own demented and somewhat schizophrenic imagination.

The flickers on the walls of our personal cave may only be shadows of a much vaster Universe, but inside of the empirical truth of the Atman they’re *all we’ve got!* We must choose a way to make the best of them to obtain a *view* of the world that casts the shadows.

So what, exactly, *is* the worldview of a sentient, Atman-iferous Buddha-natured being? We need to formally define it and consider its properties before we begin the process of constructing the best possible one.

¹⁴Such as the notion that the Moon is made out of self-luminous green cheese or the notion that a girl named Alice once *really did* fall down a rabbit hole to have strange adventures therein.

Chapter 5

A View of the World

It is fitting to speak of what is
for it *is*
by no means is it *not*.
These things I ask that you show yourself
for from this line of inquiry I bar you
but also from the road on which mortals understand nothing
wander two-headed
until helplessness in their own breast
drives their wandering being straight
they are borne lurching along
deaf and blind equally, dazed,
a tribe without judgment...

– *Parmenides: Poem*

At this point you know One True Thing – that you (if you are reading and doubting these words) exist. If I have succeeded in my writing, you know exactly what I mean when I say that you exist at, and perhaps as, a peculiar juxtaposition of what appears to be epic “input” from an outside ontic world (that includes what appears to be your own body) delivered through your senses, and a “self” made up from a mixture of memory, interior monologue, volition and imagination that we might broadly categorize as “your ongoing thoughts”. However, your *ontic* Self isn’t exactly the same thing, as (if you are like me) you can easily find your Self *watching* your imaginings without sight, *listening* to your interior monologue without ears, *knowing* your thoughts without itself thinking.

That is, your Self doesn't *exactly* seem to be equivalent to the process of sensing or thinking in any mixture. You can concentrate on the Self to where your awareness of sensory input fades away and your thoughts quiet down and yet be wide awake and entirely Self-aware. This Atman seems to be that which sits in the middle of both and through some mysterious feedback alchemy transforms them from computational mechanism to something more, something capable of "knowing".

This is not to over-romanticize it or argue that it is or isn't material – at this stage of the game we have no knowledge or system of logic to argue *with* or any notion of a material Universe that it might exist in – only to point out that *to* ourselves our Self is rather special and perplexing. Our knowledge of Atman is *ontic*, direct and immediate and "unreasonable" where our knowledge of everything else, including *one* way of viewing ourselves as mechanism bound to a real world, is *epic*, indirect and based upon *symbols and reason*.

Our job, then, is to give our Selves something to know, indirectly, based on reason. We wish to build for it a *model of the world*, a *worldview*¹.

A parenthetical remark: If you follow this wikilink, you might want to engage on a wikiromp and mouse around for at least a while in the Sapir-Whorf hypothesis², as there is insight to be gained there, and perhaps take a quick look at semiotics³. Note also the seven elements of a worldview according to Apostel: ontology, explanation, futurology, ethics, methodology, epistemology, and etiology (where I'm not going to explain what each of these is supposed to be because you can google or visit Wikipedia and read it for yourself).

I disagree with this categorical -ological decomposition. Rather than digress on this, however, it is much simpler to replace Apostel's mouthful of stuff by defining just what a worldview *is* according to *this* work:

A *worldview* is a set of propositions that defines a consistent mental

¹Wikipedia: http://www.wikipedia.org/wiki/World_View. The notion of a worldview is not new, but very few works focus on how to *build* one from the center of our being out. Most simply try to *sell* you a worldview – say, literal orthodox Christianity or Objectivism – that somebody else already made up for one reason or another. Hands on wallets, hands on wallets...

²Wikipedia: http://www.wikipedia.org/wiki/Linguistic_Relativity. The Sapir-Whorf hypothesis isn't quite as concretely formulated as one might wish, at least by Sapir or Whorf, but in a nutshell it is that language shapes thought, culturally and otherwise.

³Wikipedia: <http://www.wikipedia.org/wiki/Semiotics>. Semiotics is the collective study of three things: Semantics – the relation between symbols and the "things" symbols stand for; syntactics – a system of reason built on top of symbols that may or may not have any particular semantic content; and pragmatics – how the use of semantics and syntactics shape the life experience of those that use them.

model of the Universe and serves as the basis for reasoned volitional action and knowledge.

That is, I hope, clear enough to serve as a provisional basis for further discussion. Our goal is a set of meta-axioms that form an epic basis for worldview-building; we’re eventually going to embark on an axiom hunt that will contain axioms that pertain to time and inferred causal relationships and so on, but these elements are not *constructive*, and most people have only a fuzzy idea of what the word “ontology” even means⁴.

It may be clear, but note well that it is not *simple*! For one thing, this “set of propositions” must itself be self-defining, and there may well be several distinct *kinds* of propositions (for example, definitions, axioms, rules for manipulating propositions which are themselves propositions, and a particular “new” kind of proposition we’ll define below that is a bit different than all of the above). But nevertheless, this one short statement suffices to describe it all.

Let’s review. You, O Atman, are undoubtedly existing. It seems as though something *else* exists too. At least, there are lots of lights and sounds and smells and touches and memories and thoughts that form a consciousness-show on the walls of our personal caves where the “prisoner within” – our Atman – tries to *make sense of it all*. That “sense” *is* your worldview⁵.

This book is basically a construction manual and buyer’s guide for worldviews. Or, if you prefer a different metaphor (one that I, as a pretty serious open source coder, am quite fond of), it is an argument for choosing to use an *open source* worldview, one where you have complete access to and control over all of the meta-axioms and axioms and notional beliefs that are its foundation. It is a *hacker’s guide* for the personal software code base of whatever worldview you’ve

⁴“That department of the science of metaphysics which investigates and explains the nature and essential properties and relations of all beings, as such, or the principles and causes of being,” according to Webster. Ontology isn’t an *element* of a worldview, a worldview *is* an ontology. Not that this definition isn’t a bit oxymoronic, given that metaphysics is not science, it is meta-science, and Duke, at least, currently lacks a *metaphysics* department...

⁵Note well that this work isn’t advocating for there *literally* being a little man inside our heads, a Cartesian fantasy pooh-poohed by modern cognitive psychology and philosophy, for example in John Searle’s *Chinese Room* (Wikipedia: [http://www.wikipedia.org/wiki/Chinese Room](http://www.wikipedia.org/wiki/Chinese_Room)) thought experiment. This is an *allegory*, a *metaphor*. Atman at some point must *include* the walls of the cave and be a feedback loop. Or rather, as I propose more seriously in a different forum, a *generalized master equation*, an integrodifferential process describing a particular sort of *open system*. However, we’ve got a *long* ways to go before we can transcend the metaphor and concretely describe cognition itself in this book not as a deterministic predefined lookup table but rather as an adaptive self-referential Bayesian optimization process.

been using up to now, the one that was almost certainly loaded into you by your parents, your schools, your society.

In this computational metaphor, your worldview is the totality of software and data (strongly constrained for better or worse by the hardware on which it is loaded) that you’ve accrued on your system over all the years of your life, especially the part that is “active” and that actually processes the data coming in through the input channel of your senses and in turn distorts, filters, compresses and stores some fraction of that data, alters your internal state on a continuous basis given the sensory input and looped back data and programs from memory, and generates output that appears to alter the sensory stream interactively in predictable ways. Your worldview is quite easy to update and change, and changes constantly from the instant that your Atman is booted and starts to spin its core loop and your senses open to the flow of data from the world⁶.

On the other hand, your Atman *itself* is quite difficult to hack – it is (metaphorically) some mix of the operating computer itself (which can be viewed abstractly as microcode - a set of symbols and defined actions) and the very low level kernel code that somehow defines “Self-awareness” where somewhere in there the computational metaphor should no longer be taken too seriously, at least until we can build a working computational model of the awareness loop⁷.

Since a lot of the rest of the book *is* a guide to building a worldview through deliberate choices for its fundamental axioms, we will take a few moments to outline just how worldviews are structured and how they work. A reason-based worldview requires the following kinds of propositions:

- A **dictionary**. Semantics is deeply entangled with thought, meaning, and reason (and curiously, is omitted from Apostel’s list above). There is observational reason to believe that a nontrivial worldview requires a nontrivial language (one that spans both verbal and mathematical reasoning) to construct. The network of definitions and correspondences in the dictionary covers our ongoing sensory experiences *imperfectly* but is generally quite flexible and can easily be extended to improve the correspondence. Definitions are a special kind of axiom or premise from which reason proceeds.
- A set of **meta-axioms**. Meta-axioms are “axioms about worldviews” or “axioms required to have any worldview at all”, not axioms *of* any *specific* worldviews. To enable a search for the *best* worldview, at the very least we

⁶Otherwise known as “when you are born”, if not slightly earlier.

⁷A project that I am actually attempting, by the way.

will need a set of meta-axioms that let us comparatively “rank” the axiom sets of distinct worldviews.

We might begin, for example, by asserting that a worldview developed according to the laws of reason starting from a specific set of axioms and using logic to obtain deductions that are mutually consistent (once we’ve adequately defined what this means) is “better” than a worldview that consists of a set of assertions that are in conflict with one another and/or lead to mutually *inconsistent* deductions.

- An (infinite) set of **notions**. A notion is, basically, a proposition pertaining to the real Universe, a *trial* axiom or *trial* belief if you like. This usage of the term *notion* is, (as far as I know) unique in any discussion of reason, so permit me to carefully define it.

First of all, we have to remember the lessons learned from David Hume. No axiomatic system we can imagine has a *necessary* truth correspondence with the real Universe. There appear to be an infinite number of *possibly* true propositions about the real Universe, which could conceivably have infinitely higher dimensionality and complexity than the space-time continuum we can “see”, where we can apparently see only a *tiny space-time volume* of even that *one* space-time continuum from our vantage point strictly bounded in space and in time to some local neighborhood of the world-braid of our being⁸.

Before we *look* at the shadows of the *actual* Universe on the walls of our caves we have no way of choosing between this infinite set of possible axiomatic truths, and hence they all seem *infinitely unlikely*. We are in the position of Adam in George Roberts’ allegory – in possession of an embarrassment of riches, an infinite set of infinite sets of possibilities, consistent and inconsistent, many of them mix-and-match choices, an entire *permu-*

⁸In all canonical worldviews that contain relativistic physics of our particular cosmos, a *worldline* is the set of spacetime coordinates associated with a particle as it moves about in the four dimensional spacetime manifold. Our persons consist of many particles that are loosely bound together with particles constantly entering and leaving and spinning around one another as we eat and drink breathe and urinate and excrete and slough skin and weep and sweat. If you imagine every particle of yourself leaving a “trail” as it moves about and then stretch that trail along a time axis perpendicular to all three space axes, “you” look like a *world-braid*, a bundle of worldlines being spun by the Norns (poetically speaking, a.k.a. the laws of physics) out of the stuff of the world and woven into and through the world-braids of everything else, right out to some point in the future of your now where Atropos snips the metabolic heart of the braid and the threads of which it is composed gradually unravel. Quite a powerful image (and correspondence between relativity theory and Norse and Greek mythology), really.

tation group of possible realities.

We call any one of these propositions pertaining to the real world (which may well be conditioned by other propositions) a *notion*, an ephemeral and fleeting “idea” that in and of itself, in a state of complete empirical ignorance, is absurdly unlikely to be true. Yet some *set* of notions *is* true, and precisely corresponds to the actual information content of the actual Universe! The axiom-space “notional coordinates” of this Universe are a case of the “dartboard paradox”, where if we consider the tip of a dart to be a single point, and the dart is thrown at a dartboard with an infinite number of possible points on its surface that can be hit, the probability of hitting any given point is zero, and yet *some point on the dartboard is hit!* Of course our paradox is much worse – to this we have to add the essential absurdity of the existence of dart or dartboard in a Universe in the first place⁹.

However, we are *certain* that *something exists*, and we have named that something the Universe. Our self-awareness *is* just such a dart, firmly stuck on an obviously real dartboard no matter how infinitely unlikely our own existence appears to be, and we have only the shadows cast on the walls of our personal caves and any notions that we manage to dream up to make sense of it all with a worldview.

A notional (trial) worldview is *accurate* to the extent that its notions are at least an approximation to some significant subset of the actual true propositions that describe the Universe – a correspondence that must be *inferred* from how well it *works* to describe the shadows we are observing (including the peculiar shadows that are memories of previous shadows, our past experience as well as our current experiencing). *Knowledge* is the set of notions that emerges from this process of inference (that we will explore in detail later) to where we think our notions (or notions that are “close to” – within an open set of the neighborhood of – our notions) are really *rather likely to be true*. At any given moment the set of notions we believe in beyond *reasonable* doubt (not *any* doubt, note well) form our *personal beliefs*, the presumed truths, the *axioms* of our current worldview (discussed next). However, our worldview is not confined to just that which is (which cannot ever be known with certainty), but that which *might be!*

⁹Mathematicians, of course, have long since dealt with this problem, inventing *measure theory* and things like probability *density*. Physicists also cope – quantum theory “fuzzes” the tip of the dart and quantizes the spatial coordinates of the dartboard surface at the Planck length, thereby avoiding any actual zeros or infinities. But the conceptual problem remains.

Notions are *important!*

- A set of **axioms** that (often but not necessarily in combination with the symbolic definitions from the dictionary and the meta-axioms of implementing “reason”) generates a *semantic model*, a “system of the world”, an ontology, that possesses a strong and self-consistent correspondence with our ongoing sensory and mental experiencing of the Universe. These axioms are *not known truths!* They are *presumed* truths, *contingent* truths from which consistent conclusions can be drawn that may be compared to experience to determine the inferred *accuracy* of the resulting worldview. Ultimately, this comparison can serve as the basis for a *quantitative ordinal ranking* for notions in competition for selection into the set of worldview axioms and the dynamic alteration of the “best” set.

Note well: axiomatic systems are in general *abstract*, yet the correspondence sought in a worldview model is *concrete*. This is one way that e.g. physics (an arguably essential part of most sane worldviews) differs from mathematics. We will call a worldview that fails to achieve this correspondence “incorrect” and will (with the help of certain meta-axioms and axioms) attempt to construct an ordinal sense of incorrectness since we will rapidly learn that our own personal worldview is *always* incorrect (provably so, within some very broad assumptions on the complexity of the outside world) but that some are worse (more incorrect) than others. For example (drawing from physics as it is my personal forte), the physics component of Newton’s worldview was better than Aristotle’s but worse than Bohr’s and Einstein’s, Bohr’s in turn was worse than Schrödinger and Heisenberg’s, which is worse than the current relativistic field theoretic worldview, all on a *quantitative* basis of inferential correspondence with experiment and experience.

The axioms that make up a worldview can be *overcomplete* and contain axioms that in principle could be proven as theorems of a smaller set or that form an inconsistent theory. They can be *complete* and consist of the minimal set required to derive the best possible explanation of all experience and evidence. They can be *incomplete*, missing some of the assumptions required to derive a complete theory. Sadly, all worldviews of real live humans are *always* going to be simultaneously overcomplete in some relatively restricted milieu and yet globally *incomplete* nearly everywhere from a *practical* point of view given our narrow and projective view of an extremely large if not infinite, mostly invisible, cave.

At the moment, for example, I’m almost completely ignorant of what you

are thinking (assuming that I'm still alive when you read these words, and that you are thinking at all). Lacking any basis for preferring any notion I might have about what you *might* be thinking over any other, all such suppositions must remain very improbable although one is doubtless true and correct. Missing that information (or any evidence that might help me make a reasoned choice among the possibilities) how can my worldview be perfectly predictive or correct? It is clearly incomplete. I also know next to nothing of the Chinese language, what my grandmother had for dinner on May 16, 1937, the exact appearance of the landscape at the polar terminators of Pluto, and whether or not Elvis is really alive and living in a nursing home in Omaha.

This isn't just about ignorance – in elementary classical non-relativistic physics, there are at least three completely distinct formulations (Newtonian, Lagrangian, and Hamiltonian) that can take one from physical interaction laws and problem descriptions to equations of motion that all appear to be "correct" and can be shown to – usually – lead to exactly the same solutions to any given well-formulated physics problem. Not only is my worldview at least somewhat overcomplete here – how many ways do I need to be able to solve for the motion of a mass falling under the influence of ideal near-Earth gravity, really? – but I don't even have a rigorous basis for preferring one of these formulations or approaches over the others.

Newton's Law is convenient and simple for many problems (including the simple problem of near-Earth gravity) but provides no clear path towards quantum physics and is tricky to make relativistic; Hamiltonian physics also works for gravity and is arguably the best basis for moving from classical to quantum physics – if we have prior knowledge that the latter is going to be necessary, that the world is not classical – but can be a bit tricky to make relativistic; the Lagrangian approach can definitely solve the near-Earth gravitation problem and is arguably the best basis for building a relativistic classical theory of mechanics but is very difficult to quantize. Each has *conceptual advantages and disadvantages* in different contexts, in other words, but all three will tell me that a mass m , dropped a (small) height H from rest near the surface of the Earth, strikes the ground at speed that is approximately (within various neglected stuff like drag forces and the fact that the Earth is not an inertial reference frame) $\sqrt{2gH}$.

Which one is "true"? All of them? None of them¹⁰? All *I* know is that all three "work" in the appropriate (classical, non-relativistic) context and

¹⁰None of them is, in fact, the correct answer.

are therefore *useful*, which is a different thing altogether.

Worldviews can also be consistent or inconsistent in certain combinations with completeness. Overcomplete and inconsistent, undercomplete but consistent. However, Gödel's theorems (which we will discuss later) suggest that as soon as one's dictionary and axiom set are capable of *self-referential assertions* of a certain nature it becomes possible to construct axiomatic theories that are *either* complete *or* consistent but not both.

- **A persistent mind.** Note well that I am in no way asserting that the Universe “is mind” – only that the words contained in this book are *not* a worldview, no matter how copious they are and how precisely they *encode* a worldview (especially when accompanied by a really good dictionary and a stack of books on mathematics and logic and a computer capable of following links to wikipedia content). The words alone, written out to imperishable metal and cast to the stars to survive the eventual explosion of our sun, are meaningless without a mind to give them meaning. If you prefer, a worldview is an ongoing process linked to an Atman that may well take place in the absence of words or other symbols altogether, however important words may have been in creating it. It is an ongoing *dynamical process involving information exchange in an open system*, not a static *symbolic encoding or lookup process* taking place in a Chinese Room.

To put it a simpler way, a worldview happens in a reasoning mind, a mind with a view, not on a piece of paper, in a book (not even *this* book, which tries damn hard!), a computer's hard disk, or recorded on a DVD. Even an imaginary computer with an enormous memory that can hold the entire contents of the library of congress and run them through its processor over and over again fails to have a worldview. This point will become quite important when we later consider *God* and worldviews and information theory.

Note well that we will carefully proscribe stating that the Universe itself “is” a worldview – if we said any such thing we would mean something very different than what we mean when we talk about *our* worldview and it would be all too easy to twist the statement around into a bullshit “proof” that the Universe is mind, a question we do not intend to beg quite yet. We'll beg it later, if only to show that – subject to certain axiomatic assumptions – one is led to the *conditional* conclusion that *if* God exists at all, *then* the Universe “is” God as a perfect marriage of the material and mind.

That's it. For our current purposes you don't need to worry too much about just what "a persistent mind" is, because, if you are reading these words, you *are* a persistent mind. We aren't really talking about *abstract* worldviews, we're talking about *your* worldview, the program whose "running" *is* your own impossible-to-doubt Atman. Fortunately, you come pre-equipped with one or more languages (one of which appears to be a match for the words this book is printed in) and no doubt have any number of meta-axioms and axioms already in place however they might have gotten there. You're metaphorically all booted up and running; all we have to do now is equip you with the *right* meta-axioms that act like an "administrative password" and grant you *control* over your own axiomatic programming and then *you* can tackle the actual volitional (re)programming of your worldview without further help from me. Although *naturally* I'll offer it anyway, in the final part of this book...

At the end of it all you should be able to *freely choose what to believe*, quite possibly for the first time in your life, and have a sound basis to help guide you in making the choice. What you choose to include in your personal worldview from that point on, and what you do with it, is strictly up to you.

Part II

Meta-Axioms

Chapter 6

Logical Preliminaries

Frog: One door leads to safety, one door leads to a horrible death. You may ask me one question, but I always lie.

Wolf: Oooh. I had this one in school, but I can never remember it.

Tony: All right, all right. Wait, wait! I have a question! What is the point in having a door that has a horrible death behind it? Huh?

(Tony picks up frog.)

Frog: Get your hands off me!

Tony: What does that achieve?

Frog: What are you doing?

Tony: I mean, what is the purpose of your life? Just to be a pain?

Frog: Don't touch me there, only my girlfriend touches me there!

(Tony throws the frog through one of the doors.)

Frog: WHOA!

(Tony slams the door, there's a large explosion and fireball).

Wolf: I guess it's the other one...

The Tenth Kingdom

Tony's reaction to the frog's silly riddle in the movie *The Tenth Kingdom* (yet another movie, by the way, that suggests that our view of the Universe might be a narrow window into a small part of the whole thing) is typical of that of the human race. When presented with a puzzle solvable (or not) using logic, we are far more inclined to either run screaming in the other direction or do something illogical that not infrequently solves the problem in a completely unexpected way.

Constructing a worldview seems like it might be even *more* difficult than trying to figure out which of two doors allegedly leads to certain death armed with nothing but a single question and a self-professedly lying frog. It is sufficiently daunting that most people don't even try. Rather than wrestling with the puzzle, it is easier to act and find the answer empirically.

In this particular case, Tony's solution is the *only* safe one, anyway. After all, the frog that tells you that *he always lies!* That is, the frog makes a *self-referential assertion* – a statement that applies to itself. If it were *true* it would be a *lie* and could not, in fact, be true. It must therefore be a lie! But if the frog *always* tells the truth, he doesn't always tell the truth, so this isn't a possibility either.

The only remaining possibility that isn't *self*-contradictory is that the frog does not *always* tell the truth, it *sometimes* tells the truth, and this particular statement was a lie. If you ask it any question (or any number of questions) about the door, you will have no way of telling whether any of its answers are true or false by means of *pure reason* based on its one statement – the only way to find out is by *testing* the hypothesis *empirically*. Testing the doors themselves with the lying frog ensures that it bears all the risk associated with what is, after all, an arbitrary and silly dilemma.

Besides, if the frog had said “You may ask me one question, but I never lie” *logic* gives you an easy way out – ask it what door leads to a horrible death – but only a *complete idiot* would believe that talking frogs never lie¹. Our goal is to end up with a worldview that is in *agreement* with common sense, not one that leaves you at the mercy of every two-bit swindling frog who *swears* to you that if you just send them your personal information they'll ensure that you receive half of the twenty six million dollars they swindled from the estate of a dead oil magnate in Nigeria, and that's the truth!

To assemble a set of axioms for an optimal worldview, we're going to have to do better than this, alas. We're going to have to understand a very few things about logic in the context of worldviews, enough to support our intuition that our worldview should be *reasonable*. This book will go out of its way to avoid any detailed discussion of formal logic but we can't skip it altogether as it is associated with the *first* meta-axiomatic requirement we will need to impose on a viable worldview.

¹Ummm, did I really mean that? Actually, come to think of it, I rather think it likely that lower-life forms such as frogs *don't* ever lie. Of course, neither do they talk. Or do they? Damn, this must be another metaphor...

Let's begin by understanding the law of *contradiction*². Contradiction is at the heart of reason itself. It is quite easy to show that if a contradiction is introduced into the axioms of *any theory*, then the rules of formal logic permit one to prove *any proposition*. Or, of course, the negation of any proposition. The theory derived from any set of axioms that contain a contradiction is not *useful* because it cannot be used to differentiate the contingent truth or falsehood of *any proposition* – this is the so-called *principle of explosion*.³

This leads us to our first *meta-axiom* – an axiom that applies to the infinite set of propositions that are candidate axioms for our worldview, our “universe of notions”. As we select axioms for our worldview, we must do our best to ensure that the axioms are *consistent* – they must *not contradict one another*. Otherwise, we will literally be able to prove that night is day using nothing but perfectly valid formal deductive logic. We have to be very careful, though, as consistency will come at a high price.

To understand this, we have to consider the problem of recursion. We are trying to create a set of meta-axioms that will permit us to ordinally rank sets of axioms as being “better” or “worse”, or “more likely to be true” versus “less likely to be true”, with our averred goal being to end up with a worldview that we believe the most because we doubt it the least. How can we know that our set of meta-axioms is the best possible one? Do we need meta-meta-axioms? And then a set of meta-meta-meta-axioms *ad infinitum*?

Not necessarily. First of all, note that meta-axioms are, in fact, just axioms. We stuck the word “meta” out in front to identify them as being “special” axioms (the axioms of a metaphysics), but axioms they are. We can therefore solve the problem of recursion very simply by insisting that the our meta-axioms be *self-referential*! The meta-axiomatic requirement that our worldview be *consistent* must not be contradicted by *another* axiom (meta or otherwise) that says that it can be *inconsistent*. Ultimately, our axiom set (including the meta-axioms) must be self-referentially *self-consistent*.

²The law of contradiction is one of the original *laws of thought*, along with the laws of tautology and excluded middle. The law of contradiction states that a proposition cannot be true *and* false. The law of identity or tautology says that if a proposition is true, it is true, and the law of the excluded middle says that any proposition must be true *or* false, but we don't care so much about those, at least not yet, especially given that the law of excluded middle can't handle a wide class of perfectly understandable propositions about the real world in logic, number theory and quantum theory where the correct answer is “undecidable”.

³Wikipedia: http://www.wikipedia.org/wiki/Principle_of_Explosion. Not explode as in bomb, explode as in an embarrassment of riches that leaves you infinitely impoverished. If you can prove anything, you can *really* prove nothing at all.

This approach will be tremendously fruitful when we seek to produce a set of meta-axioms that can ordinally rank axiom sets. The meta-axioms we produce must be the *best* meta-axioms we can produce by the standard for goodness those same meta-axioms establish. If we insist on a meta-axiom of parsimony (Ockham’s Razor, as it were) then our meta-axioms should be parsimonious. This neatly terminates one sort of recursion that sometimes produces silly paradoxes, such as a search for a “first cause” in a causal chain.

However, by making our worldview (meta-)axioms self-referential we must deal with the possibility of introducing *other* kinds of paradoxes. We must confront *Gödel’s theorems*, as they simultaneously gives us a certain delightful freedom to craft startling self-referential meta-axioms and at the same time force us to *completely reformulate* the theory of logic used in the development of an axiomatic worldview, to essentially redefine “reason” in the context of our knowledge of the Universe derived from our personal experience.

We are not concerned here with the *derivation* of Gödel’s Incompleteness Theorems⁴ as they are a nontrivial result in formal logic and number theory. As always, individuals who are interested in learning more are encouraged to follow the wikilink and use it (and Google and perhaps textbooks in formal logic) as a starting point for further study. We *will* be very interested, however, in what they *say*. The first incompleteness theorem states:

Any effectively generated theory capable of expressing elementary arithmetic cannot be both consistent and complete. In particular, for any consistent, effectively generated formal theory that proves certain basic arithmetic truths, there is an arithmetical statement that is true, but not provable in the theory.

It seems likely that our worldview, when we are done formulating it in English or otherwise, will need to be capable of expressing arithmetic⁵. Furthermore, we just established that the axioms and meta-axioms of our worldview need to be self-referential, which means that they are precisely the kind of propositions that are “troublesome” and motivated Gödel’s theorem in the first place. It seems that our worldview will thus face *Gödel’s alternative* (a different way of stating this theorem):

⁴Wikipedia: http://www.wikipedia.org/wiki/Godel's_incompleteness_theorems. ,

⁵After all, I don’t recall learning arithmetic that *wasn’t* expressed in or expressible in English, although I suppose that if I had I literally couldn’t tell you about it now, in English, could I?

Any sufficiently complex axiom-based theory can be complete or consistent but not both!

Well, we've *already* decided that consistency is really, really important in a worldview. We also know that completeness is beyond our grasp *no matter what!* For one thing, even though there may *exist* a set of axioms that uniquely and precisely specifies the state of the Universe and all of its interaction laws, the amount of *information* that those axioms must represent is (apparently) extremely large. By comparison, our sensory window onto that information is extremely limited, and we *are* a small part of the information we are trying to represent. It is, in fact, information-theoretically impossible to ever have a nontrivial, complete theory of everything (both the laws that govern everything and all the data required to specify the state of everything) encoded within any *strict subset* of everything⁶.

For these reasons it seems self-consistently, self-referentially reasonable to insist that our worldview axioms be self-consistent (insofar as we can tell) and not worry about whether or not the resulting theory will ever be complete. It won't; quite aside from Gödel, and formal arguments disproving Laplace's Demon as being an entity *within* the Universe⁷ the incompleteness of our *own* finite knowledge of a possibly infinite everything is a matter of sheer common sense.

Unfortunately, insisting on the consistency of the theory has its own problems. There is Gödel's *second* theorem to deal with:

⁶This is a *theorem* of information theory given very, very broad and empirically verified assumptions on the nature of everything, and it has *profound consequences*. It is also closely tied to the oxymoronic nature of the term *random number generator* and the nature of entropy and the Generalized Master Equation in physics.

David Wolpert has generated a formal proof of the impossibility of a theory of everything being encodable on a subset of everything – the theory of *almost* everything theorem, if you like – and thereby proved the impossibility of Laplace's Demon. I have a slightly different but much simpler proof, made possible by the expedient of clearly defining *everything* to be the *Universe*. One consequence of this is that the only consistent way one can have an omniscient God (a *dualist* God separate from the space-time Cosmos and Laplace's Demon built within the Cosmos are both hypothetical omniscient entities supported by a subset of the Universe and are mathematically proven impossible by both Wolpert's argument and my own) is for that God to *be* the Universe.

I'll postpone a discussion of omniscience per se and a proof of these assertions until a much later chapter discussing formal *disproofs* of a standard model omniscient, omnipotent, etc. dualist God.

⁷Wikipedia: http://www.wikipedia.org/wiki/Laplace's_Demon. The assertion that some "demon" *could* exist as only *part* of the Universe and be given complete information about the entire Universe (including itself) at any instant, it could then predict the entire past and future state of the entire Universe (including itself).

For any formal recursively enumerable (i.e., effectively generated) theory T including basic arithmetical truths and also certain truths about formal provability, T includes a statement of its own consistency if and only if T is inconsistent.

These theorems are proven in the context of number theory and arithmetic, not because they aren't quite general but because the proof is easiest there – they apply in general to self-referential theories as complex as a worldview must be. However, in this general case, the second theorem has some extremely important consequences.

There is a very simple way of understanding this second theorem in an intuitive way (given in E. T. Jaynes' remarkable book *Probability Theory: The Logic of Science*). We remarked above that one can prove any proposition in formal symbolic logic from inconsistent premises. Therefore, if a theory *is* inconsistent we can *always* prove its consistency! Whether or not the mere existence of an internal proof of consistency proves that the theory (especially when it is as complex and convoluted as a worldview must be to describe what we can *already* reasonable infer about it) is inconsistent is moot – we can clearly not *trust* the proof because ultimately, it is the theory telling us that the theory never lies, which is precisely what one could easily make it do if it were lying!

We're back to the case of Tony's self-referential frog – any self-referential theory that axiomatically asserts or internally proves its own consistency cannot be trusted. Only if we *cannot* prove its consistency within the theory itself is there a chance that it is, in fact, consistent.

Laplace's Demon (see footnote above) is a wonderful example of this. Laplace hypothesized an "omniscient" entity that is a subset of the Universe, one which could be initialized with the exact state of the entire Universe (including itself) and then perform calculations using the laws of physics that predict the exact state of the Universe for all times past, present, and future. Leaving aside the implicit role of time as an independent parameter in this hypothesis – Laplace substantially preceded the invention of the theory of relativity where time is just another dimension that actually transforms "into" space and vice versa in particular ways – we can trivially prove that such a Demon, if it existed as a sentient entity capable of letting *us* know even the slightest bit of what it predicts, would of necessity be a liar.

What *would* it answer if asked the question: "Is the real Universe *not* one in which your *honest* answer to *this* question is yes?"

Ooo, that’s a hard one. If it answers yes, then *it must be lying*. If it answers no, then *it must be lying*. If it refuses to answer at all, *that’s a lie too* (internally, it has failed to answer yes, but the answer turns out to be yes). No matter how it answers, the answer will be a lie and worst of all, it *knows* that its own answer will always be a lie. Worse, if it is asked and tries at least to be *maximally* honest, it will have to *tell* you that it is a liar. Self-referential questions and omniscient computations of answers do not mix well, and you can’t trust a liar...

This example is not trivial. It points out the problem of the layering of complexity that we take for granted when we ask questions with a semantic content, questions that are encoded on an underlying system that are essentially *about* that underlying system. Suppose I’m driving along and approaching a fork in the road, with a Laplace Demon (possibly in the form of Google Maps loaded onto my phone) sitting next to me. If I asks LD “will I turn right or left at the fork”, it is again incapable of answering honestly. It may “know” I will (perversely) turn right when it answers left because of its ability to predict the time evolution of every bit of “stuff” that makes up the both of us, but that will never make the *semantic meaning of the answer to the question about our mutual macroscopic state true!*

As we’ll discuss later, there is only one way that a Laplace Demon (or Universe) can encode its *own* information, and that is *as being* its own irreducible self-representation, which makes the knowledge as useless as any tautology. Yes, a rose “knows” its own state by just being itself, but it will never be able to know its own state in the sense that it knows its own weight, its size, its structure, its function, its beauty or the sweetness of its perfume *and* knows the state of every particle in the rose that encodes all of that information *and* a suitable dictionary for decoding it. A computer can easily carry out any programmed sequence of operations on its internally stored data, but it can never store enough data to specify the precise microstate of all of the stuff that makes up its information store and computational unit and compute the time evolution of its own state computing the time evolution of its own state. This is *information theoretically impossible*, not just “hard”, because of the *relative information entropy* of the macroscopic program relative to the microscopic state⁸. The only case where there is no entropy is the trivial one of the actual reversible time evolution of the

⁸Forgive me if I’m losing you with these little insertions of terminology from what is, after all, the theory of statistical mechanics in physics and/or information theory, but they are very important and I’m avoiding doing any of the actual math involved. You can skip over some of this stuff if you have no idea what “entropy” is beyond “something to do with randomness or disorder”, but I’m including it for those that do or who are willing to learn.

microscopic state⁹.

Keep this in mind when we consider the common axioms of theistic religious belief, which typically assert *as self-referential axioms* that this or that theistic scriptural worldview is consistent, correct, and complete, when it is *logically impossible* for it to be all three, and where it is most likely none of them. Even if a voice from the heavens came down and said “This is God. I never lie. Prepare to take dictation and I will deliver to you Perfect Truth” Gödel’s second theorem makes it nearly certain that this voice would be *lying!* Or at the very least, mistaken, deluded, incorrect.

The true utility of Gödel’s second theorem is that one can only prove the consistency of a theory from *another* theory that you (for whatever reason) believe in “more strongly” than the theory in question. This alone suggests the need for an ordinal hierarchy of theory *in mathematics* – second (and possibly higher) order logic – and since our formulations of mathematics all occur *within* a worldview, it places the logical requirements of a worldview solidly at the top of this hierarchy, subject to both Gödel’s alternative and impossible to prove within the worldview itself, however much we might be able to prove the completeness and consistency of e.g. plane geometry *within* our worldview.

In the context of this work, we will not be able to *prove* the consistency of our worldview (even if it is consistent) but we will be able to make consistency a *strong requirement* from the higher level meta-axiomatic theory on the lower level axiomatic worldview. We will also learn from this and *not assert consistency* as an axiom or meta-axiom. Instead we will assert it as a *worthy goal of axiomatic theories* for all of the reasons outlined above, and tolerate a tiny bit of recursive inconsistency – the freedom to doubt, if you will, that our meta-axioms and subsidiary worldview are both consistent and correct.

Why all the fuss about Gödel’s theorems? Because there are logical para-

⁹I’m very tempted to formulate this as an actual theorem, maybe calling it the “meaning-entropy theorem”. In statistical mechanical terms, meaning is always encoded as a feature of a system *macrostate* – one where the specific details of the internal microstate are unknown and generally unimportant. However, the time evolution of the system is always the time evolution of a system *microstate* with presumably perfectly reversible microdynamics (so that entropy is not a meaningful concept). There is always relative entropy between the two – the log of the multiplicity of the macrostate, which is strictly greater than zero if we are encoding macrostate evolution *with its own dictionary and dynamical rules*, which is exactly what we mean by “meaning”. This is actually almost identical in content to Wikipedia: http://www.wikipedia.org/wiki/Landauer's_principle, except that Landauer’s principle addresses *real physical entropy in computational processes* where this is slightly more abstract.

doxes that naturally arise in self-referential theories, and while they are usually illustrated in a *simple* form that lets you watch the card being palmed, in a large and complex theory these sorts of paradoxes can be wrapped around through many, many assertions before the “problem” emerges.

Consider, for example, the *Liar’s Paradox*¹⁰ :

This statement is false.

Is it? Well, if it is false, then it is true. If it is true, it is false but oops, that makes it true again, and hence false, true, false... Every time you check one alternative in some sort of sequential order, you are led to conclude the other one. Thinking about it gives one a headache, and offering this or other Liar-like paradoxes presented as input to Evil Robots or Evil Computers has destroyed them in many a science fiction show of the past, as they loop out of control chasing the logical cycle¹¹. It is the frustration of this sort of tail-chasing logic that has Tony killing frogs at the beginning of this chapter: “Cretans always lie” (spoken by a Cretan) can only be a lie, but this doesn’t mean that Cretans always tell the truth, either.

This particular “naked” statement is not terribly illustrative of Gödel’s theorems per se, however – when stated so baldly it is relatively easy to deal with in logic because it is (after all) manifestly self-contradictory. We can see it and merely be amused, because we, like Honey Badger¹², should properly *just not care* about the truth or falsity of a statement like this. It can never be *useful* for anything *but* amusement, or to demonstrate the dangers of self-referentiality.

However, by the time one threads this paradox or related paradoxes through a dozen statements in a sorites¹³ that hides its ultimately self-referentiality and includes a lot of vague or ill-defined terms it is not so simple – then it can actually

¹⁰Wikipedia: [http://www.wikipedia.org/wiki/Liar's Paradox](http://www.wikipedia.org/wiki/Liar's_Paradox). This paradox is actually very close to the basic statement used in the proof of Gödel’s theorems. It is also obviously related to at least one disproof of an honest Laplace’s Demon, although I personally prefer entropy, a combination of the notions of incompressibility and/or irreducibility and degeneracy. Obviously the discussion above included a variation of this paradox to turn the Demon into a liar.

¹¹A *Lost in Space* TV episode and an episode of *The Prisoner* immediately come to mind. At least to really old people (like me) that watched and remember them.

¹²If you never have watched the Honey Badger video on youtube, well, you should. Honey Badger just don’t care.

¹³Wikipedia: <http://www.wikipedia.org/wiki/Polysyllogism>. Sorites are long elliptical arguments (polysyllogisms) in logic beloved by Lewis Carroll – literally a heap of propositions chained together, *much like a worldview!* Exactly like a worldview, in fact.

do real damage (to our sanity or the consistency of our worldview or both) if undetected.

Let's illustrate my favorite *Gödelian knot* – an unprovable but true assertion within a self-referential theory:

This statement is unprovable!

If one tries to prove that it is true, one obviously cannot. Presumed truth perfectly contradicts its provability so our proof, if correct, would be false.. However, it cannot be “merely” false either – if its *falsehood* were provable as a theorem of this statement then it is in fact impossible to prove true, and hence it *is* true and our proof of falsehood must also be false.

Both assumptions – that the statement is true (and unprovable) *or* false (and actually provable) – seem to lead us to conclude that the assumption is indeed unprovable and hence *true*. If we meditate on this for a moment or two we are forced to conclude that we have an assertion that *must be true* but which is *unprovable* – Gödel's first theorem.

This cute little example gives us a chance to be equally cute in the formulation of our meta-axioms. The word “provable” means “provable from a set of correct deductions from a given set of consistent axioms”. We will make our first meta-axiom:

An acceptable axiomatic self-referential worldview must be unprovable.

This is just a generalization of the previous statement and for the same reasons must be *true* as a self-consistent meta-axiom even though it is not *provable* in formal logic. This is *just what we need* to make use of Gödel's theorems to correctly constrain our worldview according to Gödel's alternative. We can directly conclude from this meta-axiom its corollary:

An acceptable axiomatic worldview must be consistent.

If it were inconsistent we could prove *anything*, including the theory itself, so unprovability *suffices* to permit us to consistently (in a manner of speaking) require consistency. A nontrivial self-referential theory can only be consistent if it is unprovable, even though a naive consideration of the meaning of the terms points the other way.

We can now apply Gödel's first theorem. An acceptable axiomatic self-referential worldview that is consistent *must* be incomplete – and hence consistently unprovable! Let's write this one basic idea in a third form:

An acceptable axiomatic worldview cannot be complete.

We thus have three ways of writing pretty much the same the same thing¹⁴.

Let's write this down this chain of reasoning as our first and primary logical worldview meta-axiom, and give it a sexy name to make it easy to remember. We'll go ahead and wrap the two corollaries right on in with it not because we have to, but to remind us that we really have no choice – these three statements all go together, with unprovability being the key assertion.

1. Unprovability – *An acceptable (reason-based) axiomatic worldview must be unprovable. As a consequence, an acceptable axiomatic worldview cannot be complete and must be consistent so far as it is incompletely specified.*

We only need this *single* meta-axiom to establish the *logical* basis for a worldview held by any self-aware being (where the worldview must include itself¹⁵ and hence be self-referential, just as this entire book encodes a self-referential part of my *own* worldview and refers to itself all the time – in fact, it just did, again...). In order for the worldview to be *reasonable*, it must be *unprovable*, *consistent*, and *incomplete*.

Note well that this meta-axiom is *not optional*; we must adopt it or reason itself is barred from us. It is the foundation of the worldview of *any* self-aware being. As such, it tremendously constrains a *reasonable* theory of God (an important component of many worldviews, usually described as a self-aware being with a complete and consistent and *true* worldview, perfect knowledge of the Universe).

This fundamental meta-axiom has a profound consequence for us, as well. A worldview possessed by a complex self-aware being *must* be unprovable, and since reason traditionally revolves around logical proof, we have a bit of a conundrum on our hands. We seem to have logically (and self-consistently!) proven that in order for a worldview to be reasonable (consistent, so that logic and reason can

¹⁴The last statement looks a bit weaker – what about worldviews that are incomplete *and* inconsistent? Well, if a worldview is inconsistent then it is provable, and if it is provable then it cannot be incomplete. Basically there is no way for the first two forms to be true and the third one false, given the Gödel alternative.

¹⁵Unless you somehow manage *not* to be part of the Universe your worldview describes... a possibility excluded by our clever definition of Universe, at least if you exist.

be used in its construction), it *cannot* be *completely* reasonable.

We have come full circle right back to Hume – the Aristotelian view of philosophy as an attempt to *prove* a worldview using classical reason alone is ***bullshit***, only we have now **proven this using reason itself**, not argued it heuristically¹⁶. It cannot be done, because if it could, the basis of that proof would (from Gödel) be inconsistent, and if it is inconsistent it cannot be reasonable. We therefore know *a priori* that as a sentient *part* of the Universe we *cannot succeed* in our quest to discover a complete set of consistent axioms that self-referentially describe the *whole* Universe and encode them on a strict subset of the Universe (us).

“Perfect knowledge” of the Universe is thus not just unlikely – it is *logically impossible*¹⁷. No sentient being *including a hypothesized sentient God* can “beat the game” and end up with a complete and consistent *abstract* (formal) description of the entire Universe encoded on the information content of the Universe itself. This conclusion will, naturally, disturb those of you who are still struggling with *doubting* the religious axioms you were programmed with as children (before your ability to reason clearly was fully developed) but there it is. “Omniscience” is an inconsistent property of any self-aware being. In case there is any doubt of this lingering after the remarkably *simple* discussion above, this actually can be

¹⁶This is significant. Hume *asserted heuristically* as a part of the same discussion in which he noted that a worldview cannot be deduced but is rather inferred, that a reasonable theory of inference could not be deduced from axioms the way e.g. geometry can be. Hume was *wrong*.

¹⁷An observation that is a primary theme of my fictional novel, *The Book of Lilith*. Let’s try to understand the God dilemma using my favorite means, simile and metaphor. The classical view of God designing and then playing with the Cosmos is sort of like *you* playing all four hands of a Bridge game by yourself from a stacked deck. Even if you invent “characters” for each hand and pretend to “forget” the contents of East’s completely set-up hand when you bid or play for North, all you can do is use rules that express North’s character and assess what North *should* know and bid accordingly. The game is reduced to mechanism, and it ends up being rather *boring*. Humans shuffle the deck and play with each other because only the process of *discovery* of the hidden, the process of *reason* used in an *uncertain* environment where you cannot really know East’s hand or East’s mind, make Bridge an entertaining game.

A similar, if somewhat more cruel, metaphor, portrays God as a child playing all by itself with dolls. The child can, in turn, pretend to be Barbie, Ken, G.I. Joe, Cobra Commander in a vast and grand drama but ultimately *there is only the child* as long as it has perfect knowledge of and control over the dolls – the best it can do is use *imaginary rules* to govern what Barbie does vs what Ken does, to make Joe *good* and Cobra Commander *evil*.

Well, in order for God to be anything but mindless mechanism, in order for God to be able to *enjoy* the dynamic unfolding of our Cosmos as a *sentient being*, It has the exact same difficulty as we do playing all the hands of a Bridge game, *in spades* (so to speak). But this is still a *minor* problem compared to the problems that arise when one considers the *Universe*, not (just) the *Cosmos*.

independently proven (although the proof is more complex) using *information theory*.

Not to worry. The problem isn't that reasonable worldviews are impossible, the problem is with our insistence on the *incorrect use of Boolean/Aristotelian logic and reason to formulate them!* We have to reinvent and *generalize* logic, and transform it into something that is capable of dealing with uncertainty, with doubt, with unprovability *and yet is reasonable!* We need to self-consistently define a meta-axiomatic theory of reason for which formal True/False (Boolean, Aristotelian) logic is an *unreachable limit* in the context of worldviews. This *non-Aristotelian* system of reason will completely contain classical first-order logic as a limit, but it will be an *unreachable* limit for self-aware beings with an incomplete, unprovable worldview, when applied to the non-empty Universe that they seem to be a part of.

Fortunately, this formal meta-axiomatic theory was *worked out over seventy years ago*, although damn few people fully realize that. So we're OK.

We aren't there yet in *this* work, of course. For one thing, we just used a bunch of first-order logic to bootstrap the need to construct an unprovable, incomplete, second order recursive theory that is consistent (as far as it goes) in first order logic, and we really haven't properly established a meta-axiom that says that our worldview can or must use logic of any order *at all*. Indeed, we already know (because we are bootstrapping from a fairly well developed worldview already, after all) that any worldview we are going to end up with that is at least as good as the one we have going into this process is going to include and constructively use a bunch of mathematics: geometry, differential equations, algebra, number theory, and so on. We need an explicit meta-axiom permitting the use of mathematics and logic in self-referential axiomatic worldviews or we are *already* self-inconsistent and dead in the water!

Chapter 7

The Meta-Axiom of Mathematics

This little piggie went to market
This little piggie stayed home
This little piggie had roast beef
And this little piggie had none
But this little piggie...
This little piggie...
THIS little piggie cried *Wee! Wee! Wee!*
All the way home.

– An early lesson in Piggie
Mathematics, taught to the tune
of tickles and giggles...

As we’ve already established, the worldview we are trying to build is going to be based on *reason* (as opposed to superstition, divine revelation, myth, or any other sort of *unreason*). God may or may not play a part in it in the end, but only if God can be supported by reason, because our aim is to use reason to choose the *best possible* set of beliefs, given our experiences and the evidence. We know that the final result will be unprovable and incomplete, so we rather expect (and will eventually meta-axiomatically require) that it have a certain amount of *freedom* to it, but we must insist from the beginning that our free choices not introduce *inconsistency* as inconsistency will poison the entire process and let us “prove” anything we like (and then its contradiction) and conclude that we know

nothing at all¹.

Our sole, fundamental, meta-axiom so far is crafted *just so that a worldview can be consistent*, and hence reasonable. As part of our bootstrapping process, we used a rather lot of mathematics and logic that I kindly enough shielded you from by simply leaving it out (you can always look it up and work through it on your own if this sort of thing appeals to you and is within your abilities). However, it is still there, and our one meta-axiom so far absolutely relies on it. It is therefore a good time to *add* as meta-axioms for our worldview construction kit those axioms that form the foundations of logic and mathematics and reason itself that allow reason to be used to reasonably discuss, erm, reason. This will ultimately be *meta-axiomatically self-consistent* – the meta-axioms of reason will permit our worldview to contain axioms of reason (including the meta-axiom we are about to write down) and still be reasonable.

Here, fortunately, we have little work to do. An enormous amount of work has been done for us², for the theory of formal logic and syllogism and mathematics is at this point thousands of years old, and several academic disciplines devote nearly all of their considerable energies to teaching and extending the highly refined results derived over all of that time.

As we’ve already noted, mathematics and formal logic are in and of themselves sterile. They are, ultimately, a set of unprovable axioms (that includes e.g. definitions and rules for manipulating the objects and attributes defined – *most* of the ingredients of a worldview) together with an enormous collection of consistent, derived theorems. Changing the axioms in certain ways changes the collection of theorems, so it cannot be said that any mathematical theorems are “true”, only that they are true *contingent upon the presumed truth of the axioms!* In this sense mathematics is a collection of syllogisms, nothing more, and isn’t *about* anything at all until we make it so via axioms that establish connections between math and our ongoing sensory experience that transform some of the notions of mathematics into a part of a worldview. It is this latter process that we wish to formally enable.

¹A favorite conclusion of Socrates, as it turns out...

²All that stuff I’m leaving out, given that it is an empirical fact that some 95% of the human race are either unwilling or incapable (or both) of working through anything past simple algebra or geometry. Don’t feel bad, though, if this describes you. I love this sort of stuff and am moderately good at it (obviously, or I wouldn’t be writing this book) but there are plenty of people who are far better and my own kids *suck* at it, at least so far. I’m writing this book for them, and for you, *without* all the details – and attendant arguments – because one *can* understand how worldviews work without knowing all of the details of the underlying mathematics and logic.

We wouldn't need all of this, of course, if postulates concerning the Universe came with a stamp on them positively identifying their truth or falsehood so we could insert them into our worldview with *certainty*, but they don't, and our fundamental meta-axiom of the previous chapter strongly suggests that they *can't*. We can, and indeed *must*, *doubt* the truth of nearly any proposition concerning the real world, which is identical to stating that we do *not* positively know the proposition to be true or false.

One of our urgent meta-axiomatic chores is to assert meta-axioms that permit us to in some ordinal way evaluate the strength of our belief in any given premise pertaining to the real world so that we can *use* logic, possibly a (relatively) new form of logic in a (relatively) new way, in the real world. In the meantime, we have to look ahead (and behind) a bit to enable all of the bootstrapping going on, because we need a certain amount of "prior" mathematics and logic and set theory in order to be able to work out ordinal relationships and new logical rules!

The bootstrapping is further motivated by the observation that when we look at the Universe (at least the little chunk of the cosmos that our consciousness perceives from sensory input through the world-braid of our bodies stretching through space and time) there appears to be a *strong correspondence* between what we see and set theory, logic, arithmetic, geometry, and calculus. This begins with the simplest of observations – for example the persistent sensory identity of *five little piggies*, one of which makes strange sounds all the way home. We learn as *very young children* that the piggies we play with *today* are the same piggies, somehow, as the ones that we played with *yesterday*, and that the piggies on one foot are like the ones on the other foot, that our brothers and sisters and parents have piggies too.

In in this way, in the course of our experience of guided life activities and simple observational play, we start using *set theory* before we can even talk! We are taught to (and to some extent are hard-wired by evolutionary biology to learn to) *recognize* persistent patterns of sensory experience and *categorize* them into sets of "things" like parents and non-parents, toys and non-toys (don't touch!), food and non-food, piggies and non-piggies. One of our first experiences of reason is the division of our experiential Universe into disjunctive sets and giving those sets *names* and learning similarly named *rules* governing those named sets. Piggy mathematics is important!

Eventually, in the course of this play, we learn to *count our piggies!* One, two, three, four, five! Set theory (identifying the piggies, which are all *different*, as belonging to a *common set* that is *countable* as opposed to putting each piggy

in a set by *itself* where the count of each unique item is tautologically one, one, one...) has led us to simple integer arithmetic, *counting* those pesky piggies, counting non-identical blocks in the set of “objects identifiable as blocks on our living room floor”, counting bottles of beer on the wall as we get older and counting indistinguishable bosons in a bose condensate as we get *much* older ³.

We develop a sense of ordinal relationships (where the Biggest Piggy is larger than the Littlest Piggy, and as we learn an alphabet where – in English, at least – A is “before” B). We extend this to ideas of rational fraction proportions, as we divide up food (“Jimmy got the bigger piece of cake, Mommy, it isn’t fair.”) and as we learn to count, with 1 before 2 before 3 as an ordinal sequence, as we stand up to be measured as we grow, as we step on a scale, as we experience our day in an ordinal sequential fashion, morning to noon to night; yesterday, today/now, tomorrow.. We learn logic as it becomes clear that if our brother eats our cake, we cannot eat it too (and vice versa), that *if* we wander into the street *then* we will get a swat on the bottom and a stern talking to, that there is no third alternative to “take a bath” or “don’t take a bath”, and that according to both parents the choice appears to be “take a bath” before bed.

Long before we learn any actual *mathematics* in an actual *school*⁴, we have built mathematical concepts into our developing worldview at such a deep level that it is unthinkable that one could *have* a worldview *at all* without set theory, logic, and mathematics, whether or not you are aware that they are in fact the basis for set-compressed categorical knowledge itself and totally integrated with something as simple as being cognitively aware that you are looking at a *tree* even though it is not identical to any other tree you have ever seen. Even if the child eventually grows into an adult that sucks at algebra, that adult probably understands well the quantitative ordinal concepts of more and less, because they *dominate* human experience.

The point is that our eventual worldview is *going* to include all of these examples of logic, set theory, and mathematics in application to a real Universe, or it will be laughably and foolishly wrong, *even though* we won’t be able to use them with *certainty*. So we might as well explicitly include them now and have the use of them while we search for a more general connection that will let us

³Wikipedia: http://www.wikipedia.org/wiki/Identical_Particles. Just kidding. Funnin’ with ya. Physics joke. But in case you want to get a flavor for how physics treats sets of *distinct but indistinguishable* objects, you can visit https://en.wikipedia.org/wiki/Identical_particles and start a wikiromp through linked ideas until you are satisfied.

⁴Which for some, may be never, given our society’s horrific tendency to confuse teaching *arithmetic* with teaching *mathematics*.

make the *best possible* use of them, not just the everyday uses we invented for them or were taught growing up⁵.

Don't worry! In actual fact, the use you had for them growing up is actually very close to their *best* use anyway! We just need to organize it a bit to avoid some of the *traps* inherent in its sloppy use, some of which were *also* institutionalized in your worldview growing up because they had practical social benefits, however formally incorrect they were.

So let's go ahead and do it. Our worldview may, but is not required to, incorporate the use of set theory, number theory, arithmetic, geometry, calculus, formal Boolean logic, predicate logic, and so on, as needed. Note well that we don't specify any *particular* set of mathematical or logical axioms! That's why this is a *meta*-axiom, it permits the *free variation* of the notions that underlie various specific mathematical theories or branches, and the continued exploration of notions that might well lead to *new* mathematical discoveries (and possible correspondences with experience) in the future. Note well that we *require* this freedom to avoid certain insidious traps that have utterly poisoned (and in many cases continue to poison) human discourse and reason.

We know *now* perfectly well that insisting that only plane geometry and Euclidean spaces be considered is silly, even though this is the view that was erroneously held for roughly 2100 years post-Euclid. On the other hand, Euclidean geometry is undeniably useful in certain contexts! We want to be able to use *both* flat and curved space geometries! We want to be able to use natural numbers where they make sense, integers where they make sense, rational numbers where they make sense, real numbers where they make sense, complex numbers where they make sense, geometric algebras of higher grade⁶ where they make sense! We

⁵Where "growing up" means right through graduate school in mathematics or physics and beyond, for some. As in most of us never actually finish "growing up" in this sense, which is why you are still learning by means of reading this book! Isn't it lovely the way self-referentiality works out?

⁶Wikipedia: http://www.wikipedia.org/wiki/Geometric_Algebra. A geometric algebra is a division algebra with a particular "geometric" interpretation of its outer/tensor product. Real numbers, complex numbers, and e.e. quaternions are all geometric algebras. With that said, the odds are thousands to one that you *don't want to follow this link!* By telling you this, of course, I make it nearly certain that you will visit it anyway, at least if you are reading this book in an electronic format where doing so is a matter of a mouse click.

Suit yourself, but be warned! This page will *make your brain explode*, Mars Attack style, if you aren't a mathematician or physicist, and there is a nontrivial probability that it will make *even* the brains of mathematicians or physicists explode!

Before you click it, therefore, be sure to spread a plastic sheet and ensure that your will is up to date. Your heirs will thank you.

have to work out what “making sense” means, but we know already that we’re going to need all of this and almost certainly still more that we haven’t worked out yet in order to make sense of the *Universe* in the best possible worldview we can manage (given the evidence, so far).

Hence we introduce:

2. The Meta-Axiom of Mathematics – *Axiom sets leading to consistent theories of symbolic reason are acceptable for inclusion in our theory of knowledge or worldview.*

Note that this meta-axiom does not allege that a mathematical theory itself is knowledge *of* anything at all, but it is entirely permissible to *postulate* an association between some set of symbols and patterns of experience and thereby “inherit” a system of consistent contingent truths from the mathematics that one can compare to those patterns. In some cases the mathematical systems we will use will be complete as well as consistent, not in the sense that we have proven every possible true theorem but in the sense that any suitably expressed theorem is either true or false (with nothing in between or ambiguous) and the axioms are complete and consistent, sufficient to fully define the theory if somebody could take the (possibly infinite) amount of time required to do so. Also, we are not restricting ourselves to first order logic (or *any* particular order of logic) alone with this meta-axiom.

This means that we have to be careful when using mathematics, logic, and reason in our worldview not to propose mathematical axioms that violate the fundamental meta-axiom of unprovability. Any axioms we incorporate into our worldview by means of the meta-axiom of mathematics that are self-referential and potentially complete must *always choose the consistent branch of Gödel’s alternative and give up completeness instead* (whenever such a choice arises) or it will *violate our first meta-axiom*. This will be a constant devil we must strive with, especially when working out higher order axioms and theories at e.g. the social level, where it is so very easy to “prove” that homosexuality is wrong or homosexuality is right – given an enormous and horribly inconsistent body of social and ethical axioms to start with. Our goal is to build a consistent worldview (not *provably* consistent, but consistent as far as we are able to tell given our incomplete knowledge) because an inconsistent one is unreasonable and could be used to prove anything at all. Using *guaranteed consistent* mathematical systems to formulate parts of our worldview will help us tremendously to achieve that goal, as long as we beware the traps involved.

I have tried to formulate this meta-axiom sufficiently generally that it *em-*

braces first and second order logic, set theory, Peano arithmetic, a variety of number theories, algebra, a variety of geometries, calculus – basically all of the tools already used in the scientific worldview and rational philosophy. It is still up to the worldview-builder (that is, you) to use any or all of these tools in reasonable ways in your actual worldview-under-construction, once we have meta-axioms that define just what “reasonable ways” means!

I have also formulated it sufficiently cleverly that you can understand the *importance* of mathematics in building worldviews *even though* it is objectively empty manipulation of symbols with no necessary connection with any real Universe. You don’t even need to know any *particular* mathematics beyond the Piggy level in order to be able to understand why it is important, why it has been important to you quite literally from the moment you were born. Without the *generalizing* operations of set theory, logic, and mathematics, every instant of human experience would be unique, every view of a piggie would be nothing but the actual sensory data. We cannot count piggies or reason about piggies if every time we see a piggy it is cognitively, semantically, ontologically disconnected from all other experiences and views of what we (literally) *cannot help* but believe is the same piggy at earlier times, if we cannot see that two piggies on the same foot are completely *distinct* and hence unique but nevertheless both belong to a particular named set, the set of all piggies!

The same holds for trees – every tree is different, yet one can instantly recognize many objects as belonging to the set of all trees. In some cases this identification is not sharp: Sometimes we see objects that might be considered a tree, or might be considered merely a shrubbery⁷. As we grow older and more sophisticated, we start to take trees *apart*, to look at them at *ever finer levels of detail*, and our worldview has to be able to cope with water molecules that are *not* a tree or part of a tree being taken in by a tree and transformed into molecules of cellulose that *are* part of the tree, and then in turn being eaten by a termite and becoming part of a termite, and being metabolized by the termite back into water once again⁸. Our notion of “tree” will become a very odd one, one that requires a *coarse-graining* of our vision in space and time, one with lots of semantic “fuzz” at the edges of the sets involved, and those sets themselves will be dynamic objects with constantly changing membership as a “tree” becomes a “fire” becomes “ash” becomes “dirt” becomes something else entirely or, in small part, a tree once again.

The ability to use *formal* mathematics can be both a help and a hindrance

⁷Being tended by the Knights Who Say Ni!, of course...

⁸I’m using trees here because deconstructing our own piggies in a similar manner might hurt!

along the way. If one reasons carelessly, one can end up applying tree-based conclusions to a shrubbery or a termite. Still, knowledge is better than ignorance and all this *really* tells us is that we should learn to reason *carefully*, and that if math was always a struggle for you in school that this is a *serious limitation* on the quality of your worldview. In the end, you'll need to make allowances for your own ignorance, including deciding whether or not to trust those whose mathematical knowledge and ability is greater than your own⁹.

Don't feel bad. In the next section we'll see that *everybody*, even a mathematical super-genius, has to make allowance for their own ignorance in developing their best worldview! Humility is so important to the process that we wouldn't go far wrong in making it, eventually, an axiom of our worldview.

Quantifying ignorance – and possibly renaming it something pithy, like *information entropy* – is one of the first, critical steps towards simultaneously establishing the meta-axioms that allow us to ordinally sort out comparative worldviews and develop a replacement for first order Boolean/Aristotelian logic so that the resulting worldview is still reasonable. Indeed, it will *precisely* establish the fact that we already arrived at intuitively, that we should believe the most what we can doubt the least.

⁹And whose brains are thereby less likely to explode when confronting the very real difficulty of the process.

Chapter 8

The Cox Meta-Axioms

‘What do you know about this business?’ the King said to Alice.

‘Nothing,’ said Alice.

‘Nothing *whatever*?’ persisted the King.

‘Nothing whatever,’ said Alice.

‘That’s very important,’ the King said, turning to the jury. They were just beginning to write this down on their slates, when the White Rabbit interrupted: ‘Unimportant, your Majesty means, of course,’ he said in a very respectful tone, but frowning and making faces at him as he spoke.

‘Unimportant, of course, I meant,’ the King hastily said, and went on to himself in an undertone, ‘important–unimportant– unimportant–important–’ as if he were trying which word sounded best.

Some of the jury wrote it down ‘important,’ and some ‘unimportant.’ Alice could see this, as she was near enough to look over their slates; ‘but it doesn’t matter a bit,’ she thought to herself.

Alice in Wonderland, by Lewis Carroll

Alice (as the agent of Lewis Carroll¹, who was a brilliant logician) has the right of it when she observes that her *lack* of knowledge of just who stole the tarts doesn’t matter a bit. She is also correct, at a different level, when she notes

¹Wikipedia: http://www.wikipedia.org/wiki/Lewis_Carroll. Or, Charles Lutwidge Dodgson. Lewis Carroll was just his pen name, although it ended up being the one everybody remembers him by.

that it doesn't matter if the jury considers her lack of knowledge *important* or *unimportant*. This is because the *ideal jury* – one with absolutely no bias – will make exactly the same use of her lack of information!

Now suppose that Alice was the *only* witness who had testified to a perfectly unbiased jury. What should be the state of mind of that jury be regarding the guilt or innocence of the infamous Knave of Hearts? There seem to be many possible answers, so let us review a few of them very carefully.

On the one hand, there seem to be only two possibilities. Either the Knave stole the tarts or he didn't. We don't know which, so either is equally likely². Alice's testimony does nothing to change this, so after she has testified, we remain where we started, thinking it equally likely that the Knave is innocent or guilty.

On the other hand, if the jury members aren't complete idiots, they know that while there is only *one* way the Knave stole the tarts, there are *fifty-one other cards* that might all be presumed to have equal access to those tarts. Even the King or Queen of Hearts might have taken them in order to advance a complex plot against the Knave. We don't have any reason to believe (yet) that any of these cards is more likely to be the thief than any other, so we assign a prior probability to the guilt of the Knave of $1/52$, and Alice's testimony does nothing to change this whether it is considered important or unimportant because she does nothing to *change our state of knowledge* concerning the crime.

On the third through infinity “other other hands”, if the jury members are *very* smart, they will have prior knowledge of *many other ways* the tarts might have disappeared. Perhaps they were stolen by the Mock Turtle, the Gryphon, the Mad Hatter! Perhaps they were never baked at all and the Queen is lying because she enjoys cutting the heads off of the innocent! Every being in Wonderland, right down to drug-abusing caterpillars who might have needed to sell some tarts on the black market in order to smoke more mushrooms become members of the set of possible thieves, each just as likely (given the complete ignorance of the jury of *facts* pertaining to the case) as any other. Even this isn't exhaustive of the set of possible explanations for an allegation of tart theft; it *still* neglects the near infinite number of ways the tarts might not have been stolen at all or were (for example) stolen by space aliens intruding from an entirely distinct space-time continuum, including that very real possibility that this is all just

²At least, this is true if we use a maximum likelihood estimation in the absence of any Bayesian priors at all or any data pertaining to the case. I won't always put in “warning” footnotes on this sort of thing, however. Suffice it to say that nearly any statement made in this chapter is going to be arguable by someone sufficiently knowledgeable, but this won't, actually, interfere with *my* argument and conclusion outside of constraining it in various irrelevant ways.

a *story* of stolen tarts being amusingly presented in a *fantasy* about a Cosmos containing talking cards to make some *logical point*³!

In this case they might assign a very small number indeed to the prior probability of the guilt of the Knave out of this *universe* of possibilities⁴.

This perfectly unbiased jury wants to do its best to arrive at a fair verdict, given the available information. By just counting the size of three possible statistical universes we can see that how difficult the jury will be to convince of the Knave's guilt (as actual evidence is eventually introduced) depends far less upon the *facts in hand* concerning the case than upon *how good an imagination they have!*

District Attorneys are well aware of this, and know that it is risky to put somebody that *knows too much* on a jury, because it will be correspondingly more difficult for such a person to achieve a state where they lack reasonable doubt than it will be to convince a juror that considers only the *much smaller set of possibilities* that a good D.A. *tells* them to consider.

The D.A.'s odds of obtaining a conviction, given any presentation of evidence, will always be best if they can convince the jury that the space of prior possibilities is as small as possible. Binary is great, because then the "natural" assumption is that it is even odds that the defendant is guilty (out of the two possibilities, guilty or not guilty) before any evidence is presented. If the D.A. convinces the jury – for better or worse – that only the Knave or the Mad Hatter could have taken the tarts, the *perfectly unbiased* jury will start out considering it a coin flip. At that point it won't take a *lot* of evidence to tip them towards strongly towards a guilty verdict – for whichever of the two the D.A. wishes to convict, say the Knave.

Every bit of evidence that the Knave did it reduces the chance that the Hatter did it, and even things like motive suddenly become persuasive evidence. If the D.A. can show that the Knave had *any* motive – say, was *known to be hungry around the time the tarts were stolen* – and the defense attorney can't

³Nahhhhhh, this can't be right. I mean, what are the odds that the author of *The Logic Game* would be making an amusing logical point...?

⁴Note that I carefully defined the term "Universe" (upper case) in the very first chapters of the book and I'm clearly using it in a different (lower case) sense now. In this case the "universe" in question is the "statistical universe" of possibilities from which an assessment of probable guilt or innocence must be constructed. Sadly, it doesn't appear that there is any rigorous way to determine just how large that universe should be, when a jury member might have the *notion* that the tarts *might* have disappeared because Captain Kirk had a hankering for tarts and had Scotty beam them up...

show that the Hatter *also* had a motive, the chances that the Knave did it *must* increase in the minds of jury members, at the same time the chances that the Hatter did it *must* decrease. Two or three items can be enough to convince jury members “beyond reasonable doubt” even though an imaginative jury member might think it just as reasonable that the Mad Hatter was hungry enough to steal a tart around lunch time even if he *didn’t* announce to the world that he was ready to go get lunch the way the Knave did.

The attorney for the defense, on the other hand, wants to emphasize the number of ways their client might *not* be guilty and make it as *large* as possible, so that the “natural” prior probability of guilt is close to *zero*, instead! If the jury contains people that from the beginning believe that “anybody could have done it” including people that aren’t even referred to or presented as possibilities during the trial, it will be much harder to convince them otherwise. “Your honor, Wonderland was full of people hungry for lunch, whether or not we have a record of them announcing the fact. Why, the Hatter was seen shortly before at a tea-table *with nothing to eat on it* although we all know how much the March Hare and Dormouse like to eat, singing of treacle and all. If the Knave is guilty just because he was hungry, so we all must be guilty because – why look at that, it is almost time for lunch!”

Prior knowledge and the wilful imagination of alternative possibilities change *everything*, usually in the direction of increasing doubt concerning any proposed outcome⁵.

This is almost exactly our situation when building worldviews. To build the best possible one, we have to start from a state of complete ignorance. Literally everything (not internally contradictory) that we might imagine as possible has an equal probability of being true in the *complete* absence of evidence, as we originally suggested with the example of Adam, Eyes Still Closed in a previous chapter.

This is the origin of our *doubt* – like a well-informed jury⁶, we can conceive of a vast universe of *notions* that are all *a priori* equally likely, and must sift through the *evidence* of our own experiences both sensory and cognitive and turn them for better or worse into *Bayesian priors* and *then* consider the evidence presented in the case to arrive at the *best* assignment of probable truth, lifting

⁵If this paragraph makes you suddenly cynical that anything *like* a fair trial has occurred in the history of mankind, well, it should. Criminal trials are an exercise in Bayesian reasoning (without exception), which simply means that the *biases* of the jury members – a.k.a. “Bayesian priors” – are usually *at least as* important as the actual *evidence* in determining the outcome.

⁶or rather, perfectly well *un*informed...

up some notions to the status of worldview axioms (for example, laws of nature) or assertions that are (probable) knowledge (Professor Plum did it in the lounge with the candlestick⁷) in a consistent way, while decreasing our degree of belief in others as they seem contradicted by the totality of our (probable) knowledge and ongoing experience so far.

To the extent that we believe in gravity, we disbelieve in levitation. If we're pretty sure Plum did it with the candlestick in the lounge, we are also fairly certain that it couldn't have been Colonel Mustard and the rope in the dining room⁸. Note well that also for better or worse, our Bayesian priors themselves are subject to this same sort of decisioning process – they aren't *fixed* or truly *known*, they are themselves estimates conditioned by all of the other priors. In the end, we will be optimizing the self-consistency of an *entire network of interconnected beliefs*, not just looking at the guilt or innocence of some specific Knave.

Humans do this automatically, of course. *All* animals with brains do this to a greater or lesser extent, but humans have developed the ability to reason in this manner at a very high, symbolic level. However, for most of human history humans have reasoned in this way *incorrectly*, because the formal mathematical basis for doing it correctly is only a bit more than seventy years old at the time of this writing (and good examples of the connections between this theory and the reasoning process are even more recent), and most people are, possibly blissfully, unaware of it.

Let us pause for a moment to pay homage, all at once, to a list of names of at least some of the humans who had the key insights that led to the development of the correct meta-theory. In no particular order, René Descartes (already mentioned) invented methodological skepticism, which we have already exploited to good effect.

David Hume raised it to high art and demonstrated that the limit of methodological skepticism is *complete ignorance* because all so-called “truths” are either

⁷I'm sincerely hoping that you, dear reader, are generally familiar with and have even played the game of *Clue* (originally Wikipedia: <http://www.wikipedia.org/wiki/Cluedo> in the UK where it was invented). If you are unfamiliar with it, well, *Clue* is a board game version of Carroll's Sorites, a logic game of binary exclusion with the premise of players that must act as competing “detectives” (one of whom committed a murder in an isolated mansion) seeking out the murderer amongst themselves based on sequentially accumulated, initially incomplete, information that eventually excludes all possible murderers, murder weapons, and murder locations *but* the correct triplet, which one must assert to win the game.

⁸At least, in a game where Plum and Mustard couldn't have *collaborated* and both hung and shot the victim while working together, with the victim's head in the lounge and feet in the dining room...

assumptions themselves or are contingent and depend on assumptions, where *the fundamental assumptions could not be proven*. At the time, Hume was unable to derive a well-founded theory of inference even from a set of reasonable axioms, and hence to him it seemed that *everything* could be doubted (in some sense) *equally*. Hume lacked a well-derived *calculus of doubt*; everything was either perfectly black or perfectly white with no way to move through the gray scales in between. IMO Hume knew that this was incorrect, but lacked the mathematical skill or insight to proceed further.

Moving from philosophers *per se* to mathematician/statisticians, I should probably mention the Bernoulli brothers, in particular James, who formulated the *principle of insufficient reason* or *principle of indifference* whereby we assigned *a priori* equal probabilities to all members of a universe of possibilities in the absence of any reason to favor one or more of them relative to the rest.

The Bernoullis are closely followed by Pierre-Simon Laplace, arguably the founder of modern probability theory. Laplace wrote down a number of axioms of *probability theory* that are still a part of its common algebraic foundation today. That theory included *Bayes theorem* as a special formula connecting joint and conditional probabilities (which was never actually written down by Thomas Bayes, although we hereby give him an honorable mention as well).

We should now fast forward to George Boole, whose *Investigation into the Laws of Thought* brilliantly transformed the Aristotelian rules of logic (which very likely were not due to Aristotle but rather Parmenides and possibly Socrates and Plato, just to get their names and a few more philosophers into the list) into an *algebra* of true or false propositions that is still in use today as *boolean algebra*, and to his unremarked observation that there was an extremely close correspondence between this algebra and the algebra of probability as given by Laplace. Indeed, boolean algebra was the *limit* of probability algebra wherein propositions are assigned probabilities of 1 (certain truth) or 0 (certain falsehood).

This observation – that the stark binary certainty of boolean algebra that works so well in *Clue* is *consistently softened* into the algebra of probability theory with one as the limit of the other carried him *so close* to the set of insights that we will eventually make into our worldview meta-axioms, but in spite of the auspicious title of his book, in the end Boole still lacked the connection between computable probability and mentally spontaneous *belief*. I personally think it rather likely that Boole (like Hume) apprehended the whole importance of *information* in assessing probabilities (and knew intuitively how this related to belief and thought), but he lacked a statement of the meta-axioms necessary

to fully develop this point of view.

Unfortunately, it proved possible to develop the algebra of Laplace in another way, from a set of axioms that defined probability as the *frequency* of a given event occurring out of a well-defined universe of possibilities given an *infinite number of trials*. This *frequentist* or *set theoretic* definition of probability (due to Venn) was to *dominate* the academic and philosophical treatment of probability for the next 140 plus years and still is influential today. The reason that it was unfortunate is that it is all but useless to our purposes here or the theory of knowledge in general as it presumes an *a priori* knowledge of the set universe of possibilities that we (like Alice’s jury) in general lack – ultimately it has to be derived from our experience in the *one-shot experiment* of our lives – or that has some arbitrariness in it that can only be resolved by knowledge drawn from outside of the *mathematical* problem, as our example of the infinity of different, equally “valid” estimates of the prior probability that the Knave of Hearts stole the tarts clearly demonstrates.

In no case are we *ever* able to perform an infinite number of trials or collect an infinite number of independent, identically distributed samples in the real world, and so a frequentist approach at best provides an asymptotic and somewhat abstract *model* that is nearly useless in practical cases where an estimate of probability must be made from a very finite set of actual data and experience. In real-world⁹ one-shot questions like the guilt or innocence of the Knave of Hearts, where we can hardly consider the situation to be a *random sample* from some *a priori* known distribution of Knaves that did or did not steal tarts baked by the Queen of Hearts, we are left making up an estimate of the prior probability by counting the possibilities in an *imaginary* statistical universe that we make up on the spot and factoring in our other prior knowledge (if any) in a favored way that often excludes it from being modified in the subsequent analysis. This is a highly subjective process that is hardly unique! My estimate and yours could be enormously different without either of us being “wrong” because they depend upon *what we* (think we) *know*!

Finally, the singular and unique Knave in the Cosmos of *this* story is *entirely* guilty or *entirely* not guilty, not 10% (likely to be) guilty or 90% (likely to be) not guilty in any frequentist sense of the term, presuming an infinite number of identically prepared Knaves who might have stolen an infinite number of missing tarts¹⁰ or the even more absurd *quantum superposition* of guilty and not-guilty

⁹For some meaning of the term “real-world”, that is not, in fact, the meaning of the term real-world. But you know what I mean...

¹⁰Or not, given that the entire story is just a fantasy. In fact, using my own carefully

Knives that one often hears about in silly discussions of quantum theory.

Indeed, the best way to interpret our estimate for any given probability *given the data* is that it is the number we (most) expect the frequency to turn out to be *if* we were able to obtain an infinite number of samples of the event under *almost* identical circumstances¹¹ – something that can never, ever happen in our finite lifetimes where there *are* no such things as identical circumstances, where every instant of experience is unique. The frequentist view of probability is precisely backwards, in other words, from what the word actually means to us, and is incidentally utterly irrelevant in a court of law. We will therefore bless John Venn¹² and curse him at the same time, for inventing some arguably very useful ideas that nevertheless form a very persuasive blind alley that actively retarded the search for the meta-axioms of the optimal worldview for almost a hundred years¹³.

Following Boole there are a number of authors who expressed the *philosophy* of probability in varying degrees of clarity, or who introduced important concepts in building models (where a worldview is a *really, really big*, indeed *Universal* model). Ronald Fisher introduced the theory of maximum likelihood estimation of probabilities: This is the idea that the best estimate of the *parameters* of a statistical model are those that maximize the probability of producing the data the model is supposed to explain (an idea that had been around for some time and was used by Laplace and Gauss among others), given e.g. “uniform priors”. But there was (and to some extent continues to be) the question of what to do with priors, those assumptions upon which any model is based *beyond* its mere parameters. While maximum likelihood (or variants thereof) proved to be highly successful and is built in to many, perhaps even the majority, of statistical modelling applications, it was not, however, generally viewed as being the foundation of epistemology, possibly because of our historical obsession with and implicit belief in the applicability of binary logic to true/false knowledge of the real world *as if it actually exists!*

constructed worldview, I think it rather likely that *no tarts have ever been stolen by an actual Knave of Hearts*, based on my life experience and the evidence already in my possession.

¹¹That is, there *must* be some *entropy* in the system that “generates” the samples so that they are all independent but identically distributed – *iid*, in the jargon – something that frequentists have a very, very hard time conceptualizing inside the theory, but which arises completely naturally in Bayesian treatments.

¹²Wikipedia: http://www.wikipedia.org/wiki/John_Venn. John Venn was the inventor of frequentist probability theory as well as the inventor of Venn diagrams that help us to visualize set theory.

¹³And perhaps continues to have a negative effect even today...

Bertrand Russell, after writing an extensive book on the theory of knowledge in 1913 that is interesting insofar as it attempts to relate cognitive processes to knowledge but otherwise fatally flawed, wrote a lovely article¹⁴ on the theory of knowledge for the Encyclopedia Britannica in 1926 that is *still* flawed by an obsession with “complex symbols” and excessive tribute to behaviorist philosophies of psychology but which illustrates that Russell’s thinking was gradually moving closer to the insight that knowledge had a *mathematical* character similar to that illustrated above, where the more specific (or “precise”) an assertion, the more *likely* it is to be false.

For the mathematics of this relationship he relied heavily on *A Treatise on Probability* by John Maynard Keynes written in 1921, of which he remarked:

So superior is his work to that of his predecessors that it renders consideration of them unnecessary.

This work of Keynes was, perhaps, the final step towards the key insight into knowledge that this work seeks to distill and communicate as the basis for a sound worldview. It sought to make concrete and *quantitative* the relationship between mere *correlation* – the observation that certain regularities occur in nature, places where *A* is always observed in association with *B* – and a quantitative statement of the *conditional probability* that, given *A*, one also has *B*.

It is arguable that Russell (who was, after all, one of the smartest men who ever lived) understood directly and intuitively the result we are working toward – he certainly had all of the ingredients and also wrote this in the *Encyclopedia Britannica* article:

Scientific inductive or analogical inferences may, in the best cases, be assumed to have a high degree of probability, if the above principle of limitation of variety is true or finitely probable. This result is not so definite as we could wish, but it is at least preferable to Hume’s complete scepticism. And it is not obtained, like Kant’s answer to Hume, by a philosophy ad hoc; it proceeds on the ordinary lines of scientific method.

Unfortunately, another work that was perhaps as important and influential as Keynes to the formal development of probability as the (Bayesian) basis for epistemology was the *The Theory of Probability* by Harold Jeffreys, and while

¹⁴See: <http://www.marxists.org/reference/subject/philosophy/works/en/russell1.htm> ...if the link still works.

Russell very likely knew both Fisher and Jeffreys, I could find no explicit indication that his epistemological meditations were influenced by either one. Fisher and Jeffreys were contemporaries, and personified the ongoing conflict between the “Frequentist” (Fisher) and “Bayesian” (Jeffreys) approaches to probability and scientific inference. Jeffreys’ book, written after he was somewhat reconciled to Fisher (at least on the human level, where their original interactions were reportedly “fiery”) was perhaps the first attempt to transform Bayesian probability theory into the epistemic basis for the scientific worldview, or at least for the scientific method and a way of systematically transforming an increasing body of experimental evidence and experience into the likelihood that a theory explaining it is true. Jaynes’ work (discussed below) was largely inspired by Jeffreys’ book, and Jaynes dedicates his own book on probability theory to Jeffreys. But several ingredients were missing, in particular a (reasonably) sound axiomatic basis for the development of this approach that would justify and specify how to deal with the problem of (Bayesian) priors, which were viewed by Fisher as being more or less arbitrary to the extent that they themselves were not justified by observations and computed from frequentism.

How *exactly* one can proceed from a small set of axioms to a remarkably clear and even quantitative scientific epistemology, was worked out and beautifully expressed by the synthesis of the work of three different men working not on “philosophy” per se but on two *technical* problems that are not at first glance epistemic – the problem of how to axiomatically derive statistical mechanics in physics in one case, and how to compute the probability that an encoded message sent over a noisy channel could be received at the other end as a quantitative function of the degradation of the transmitted information.

As it turns out, the mathematics they derived is a remarkably accurate representation of what goes on in a *neural network* model, and may actually be a substantial part of the quantitative basis of the *biological basis* of the “worldview” of living organisms that have one¹⁵. Russell, who obviously lacked knowledge of the *microscopic* basis of thought as a neural network was (perhaps) seduced by behaviorism to conclude that “the connection between these parts¹⁶ is not very close”¹⁷, got this part *very wrong* in his theory of knowledge which was otherwise *extremely close* to what this work presents. Not only can one work out an actual

¹⁵Wikipedia: http://www.wikipedia.org/wiki/Bayesian_inference_in_phylogeny. ...as well as the process of evolution that gave rise to them in the first place. See my paragraph immediately below on a book by David McKay if you are interested in the connections between information theory and neural networks and models in general.

¹⁶logical and psychological

¹⁷Still in the *EB* article, at the very end.

algebra for inference (obtaining a familiar result), not only can one show that this result is the logical basis of all reliable knowledge of the real world (scientific or not), but that it is *plausibly the basis for the physical mechanism through which we think at all*. The theory of psychological knowledge is actually *consistent* (as we *require* as our first meta-axiom above and in any event would rather expect to be the case unless one prefers to believe in supernaturalist explanations of knowledge) with the theory of inferential knowledge and logical reason, with physics and chemistry and biology and electrophysiology and all the rest of science.

Let's take a look at those three men (and maybe a few others who deserve an honorable mention)¹⁸.

First we must take our hats off to physicist *Richard Cox* who took the work of Boole and Keynes (and Harold Jeffreys) and, in 1946, abstracted a tiny set of axiomatic propositions from which the algebra of probability theory and, as a limiting case, the algebra of formal boolean logic, can be derived. Cox did not clearly state these axioms, however, but instead *used* them as the basis of his derivation via arguments. Either way, he should clearly be given the platinum feather as arguably the greatest philosopher of all time¹⁹, as these axioms are the key to everything that we call knowledge and, very likely the way the mind itself functions. Cox's results (which were originally published in the *American Journal of Physics*, not a philosophy or statistics journal) are summarized and presented in a charming little monograph written in 1961 entitled *The Algebra of Probable Reason*, which is easily mastered by anyone with an elementary understanding of algebra and perhaps a smattering of knowledge *about* logic and statistics.

At almost the same time, a mathematician named *Claude Shannon* was working through the statistics of the transmission of encoded information over noisy communication channels. He derived and published in 1948 (from very similar but narrower principles) *information theory*, which turns out to be more or less isomorphic to the algebra of probable inference derived by Cox²⁰. That is to

¹⁸While omitting others, as this is not intended to be a completely encyclopedic discussion on the theoretical development of probability theory in this context. Hence I will not walk through Kolmogorov, Bruno de Finetti, Poincaré, or Borel. See, however, G. Shafer in *Internat. J. Approx. Reason.* 35 (2004) 97-105, if you want a more balanced and thorough guide to the development of these ideas.

¹⁹Standing, as always, on the backs of giants, in this case primarily the giant named "John Maynard Keynes" whom he, like Russell much earlier, acknowledged as his primary inspiration. This event also inspires would-be authors such as myself who might hope that their unreferreed *treatises* – like this one – have a chance of inspiring the thinkers of the future in critical ways.

²⁰To put it in a very intuitive way, we are attempting to *decode* nature on the basis of *incomplete observational evidence that accrues over time*, which makes it very reasonable that the one would describe the other.

say, information theory can be derived from the Cox axioms, and the algebra of probable inference can be derived from information theory. Although I would argue that Cox (being temporally first to publish as far as I can tell, by a hair) deserves the *platinum* feather, Shannon surely deserves no less than a gold one as there is absolutely no reason to think his work was not completely independent, and because it contained additional useful concepts without which the resulting theory would much more difficult to understand and less complete²¹.

In particular Shannon deduced and named²² the concept of *information entropy*, the log of the *missing information* required to fully specify any given physical state in physics or decode any given partially corrupted message in computation or communications theory. In both cases it is a small step from *knowledge of state* to *state of knowledge* as both are symbolic encodings of (generally uncertain) *information*.

This idea creates a natural mapping between evidence and data and the best possible assignment of degree of belief (resolving several of Russell’s complaints regarding the use of probability as the basis of a theory of knowledge). It also should be noted that “information” is arguably the *ultimate abstraction* of semantics and ontology – we find it very easy to say that knowledge *is* information. Information theory is thus a sort of *communication and computation* specific variation of the general theory of knowledge. Shannon’s work is rather technical, alas, and not easily comprehended by the non-technical individual (perhaps including many readers of this book, but see below for a reference that might help).

A second gold feather should surely be awarded to *E. T. Jaynes*, another physicist, who perhaps alone fully realized the staggering implications of Cox’s and Shannon’s theories as a formal justification for a lot of Jeffreys’ ideas and making them suitable as a *derivable* basis of science, and a *practical* basis for

²¹Sadly, historically it has been mostly the other way around, as Shannon’s Theorem is widely known where Cox’s results are not.

²²With the help of John von Neumann, yet another giant. Tribus, in a Scientific American paper, quotes Shannon as saying: “My greatest concern was what to call it. I thought of calling it information, but the word was overly used, so I decided to call it ‘uncertainty’. When I discussed it with John von Neumann, he had a better idea. Von Neumann told me ‘You should call it *entropy*, for two reasons. In the first place your uncertainty function has been used in statistical mechanics under that name, so it already has a name. In the second place, and more important, nobody knows what entropy really is, so in a debate you will always have the advantage.’” This gem illustrates the key role of uncertainty/doubt in the theory of information, at the same time it reports the *ironic truth* that *no one knows what entropy really is!* By definition, in fact. If we knew, it *wouldn’t be entropy!*

Sorry, physics pun. I’ll explain. In physics, one way of viewing entropy is as the (scaled) log of the missing information required to fully specify the state of an imperfectly known system.

human knowledge as well as the basis of human thought. Over an entire career in physics Jaynes never ceased to promote his clear vision of Bayesian reasoning as a basis for human knowledge of all sorts, and I am deeply indebted to Jaynes' work *Probability Theory: The Logic of Science* (as well as his much earlier Mobil lectures that formed its original basis) in *this* book. Ordinary people who wish to go beyond this book are strongly encouraged to perhaps read Cox, skip Shannon, and read at least Jaynes' Mobil lectures and the first five chapters of Jaynes' book (where remarkable little math is required – they are quite readable and illustrated with simple and easily comprehensible examples); students of mathematics, physics, philosophy or statistics should, of course, try to read everything I mention and then some.

It is worth giving an honorable mention to *George Polya* who wrote several volumes on plausible reasoning and inference in *mathematics* that fairly convincingly showed that far from being purely deductive, mathematics is almost always derived *first* from a process of observation and inference *just like the one used in science*, which is *followed* by the formal work of proving, from suitable axioms, conclusions that are already strongly believed to be true. Indeed, it is often the case that the axioms themselves emerge from the sea of notions when contemplating these numerical or geometric “observations”. Two favorite examples of this are *Fermat's Last Theorem*²³, that $a^n + b^n = c^n$ can be true for natural numbers a, b, c only for $n = 1, 2$, which was finally proven after more than 350 years of concerted effort by thousands of mathematicians and would-be mathematicians; and the Goldbach Conjecture²⁴: *Every even integer greater than 2 can be written as the sum of precisely two prime numbers* – a regularity with no known exceptions out to over 10^{17} as of this writing – that has yet to be proven as a theorem of number theory (but which still provides many an hour of harmless pleasure to those seeking instant fame in the mathematical community

²³Wikipedia: [http://www.wikipedia.org/wiki/Fermat's Last Theorem](http://www.wikipedia.org/wiki/Fermat's%20Last%20Theorem). Fermat scribbled the following into the margins of his favorite math book: *It is impossible to separate a cube into two cubes, or a fourth power into two fourth powers, or in general, any power higher than the second into two like powers. I have discovered a truly marvellous proof of this, which this margin is too narrow to contain*. It is generally believed that his “proof” was one of the many false proofs found by mathematicians over the years, in part because the proof that was eventually discovered contained an enormous amount of highly sophisticated mathematics that would have been unavailable to Fermat. On the other hand Fermat, like Ramanujan, Gauss, Riemann, Kolmogorov, and various other humans over the years, was a *transcendent* mathematician, able to “see” relations that elude others, so there exists at least a small romantic possibility that a simple, *marvelous* proof that mathematicians have yet to discover is out there waiting for the next uber-genius.

²⁴Wikipedia: [http://www.wikipedia.org/wiki/Goldbach's Conjecture](http://www.wikipedia.org/wiki/Goldbach's%20Conjecture).

now that Fermat’s theorem has been proven). There are actually quite a few of these empirically-true-but-unproven conjectures awaiting formal proof in number theory if any of *you* reading this feel lucky....

Polya is also famous for having developed certain types of *urn models* as a way of exemplifying how we turn observational data into a probability as we iteratively repeat an experiment or sampling process, which in turn can be derived by considering the sampling process as producing *information* about the model (subject to some Bayesian considerations) that is used to iteratively decode the “message” (the probability distribution of the contents of the urn). These “toy models” are important as they often enable one to have insights that are obscured by applying more involved methods to much more complex problems.

For example, a Bayesian estimate of the probability of getting heads in a two sided coin (one “urn-like” problem of sampling with replacement) was used by Richard Palmer to teach the Jaynesian course in statistical mechanics I took in graduate school at Duke in which many of these ideas first came to my attention (Richard also gave me my *first* (electronic) copy of Jaynes’ then unpublished book, which was passed around online by cognoscenti for decades before finally being completed and printed after Jaynes’ death). We’ll go over the *process* involved in an actual example later in this text, as it will illuminate several of the ideas I’m advancing. This process is also the *correct* resolution to the coin-flip problem of Fat Tony versus Dr. John in Taleb’s book *The Black Swan*, where Joe turns out to be a natural Bayesian with well-informed global priors... although Taleb perhaps does statisticians in general, frequentist or not, a disservice by thinking them naive enough not to recognize a rigged coin even faster, and a lot more accurately, than Fat Tony.

Finally, for people who really do want to figure out this “information theory” thing and its connection to modeling and inference if not epistemic knowledge, let us at least name *David MacKay*²⁵, for writing a lovely book entitled *Information Theory, Inference, and Learning Algorithms*²⁶ that ties all of these ideas (including marvelous connections to e.g. simulated neural networks and predictive models) together into a cohesive, *quantitative* whole. His beautiful examples illustrate Shannon’s theorem in action and its use in reliable encoding

²⁵Wikipedia: http://www.wikipedia.org/wiki/David_J._C._MacKay. Who was alive when I first wrote these words but has in the meantime died of cancer.

²⁶See: <http://www.inference.phy.cam.ac.uk/itprnn/book.html> The online version of this book is free for students and scientists, but I strongly urge anyone that can afford it and is interested to buy a paper copy and thereby support the author²⁷. I certainly did. It actually makes it somewhat easier to work through, for what that is worth – which in the case of a *really complicated subject* can actually be quite a lot!

schemes, in compression algorithms, in the (Cox-Jaynes) process of data-based inference, and in the formal theory of cognition and learning. It is accessible at about the level of undergraduate students who have completed multivariate calculus, although a course in elementary probability and statistics and knowledge of computation and programming would certainly help as well.

There. I apologize for the length of what is, after all, just the *introduction* to this chapter²⁸, but while most of the content of *this* book is presented without elaborate cross-references and attribution (for the sake of readability if nothing else), this key point simply cannot be presented without giving the interested reader the full opportunity to work through and verify the theory and its historical evolution *for themselves*, since I will present only the *results and consequences* of this theory with the least possible accompanying algebra. That works, as it turns out, because even the *verbal* expression of the Cox meta-axioms is very, very useful in understanding how to go about building the best possible worldview, given the data of your continuously unfolding personal experience.

So fine, just what are these marvelous meta-axioms, why are they *meta*, and why are they so important? And what do they have to do with Alice and the Knave and the Tarts?

Let us just write them down as Jaynes has them²⁹ after establishing some preliminary definitions that are themselves meta-axioms, but rather boring and mundane ones so we won't bother numbering them.

It is hopefully crystal clear by now that our goal in constructing a worldview is to take an unbounded universe (lower case, hence “statistical”) of *notions* and reduce it, using some mix of data, experience, “intuition”, bootstrapping, and black magic to a *much smaller universe* of *interconnected* notions that we

²⁸At that, this is only a tiny fraction of of what I *could* include, as the field of epistemology is wide, as are the fields of probability and statistics, information theory, cognition theory, etc. If I did all of these topics and their contributors justice, they'd be a whole book in and of themselves and the *point* of this one would be lost. I bring this up as you will note that I am not even mentioning in passing Wittgenstein, Carnap, Popper, Quine, and many others who have been very influential in epistemology as they are *not in the main line of the development above and what I want to say*. On the other hand, I did at least just now drop a few of their names and may do more elsewhere...

²⁹Jaynes apparently recognized that these propositions are not exactly *axioms* in the usual sense of unprovable propositions or definitions. He referred to them therefore as “desiderata”, something that the dictionary would have us identify as *weaker* than an actual axiom, more like a fond hope or need. In this work they are presented as being in fact closer kin to the *laws of thought* of Aristotle and Parmenides, axioms as “manifest truth” and as rules to which axioms as hypotheses in presumed correspondence to a real Universe must submit, that is to say, as meta-axioms that are *stronger* than ordinary axioms.

have reason to believe constitute *as a whole* a “plausible” theory (or model, or representation, or map) of the Universe, a *worldview*.

There is no reason at all to expect that we will end up with only one such set. In fact, there are several trivial edge cases or limiting cases, some of which we’ve already referred to – solipsism, religious explanations, invisible fairies – that can *always* be made to “work” by simply multiplying out the causes, increasing the number of axioms until (if necessary, in the limit) *every separate observation* is covered by its *own axiom*. Even this last sort of complete lack of the use of inference *at all* in one’s dynamic worldview, tragically, is not unknown – it results from certain kinds of damage to the human brain that prevent the formation of memory so that every experience once again becomes *unique* and new associations of the sort we consider “knowledge” cannot be formed from correspondences within the temporal sequence of past experiences. Physically encoding and storing sensory experience (*information*, note well) as *memory* is an obvious necessary step towards any sort of cognitive experience of knowledge *beyond the immediacy of the sensory experience of the Atman*.

In order to choose the *best* worldview from this nastily infinite set of possible worldviews with wildly varying numbers of axioms and underlying notions, we must define a quantity we will call the *plausibility* of any given proposition or combination of propositions (where we will worry later about how to combine propositions). The plausibility³⁰ will need to admit *ordinal ranking* or we cannot sort through plausibilities/degrees of belief and find the most or least plausible/believable proposition(s) from any given set.

Using our meta-axiom of mathematics, and riffing through the various axiomatic theories that it makes available as fully developed tools ready for our use, we note that number theories that support arithmetic (perhaps proven from a generalized “successor operation”) are generally ordinal. We have two or three choices as to which kind of numbers we should use. Natural numbers might work, for example, but they are discretized, and it isn’t clear that we can or should *a priori* express plausibility in terms of a scale where there is a “quantum of belief”, the smallest possible change in a plausibility. Also, we might want to use zero (or negative infinity on a *logarithmic* scale) to describe *perfect implausibility* – the boolean state of a definitely *false* proposition.

Rational numbers, on the other hand, have no lower bound and no quantum

³⁰Or – to address objections of Shafer in the article referenced above – “degree of belief”, what Cox called “likelihood” and Shafer suggests might be called “likeliness” to avoid confusion with the likelihood of Fisher

(and there is the poetic beauty of using rational numbers in the construction of rational worldviews) but this is still a bit worrisome – rational numbers are only countably infinite and hence have cardinality \aleph_0 (pronounced “Aleph-null”, the cardinality of a countably infinite set, one where every number can be placed in a one-to-one correspondance to a natural number) where we rather expect – or at least do not want to *a priori* limit – our “space” of possible notions (and in the process throw out an enormous amount of potentially useful mathematics). It seems wiser to assume that the notional space of possible worldviews is *uncountably* infinite unless or until proven otherwise and hence at *least* \aleph_1 (“Aleph-prime”, the cardinality of an *uncountably* infinite – set).

For that reason, we choose to represent “the plausibility of a proposition” with the simplest possible numbers that form an \aleph_1 ordinal set – the reals³¹:

3. Real Plausibility – Measures of plausibility are represented by real numbers.

The next meta-axiom is worthy of being etched into a thick slab of platinum and decorated with precious jewels and being mounted within a shrine to human knowledge set in the exact center of every major city in the world. Schoolchildren should have a once-a-year mandatory trip to visit that monument, a trip that they can only skip if they have it *permanently tatoored backwards* on a body part that they must see every time they look in a mirror naked. Or (snitching a good

³¹Note well that neither Cox nor Jaynes went to quite this level of pickiness, but then, Jaynes used as his justification for using real numbers the fact that his “robot” had to do the computations to get a consistent answer. In fact, *real* robots (computers) reason with *discretized rationals* as an *approximation* to the reals, and as a consequence will always have a problem with *consistency* due to roundoff and other numerical errors on discretized sets relative to real numbers. Sure, we know what Jaynes *meant* – he is talking about an *idealized* robot that can compute using real numbers – but the theory of deterministic chaos and orderings of infinities and so on does, in fact, make the distinction nontrivial. In a *real* robot, or human, brain, discretization *along with many other* errors will contribute to *information entropy*, which is yet another way of stating that in this approach inferential knowledge can never really be certain.

In any event, the cardinality of the continuum is 2^{\aleph_0} . *With certain axioms of set theory*, this can be shown to be \aleph_1 – the celebrated *continuum hypothesis*, and that’s what *we* are going to axiomatically specify as the basis for plausibility. Hmmm, looks like we really *needed* the meta-axiom of mathematics before we did this chapter (and its meta-axioms), didn’t we?

Note well that I’m footnoting this only to keep set theorists, logicians, and formal mathematicians off of my back (and, sigh, it probably won’t work), because physicists frankly, tend to be cavalier about infinity (myself included). *Almost nothing will change* if we use rationals instead of reals here, at least nothing that I can think of, given the physical limitations of human observations or measurements that are always going to be uncertain at a scale far from the continuum.

This is fortunate, because spacetime itself may turn out to be discretized and truncated (perhaps at the Planck scale), just like numbers represented in a real robot’s “brain”.

line from the Second Kalandar’s Tale), it should be “graven with a needle on the corners of the eye as a warner to whoso would be warned”³².

4. The Calculus of Common Sense – *Plausibilities can only change in qualitative correspondence with common sense.*

Let’s make this meta-axiom concrete with a little example. Consider our friend the Knave of Hearts. Suppose Alice had replied with something *besides* complete ignorance. Suppose that she stated, under oath, that she was *with* the Knave of Hearts during the time of the supposed theft of tarts, and that he therefore is innocent of the crime. You (as a member of the perfectly honest jury) are now in possession of *two* pieces of information. First, you have your own personal prior estimate of the probability of the Knave’s guilt, perhaps derived from some prior set of beliefs about the probable size of the “space of the possibly guilty” and informed by any other prior knowledge you bring to bear about the character of Knaves, but this initial value is *unimportant* to the *direction of the change* to be brought about by evidence.

To this prior knowledge and estimate you *now* must add Alice’s testimony. You are ignorant of Alice’s character – perhaps she is a liar, perhaps she is the Knave’s lover. However, you have no reason to think that she *is in fact* his lover, and you have no reason to believe that *most* people would lie on behalf of the Knave if the Knave was, in fact, guilty. In fact, they, like you, might have been looking forward to having some tasty tarts and now they’re all gone. You therefore think – absent reason to think otherwise – it rather more likely than not that Alice is telling the truth.

You begin to see how even the *simplest* of decisions concerning the real Universe requires the use of a *network* of plausible beliefs – your judgement of Alice’s *a priori* credibility is the same sort of thing as your judgement of the Knave’s *a priori* guilt, and your decision will ultimately depend on both.

Given a prior estimate that Alice’s testimony is more likely honest than not *and* your prior estimate of the Knave’s guilt (whatever it might have been) which of the following actions makes *more sense*:

- Increase our degree of belief in the Knave’s guilt on the basis of Alice’s testimony.
- Leave the degree of belief in the Knave’s guilt unchanged.

³²From *A Thousand Nights and a Night*, in case you’ve never read the Second Kalandar’s Tale. Sounds painful, but important lessons often are.

- Decrease our degree of belief in the Knave's guilt.

Only a complete, irrational *idiot* would use *only the information given above* and no other prior assumptions or knowledge and *increase* their degree of belief in the Knave's guilt. Indeed, it seems as though the *best* thing to do is to *decrease* it, as now there is evidence that the Knave is innocent as he lacked the opportunity to commit the crime *if* Alice's testimony is true, and while a true skeptic might argue that we are completely ignorant of Alice's character or observational skills (so that she could lie or be mistaken) I did give you the information that as a juror you *do* have reason to believe that *most* people would have no reason to lie on behalf of the Knave and the Knave is a rather characteristic card that could hardly be confused with most of the alternative guilty parties, say the deuce of hearts, the knave of spades, or even the Dormouse, so it is also reasonably unlikely that she could be mistaken.

This clearly illustrates the basic reason for this meta-axiom. We don't want to build a stupid, unreasonable worldview, one where we, as jurors-in-perpetuity deciding what best to believe, hear reliable evidence *for* an assertion and perversely *decrease* our degree of belief in it³³. We therefore have to use our *common sense* to determine the *direction* of any changes in our system of plausible beliefs, given new evidence. Note well that this doesn't mean that we should always uncritically take evidence at face value – if we *do* happen to have some reason to believe that Alice (like the frog) *always lies* then her testimony might well lead us to *increase* our degree of belief in the Knave's guilt!

Real world juries might form estimates of Alice's character a thousand ways, from the way she dresses and talks to other evidence presented. If we hear from the Wonderland Crime Scene Investigation team that they found tart crumbs on Alice's pillow the day after the alleged crime, we might well discount or even invert the effect of Alice's testimony and convict the Knave and Alice together in our own minds. Ultimately, we have to be certain that our eventual theory can explicitly handle cases where we have more than one source of knowledge or a preexisting set of plausible beliefs that we must include in our "best" evaluation of changes to any particular belief or to the entire *network* of our beliefs all at once, and sadly (for those that lack it or those that might wish for something

³³Yes, this statement begs any number of questions concerning you, dear reader. Perhaps you are reading this book to figure out how build the *stupidest possible* worldview, because you delight in being almost certainly *mistaken* in your beliefs. I hope not, but I cannot deny the possibility that it is true. There is *historical* evidence that religious beliefs are often reinforced in just this perverse way, and there is even the (psychological) theory of *cognitive dissonance* that attempts to explain it.

more rigorous), our only possible guide is mere common sense. In the end, there is no possible substitute.

The third meta-axiom is very simple, although we'll end up *using* it in several ways in the construction of an axiom based worldview. We've already encountered this meta-axiom in the *logical* constraints on the *abstract* formulation of our worldview, where we do in fact need it. We now need it for the *generalized* logic of a worldview, the logic of a *network* of *related numerical plausibilities*.

5. Consistency of Plausibility – *The complete network of mutually related plausibilities must be numerically consistent.*

In other words, if we have more than one way of evaluating a plausibility, they all have to lead to the same result³⁴. That result must use *all* of the network of connected plausibilities; we cannot use any sort of “ideological filter” to select only certain “convenient” propositions or a filtered subset of the data to arrive at a conclusion, at least not without fully understanding what we are doing and how it affects the plausibility and believability of our final result. Two people (or two computers, or two “robots”, to borrow from Jaynes’ favorite metaphor that emphasizes the necessary lack of bias in the results) must always *reach the same conclusion* when reasoning from the same data with the same network of prior plausible knowledge, even if they arrive there by means of different “arguments” (computations).

Of course, in the real world they *don't*; even *completely honest* jury members who are *intelligent enough* to reason in a valid way often disagree, and of course some are *not* particularly honest or intelligent. They disagree because they each bring into the jury room their own *unique* collection of prior knowledge, experience, and beliefs (some of which may well be unreasonable, inconsistent, or mistaken). Alternatively, they can just reason *badly* (making mistakes, for example) from good prior beliefs because they are not, after all, robots! Humans, including myself (to my own direct experience as a teacher of University level physics) can be remarkably intelligent and make mistakes, which is why any writer of a book such as this has to constantly audit the work for errors³⁵ and will *still* miss some, giving editors and proofreaders a reason for existing. It is nevertheless a *strong requirement* for a *reasonable* worldview, as it would be very disturbing if correct mathematical reasoning from precisely the same information two different ways leads to mathematically distinct conclusions.

³⁴Within roundoff and other errors... sorry, Jaynes as noted sort of left that one out, although he does discuss how in the real world different folks can arrive at different conclusions just as I do in the paragraphs above.

³⁵Just kidding...

This is what causes ulcers in trial lawyers that argue in front of a jury. People have *well-hidden* biases and prior beliefs (often derived from their own personal experience, valid or not) that can and do profoundly affect their reasoning process and conclusion in any trial and that may or may not be revealed during the questioning process that seats a jury: “Police testimony is more/less reliable than the testimony of private citizens.”; “People who are different from me – of the opposite sex, a different race, a different socioeconomic background, who talk differently – are more likely to be liars than those that are like me.”; “If this person is found guilty, I will suffer in the following way.”; “If the D. A. thinks they are guilty, that is good enough for me.” Whether or not the prior beliefs are *true*, they will most certainly affect the outcome of a *valid process of plausible reason* in fairly predictable ways. Jaynes’ “reasoning robots” will usually come to *different* conclusions from the same evidence if they are preprogrammed with different prior data, even if they reason absolutely correctly, unless they include a mechanism for *correcting their priors* in a way that (ultimately, eventually) converges to the same values.

One of the major points of *continuing* contention in statistics is just how to pick priors before one has any data and how to alter them (and any model parameters), given the data, to produce the best possible posterior probability distribution. No matter what scheme one comes up with, one can invent specific examples where that scheme doesn’t work as well as another scheme (or even “fails” in some way) but in the end, insisting on *global* consistency ensures that this approach *as a methodology* will lead to knowledge that, on average, tends to improve as we accumulate more data and observations and experience. Many examples of this sort of reasoning are given in Jaynes (and a few in Cox as well) and there is no reason to repeat them all here.

That’s it. When selecting a worldview from the vast ocean of notions that can all be *doubted*, we wish to end up with the one that (given the data of our experience) we can *doubt the least*, the one that is the *most plausible* in a sense of the word “plausible” that permits “undecided”, or “not sure” or “maybe” sorts of intermediary distributions of plausibility among the various alternatives. We accomplish this by means of a *calculus* that causes changes in the current values of an interconnected network³⁶ of real-number plausibilities assigned to those notions (including the priors!) in the *direction* suggested by common sense, given the prior state of the network and the new data of our ongoing human experience. If there is more than one way to evaluate the new state of the network given its

³⁶Dare we say, in a mechanical and somewhat noisy interconnected *neural* network?

prior state(s) and the data, they all have to lead to the same numbers³⁷; answers obtained within a given worldview must be unique in order to be consistent, and must be consistent in order to be the best that we can do.

Note well! This is an *idealized* description of a *dynamical process*, not a static prescription for evaluating a matrix of probabilities. Epistemology is a *calculus*³⁸, not just a static *algebra* and is generally *relative and ordinal* and not *absolute*! Newton *invented* calculus so he could (start to) build the physical science foundations of the scientific worldview, and the scientific method is also a kind of calculus of iterative refinement that is justified by this set of axioms. It is also highly error prone, noisy, and the axioms themselves do not give one a full appreciation for just how much *entropy* a given living organism has compared to the full information content of the Universe, or how limited our abilities are to extract state, observe, or infer information to reduce it.

Implementing it isn't *easy*, and I don't want to imply that we would all just agree on everything if we had enough evidence as the axioms and theorems and observational evidence supporting *just physics* (as one important part of the most successful prevailing worldview) more or less guarantee that that can never happen!

Still, this is an *enormously, awesomely powerful set of meta-axioms*! It works for different *kinds* of systems and models, some of which are not worldviews per se at all. Very shortly, we'll see where these meta-axioms take us as we try to choose good axioms for worldviews, but first, we have a few "leftover" meta-axioms that we should take note of, meta-axioms that help us still further constrain our worldview by adding several more dimensions that must impact our definition of *best*, our ordinal ranking. These meta-axioms are also essential to the *search process* – they permit a worldview to be a *self-organized* emergent phenomenon and avoid certain traps that the *local* Cox calculus will otherwise very likely fall into.

³⁷Or at least they would if we were reasoning robot supercomputers. As it is, a lot of our beliefs are the result of plain old bad arithmetic, and many more are the outcome of what amounts to an internal coin flip. Finally, we as a species have a depressing tendency to take some notion out of the vast sea of "I don't know" and elevate it to near certainty without any good reason. Sigh.

³⁸Or, if you prefer, a kind of an iterated map.

Chapter 9

Global Meta-Axioms

*First to affirm that ... the earth is situated in the third sphere and revolves with great speed around the sun, is a **very dangerous thing**, not only by irritating all the philosophers and scholastic theologians, but also by injuring our holy faith and **rendering the Holy Scriptures false**.*

*Second ... not only the Fathers but also the commentaries of modern writers on Genesis, Psalms, Ecclesiastes and Josue ... **all agree** in explaining literally (ad litteram) that the sun is in the heavens and moves swiftly around the earth, and that the earth is far from the heavens and stands immobile in the center of the Universe...*

*Third ... with regard to the sun and the earth, no wise man is needed to correct the error, since he **clearly experiences that the earth stands still** and that his eye is not deceived when it judges that the moon and stars move. And that is enough for the present.*

Cardinal Bellarmine's Letter to Galileo, 1615 CE

Even when the experts all agree, they may well be mistaken.

Bertrand Russell

(excerpts & emphasis my own)

Things are shaping up nicely. We have a perfectly lovely set of meta-axioms that (so far) seem to describe the way we think, the way we arrive at knowledge through experience when we're thinking rationally. Our "ideal" worldview (according to these axioms) *should* provide a consistent conceptual explanation for

all of our evidence and experience of the Universe, mirroring in a fuzzy and imperfect way a reality that is objectively true and consistent as (probable/plausible) *knowledge* .

However, our meta-axioms are not yet *sufficient*. They simply won't work. In fact, they have the capacity not only to fail, but to fail *badly*, to produce a *terrible* worldview.

We are trying to invent a *global theory of explanation of experience* that explains (among other things) how a global theory of explanations of experience must be dynamically self-optimizing. Ultimately, our meta-theory has to include a *process* – not just *what* the specific axiomatic rules are in our eventual best worldview *du jour*, but how our worldview includes the rules that govern its own change. If we consider our worldview as a “moving body” and our lifetime-so-far sensory experiences and memory as a sort of “dynamical force” that drives its self-consistent self-referential time evolution, the Cox Meta-Axioms are a foundation for a calculus that describes the process of change from a worse worldview to a better one (learning), but we still lack the dynamical principle that gives this search *direction*.

For example, one problem that we will not easily solve is that of *degeneracy*. What of the many, many cases where competing axiom sets work *equally well* (or nearly so) on their own terms to describe all of the data and personal experience but which may be *quite different* in their implementation? How do we make the best choice when confronted with an infinite (or even just extremely large) number of alternatives? We face the paradoxical problem that the smarter we are, the more likely we are to be able to generate multilemmas, to consider not just the binary problem of Knave or Not Knave but to think about the entire deck of cards stuck up the prestidigitating D.A.'s sleeve, where that sleeve potentially contains *every deck of cards that could ever be conceived*. We need a meta-axiom to “keep a lid” on this process lest we find ourselves blinded by our science, bewildered by a terrible infinity.

This is a problem alluded to by Russell in the *EB* article – as we increase or decrease the “complexity” of an assertion, we seem to increase the *volume* of the space of competing notions in a horribly nonlinear way and this somehow “dilutes” the associated plausibilities¹. We have to *trade off* the specificity of

¹This is the basis of some part of the endless argument over evolution versus e.g. intelligent design or other non-stealth theisms. By selecting *one particular highly specific statement* of the theory of evolution, usually Darwin's *original* statement, theists argue that the specific model doesn't produce *precisely* explain the evidence the way it “should”. This makes (they continue) evolution *less* likely to be true and hence “intelligent design” by a non-evolved designer *more*

a theory against its plausibility, especially when we have inadequate data (and we almost always have inadequate data about truly complex phenomena in open systems with many moving parts, most of them hidden).

This will often be an *enormous advantage*, as it turns out, because our network of most-probable-knowledge will rapidly constrain new *consistent* additions. Sometimes only one plausible choice (or family of choices, that we have posited *so far*) out of a near-infinity of notional possibilities explains new observations in a way that is *consistent* with what we already believe precisely *because* of the notional dilution, for example way that statistical mechanics in physics effortlessly rejects *nearly all* of the possible states of particles in a gas in a container as being negligibly improbable in favor of the vastly smaller (but usually still “large”) number of states that *are* reasonably probable because they are consistent with, say, the total amount of energy shared, on average, between the particles.

A second serious problem is that even *with* some meta-axiomatic direction, a simple dynamical *search scheme* based on our calculus will almost immediately get “stuck” in a non-optimal worldview! This is because while we usually *do* try to implement the meta-axiom of common sense in making decisions and inferring knowledge, we have a natural, understandable tendency to do it in what might be called a *local* way – using as givens/priors our existing state of knowledge as being “fixed” and making an optimizing step on that basis. Understanding why this approach fails in the Universal case of “complex landscapes” will provide us with many profound insights, including insights into the human condition; indeed, the calculus above will turn out to be at least partly the calculus of social and political dynamics, as it must be, given that a worldview covers *everything* from “objective” physics right down to immaterial questions such as “what is the good” that baffled even Socrates, Plato, and Aristotle (however diligently they attempted to provide and “prove” bullshit answers anyway using “reason”).

Still, explaining *why* the meta-axioms won’t work yet in simply understand-

 plausible because – as a “fairy theory” – it is clearly capable of producing *any* historical pattern of species change observed in the fossil record on the basis of the whimsy of the intelligent designer and predicts *very little* that can be contradicted by the evidence. What they fail to understand is that “the theory of evolution” is actually a *fluid neighborhood* of propositions such that *less* specific models are in excellent agreement indeed with the evidence. They also fail to appreciate the significance of the human appendix as a evidence that our designer, if any, wasn’t smart enough to remove unnecessary parts from past designs, sort of like leaving a *broken, repurposed spring* inside an *electronic watch* found in the middle of the teleological desert. They also don’t appreciate the weight of the evidence that our closest primate cousins, the gorilla and chimpanzee, have one fewer chromosome and that two of *our chromosomes* are very clearly the result of a chromosome in our common ancestor species breaking in two at some point in our evolutionary past.

able terms is a bit of a chore. If we implement them according to Cox and Jaynes, the meta-axioms lead to an algebra of plausibility that involves a whole bunch of sums over what amount to matrices of very high dimension (if this sentence strikes fear that we’re about to devolve into lots of mathematics, don’t worry about it – we’ll see some examples worked out later for *very simple* cases, but I haven’t forgotten my promise to keep the math to a minimum) with a very simple “calculus” that causes the entire “super-matrix” that describes our current state of plausible belief (encoded in the self-referential dynamic neural network of our brains) to change incrementally as we learn new facts, make new observations, accumulate new data.

Let’s start by considering that “terrible infinity” in the set of all possible worldviews.

9.1 The Set of All Notions

It is possible that even with all my talk of notions and counting alternatives I have failed to communicate just how *big* the space of all possible worldviews is, that is, how large that supermatrix of all possible interconnected notions is in both dimension and range. It is, to put it simply, larger than the largest conceivable thing – it is *inconceivably* large. It is infinitely large with an infinity that is infinitely larger than \aleph_1 , call it \aleph_∞ , a “superhypergeometric continuum” with \aleph_1 fractally infinite dimensions, each with an \aleph_1 range of unbounded continuous real numbers forming via an outer product of outer products of outer products... (repeated an infinite number of times) parametric supertensors – if reals really are adequate to the task and the supercontinuum supermatrix elements shouldn’t be supergeometric numbers of \aleph_0 infinite grade. It’s Super!

Basically, if a set-theoretician can imagine a set (and specify it with a given collection of axioms), I can come up with a notional “trial” worldview with at *least* the same parametric cardinality via the meta-axiom of mathematics². It may or may not be highly implausible, but since the Universe *could* always be the *outer product* of a notional cosmos with this cardinality and our own experiential

²Set theorists hate this sort of thing, by the way. They argue against things like “universal sets” because they tend to be a fertile ground for certain paradoxes. Unfortunately for set theorists, the existential Universe doesn’t give a damn; it *is* a Universal set. Behold it. This is perhaps the fundamental difference between a physicist and a mathematician; the physicist starts out with a strong prior belief in some things (like a Universe that *is* the Universal set of everything that exists) that mathematicians have to get headaches over because they cannot easily be axiomatically specified and derived or that open the door to certain paradoxes.

spacetime Cosmos with either no coupling to the latter or a weak one we have not yet been able to experimentally probe, this notional super-universe cannot be assigned a plausibility of zero or definite falsehood. We've created a monster – the space of all possible Universes, where we can *always* make the space larger by all sorts of means, such as taking the outer product of whatever infinite dimensional notional Universe we've postulated so far with itself and adding a continuous or discrete parameter to differentiate the notional sub-Universes we imagined combined in this way.

But this is way too much math, and reasoning about infinite cardinalities (of infinities) *will* give you a headache. To give you a very simple headache-free mental picture, we can directly observe what appears to be our own Cosmos as a plausible (possibly proper) subset of the Universe. So let's start there, imagining, for the moment, that our Cosmos is in fact objectively real and that we are a part of it in pretty much exactly the way we appear to be, humans made of matter and energy living in space and time and yadda yadda.

Now imagine a “Lord of the Rings” cosmos, one where the physical laws are *somewhat* like they are here but where there are laws of magic and magical superbeings and transcendent magical conflicts between good and evil. We cannot currently *measure* the existence of this cosmos, but we all have a notion (however implausible) that it exists. Somewhere, sometime out there Frodo may indeed be casting a magical ring into a Crack of Doom and J. R. R. Tolkien may have been spiritually channeling its existence (however unlikely that may seem to be given our prior knowledge of *our* Cosmos and the probable process whereby individuals therein make up stories).

In fact, *every* work of fiction describes a cosmos, mostly “like ours” but with somewhat different histories. All of them *could* exist in uncountably infinite replicas so the set universe of *possible* Universal sets must include them, and since this is a *self-referential set* its cardinality literally explodes, iteratively increasing without bound. Our meta-axiomatic rules will (and *should*) reduce the plausibility of the myriad of *possible* co-cosmi to very, very, very... very implausible for some absurd number of very's, but they cannot make any fictional notion *completely* impossible, known to be false, simply because a lack of evidence is at best *conditional* evidence of lack and *can easily be mistaken or corrected later by more evidence*. In this case, by hypothesis the cosmi in question could be disjoint, *completely independent* cosmi that do *not exchange information* with our Cosmos, so that we *cannot* ever observe their existence. That doesn't make them (if they truly do exist) any less real, but it perhaps makes them *irrelevant*. This is all a consequence of the unprovability meta-axiom (and our worldview's con-

sequent *certain* incompleteness). A large part of the Universe, even if it consists of *just* our own Cosmos (whatever its ultimate field-theoretic dimensionality) is at least unknown (to me, if not to you), if not fundamentally unknowable.³

This is itself a general rule for our system of the world: we can never positively exclude any notion for lack of evidence, because lack of evidence does not constitute *positive* proof of lack. To offer a more concrete, rather current example, physicists would in some sense (that this chapter seeks to establish) “like” for there to be at least one magnetic monopole⁴ in the Universe. They’d also “like” for a magic particle called the Higgs boson⁵ to exist. There are physical theories – whole chunks of worked out notional potential worldview – that are just waiting for these particles to be discovered in a reproducible laboratory setting and thereby constitute *positive* evidence that these theories are correct, as they would explain as derived results why charge is quantized and why particles have mass, respectively, if they are found.

Physicists have been *looking* (rather hard) for these particles for decades in experiments designed to put salt on their metaphorical tails. After all, the primary discoverer gets free tickets to Stockholm more or less on the spot the day they are found to receive their Nobel prize, fame, fortune, and remembrance in the litany of great Physicists. So far, nobody has succeeded⁶.

Failing to find them (looking hard!) is not *proof* that they don’t exist, any more than the 4×10^{18} or more explicit numbers that we have checked (so far, at the time of this writing) where Goldbach’s Conjecture⁷ works out is in fact sufficient evidence that it is in fact *true* for all even integers. It just takes one

³A perfectly natural tendency and common argument for God is to take this terrible infinity of possibilities as the set universe from which the Universe was selected, and then argue that the *particular* Universe we find ourselves in is *infinitely improbable* and thus had to have had a *cause*. Note well that this is a perfectly natural *bullshit* argument because it presupposes a set universe of Universes, a magical “urn” from which Universes can be drawn by a Godlike hand outside of the Universe, which *perfectly contradicts* the idea that the Universe is Everything and would have to include urn and Godlike hand – by definition.

⁴Wikipedia: http://www.wikipedia.org/wiki/Magnetic_Monopole. Read here to learn why.

⁵Wikipedia: http://www.wikipedia.org/wiki/Higgs_Boson. Ditto.

⁶Or at least, this was still true when I originally wrote these words... but at this point the Higgs particle is now *strongly* believed to exist on the basis of direct evidence. This is the way Bayesian reasoning as the foundation of science and the scientific worldview works – it doesn’t matter how *pretty* a theory is, or how *explanatory* it would be if it were correct, if it doesn’t have *some* direct empirical support.

⁷Wikipedia: http://www.wikipedia.org/wiki/Goldbach's_Conjecture. Again, that every even integer greater than 2 can be written as the sum of two prime numbers. Note that the number has increased since I wrote about it in a previous chapter, and is probably still larger by the time, if ever, that you read this work.

single even integer for which it fails to *disprove* it. Maybe the first exception to the rule is out there in the integers larger than $10^{10^{10}}$ th and that's why we haven't proven it mathematically, because any "proof" that succeeded would be *incorrect*.

It is pretty easy to come up with sensible notions that could be true and that would produce the same experimental (null so far) result for these particles:

- Perhaps they *don't* exist. The theories that require their existence are wrong, and we haven't yet found the right theories that will explain charge quantization and particle mass without them. Perhaps those theories involve more dimensions, different symmetry groups, graded algebras of higher grade, some really *difficult* math that we just haven't worked out yet.
- They do exist (either of them) but are very, very rare. There only has to be *one magnetic monopole* per space covering overlapping sphere with a radius of thirteen or fourteen billion light years in order to explain charge quantization of all charges we can see.
- They do exist, and are even relatively common, but we haven't devised the right experiments to find them. Perhaps, for example, free monopoles don't bind to atoms. In fact, as a physicist, I don't really see how they *could* bind to atoms – they can be momentarily attracted or repelled, but there is no way to construct a three-dimensional minimum in the potential interaction between ordinary charge (with at most magnetic *dipole* fields associated with it) and a monopole.

In that case, one would expect free monopoles in any quantity to be found in *precisely one place*: The center of large massive bodies, where gravity has pulled them as they lost energy colliding with (but not binding to) ordinary matter. There could easily be a small core of "monopolar matter" at the center of the earth or moon, for example. To find them in any concentration, one might have to drill to the center of a small moon or planet – or possibly an asteroid (big enough to attract, stop, and gravitationally bind free monopoles left over from the big bang) and quite deliberately look for them there, an experiment that has yet to be performed.

- Something else entirely that I haven't imagined yet. There is no guarantee that my knowledge of physics, my intuition, my grasping of notions from the supermatrix of possibilities is *sufficient* to imagine the the right notion yet. Or or anyone else's, for that matter. That vast and terrible infinity of possible answers to almost any question ever lurks, and can dilute the

“plausibility” of any particular answer (including some very reasonable ones that might well be correct) to zero if we are not careful.

So fine, the space of notional worldviews that we must admit for consideration is arbitrarily infinitely infinite and arbitrarily complex, subject to the constraint that they *remain consistent with our direct experience of the Universe*. That experience, so far limited experimentally to only our own particular Cosmos, is projective and limited, shadows on the walls of our personal caves, and we have to use the tiniest of hints to *guess* at a possible consistent explanation of the reality that casts those shadows. Using what we’ve developed so far (and brains that appear to have evolved to *automatically* think in the way it describes, whether or not we are aware of this) permits us to reject *almost all* of this open superinfinity as being almost infinitely implausible and focus in on worldviews that “work” and correspond reasonably well with just what we can see. Tolkien’s LOTR cosmos is possible, but we are justified in calling it improbable or implausible⁸ – lacking any direct observational evidence for its existence – as long as we bear in mind that *we could be wrong!*

However, what is left even after rejecting worldview notions that we really have no good experience-based reason to believe (however mathematically appealing or romantic or psychologically compelling a story they tell, even though they don’t *contradict* any particular aspect of our total life experience) is *still* an extremely large if not infinite space of notional possibilities. Worse, our search for the *best* set of notions forces us to confront the *theory of complex systems* and *optimization on high dimensional spaces*.

What we have so far is a deadly conceptual trap!

I mean this quite literally. The history of knowledge contains numerous examples of *revolutions* where a single person (generally people whose names we still revere) has *radically changed the commonly accepted best human worldview* “all at once” from one thing to another that is *completely different*. That is, the most successful worldview (the one that we could doubt the least) did not undergo a *small* change, it underwent a *big* one. All sorts of elements in that supermatrix, including some that correspond to notions that hadn’t even been explicitly articulated and hence were lumped together with the infinite mass of unformulated “virtual notions” with very, very low plausibility before, are *suddenly* elevated to “most plausible” while others that were previously the most

⁸Or, if you prefer, *irrelevant*, whatever you might wish to consider its plausibility. Another (utilitarian) interpretation of plausibility is “relevance” – *computational* utility in producing a functional worldview that agrees with the actual evidence that we have at hand.

plausible suddenly become highly implausible⁹.

Unfortunately, the calculus we have described so far cannot, in general, admit this sort of “change everything” transition. Well, it can, but the process will be very, very slow, much too slow for us and very unsatisfactory. Let me give a few examples to illustrate the problem.

Once upon a time, not so very long ago, the following beliefs were held by nearly everybody in Europe. They were all part of the “prevailing worldview” before the Enlightenment:

- The world was flat
- The world was the center of the Universe
- The sun and the moon went around the flat earth, passing beneath the sea that itself sort of “floated” in the midst of nothing at all.
- The heavens were a solid bowl, the stars tiny lights on that bowl that also rotated about the earth. They could be shaken down by earthquakes.
- There was a rich assortment of invisible beings, benign and malign, angels and demons, that were the proximate causes of many things in human life. For example:
 - Disease was caused by evil spirits. In many cases it was divine punishment for an original “sin” committed by a single pair of divinely created progenitors, if not additional sins committed by the individual so afflicted or his or her forbears unto the third generation.
 - Other things, such as natural disasters and death itself, were similarly directly caused by divine or demonic intervention, generally as part of the same punishment.

⁹Stupid people sometimes point to this observation – the fact that science can and does make big mistakes – as an excuse for rejecting the scientific reasoning process in favor of, say, divine revelation. “Look,” they crow, “Science isn’t so great. Scientists were wrong about (fill in your favorite revolutionary mistake here)! Therefore Science cannot be trusted to give us Truth.” The reader, fortunately is now too wise to be taken in by this nonsense as they have already seen that Truth is not accessible, and so we can do no better than believing the most that which we can doubt the least *given the evidence!* We have also learned to to doubt *especially* anything that claims to be perfect knowledge *as* an axiom, quite independent of how well it fits our personal experience and the data accumulated and analyzed by humans of good will working without prior bias. Science, at least, is imperfect but self-correcting in precisely this regard, which is why it is nearly always the collection of beliefs to be trusted *the most* even as sure, it has often turned out to be wrong. More on this later.

- By reciting certain phrases, wearing charms, performing ritual magic, maintaining a supposedly desired mental state of belief in invisible and powerful beings who could “save” you, one could appease the agents responsible for the bad things and obtain benefits, cast out disease causing demons, attract angels who would ward off these misfortunes, and eventually receive vast benefits up to and including infinite pleasant life, freedom from death and pain.
- On the other hand, those who *failed* to recite the correct phrases, burn the right incense, wear the right charms, perform the correct ritual magic, or (above all) maintain the requisite *mental* state of belief in invisible and powerful beings and their invisible and all-powerful overlord would be tortured for an eternity in a state close to the theoretical maximum of pain, without any possible escape.
- If the propitious measures failed, it was always because of that original sin and hence divinely ordained evil (as measured in human misery and misfortune, up to and including eternal torture) inflicted by a supposedly omnibeneficent, perfectly just superbeing who as far as anyone could tell created us primarily to perpetually offend It.

It is important to emphasize that this worldview (plus the many, many more components that I don’t mention – worldviews are enormous, recall) *worked*. Your average person would get up and look out their window and see the world, and it looked (when things like mountains were accounted for) quite flat. In order for flatness to make sense given a surrounding ocean, the ocean had to have some solid barrier holding it in at some point – the firmament. Some stars appeared fixed in a giant sphere that revolved around the earth, a few others wandered but in a way that could be successfully modelled. Still other stars appear to fall, burning up as they do.

This led to a reasoned conclusion that the stars must be small fires – candles or torches as it were – attached to the same firmament overhead, solid because if it weren’t solid, engineered as an enormous dome, what holds the stars up? The sun and the moon clearly come up in the morning and go down in the evening. We see their light. What could be more sensible than the notion that they too follow their own special tracks overhead and down under the surrounding deep every night? If the earth experiences gravity, what supports it on that deep? Why, pillars, of course. And so on.

Disease and disaster often had no visible cause – they “just happened” in a seemingly random, painful and horrible way, so they needed an *invisible* but

malignant cause. This worldview postulated a “universal” invisible cause in the form of a hostile and angry intelligent force bent on getting even with humanity in general for an insult delivered in the remote past. Strife in nature, strife among humans, simply mirrored the invisible strife between invisible beings who were preoccupied with making our lives miserable or – rarely – preventing such misery.

This paradigm was interwoven with society in such a way that it helped to prevent crime and hence provided certain *benefits* to those that believed it. In fact, the entire worldview was tightly intertwined with the social and legal fabric and provided *many* benefits. Even those who had reason to doubt it were “trapped” by the fact that any *small* change they might imagine in the space of notions often made their worldview worse – it might be an improved explanation of one thing, but it then conflicted with many other things that people still firmly believed and for which no *known* alternative solution existed. Even small changes of notions in one place often require accompanying *enormous* changes elsewhere in the space of notions in order to reassemble the whole thing all at once into a *better* worldview, one that explains all of the observational data and human experience that the previous one did *and more*.

As a historical example, consider the following. The *data* that ultimately refuted the worldview above was around even before that worldview became universal. Anaxagoras¹⁰ had already guessed that stars might be incredibly distant suns like our own, and Aristarchus of Samos¹¹ deduced the rotation of the Earth and had a successful, empirical heliocentric model that (due to a small error in measuring a geometric angle) was only off by a factor of around 20 in the distance between the Earth and the sun – *2300 years ago*. At about the same time Eratosthenes¹² used geometry to not only conclude that the Earth is round, but make a credible measurement of its circumference, one only about 10% off, and both he and Hipparchus¹³ may have corrected Aristarchus deduction of the distance to the sun (if necessary, this is somewhat uncertain after thousands of years) to be accurate within a couple of percent. In other words, long before Columbus, Copernicus, Galileo, Tycho Brahe, Kepler and Newton during the Enlightenment, a *quantitatively correct* model of the round, rotating Earth revolving around a more or less “fixed” sun existed.

However, this model was not well integrated with the rest of human knowl-

¹⁰Wikipedia: <http://www.wikipedia.org/wiki/Anaxagoras>.

¹¹Wikipedia: <http://www.wikipedia.org/wiki/Aristarchus>.

¹²Wikipedia: <http://www.wikipedia.org/wiki/Eratosthenes>.

¹³Wikipedia: <http://www.wikipedia.org/wiki/Hipparchus>.

edge. A round earth requires a *completely different model* to explain the *other* observations noted by Cardinal (and Saint!) Bellarmine, and the questions that attend them.

What keeps the stars from falling if they are not in a solid sphere overhead that holds them up? How do you explain the fact that some *do* appear to fall, every night? How do you explain the apparent lack of parallax – relative motion of the nearer stars relative to the more distant ones as the world turns¹⁴ If the world is round, where, exactly, is *God*, when heaven is no longer overhead, and hell is somewhere inside an apparently solid ball? Indeed, how could you even *begin* to convince somebody that the world is round when they could *look out their window* and see that it is flat, when even educated people were *badly* educated (and the vast majority were illiterate, ignorant peasants) and couldn't (and didn't!) understand the evidence for its roundness even if it were literally sitting right there in front of them, being explained by somebody that did understand it?

Readers of the modern age who have a hard time appreciating just how ingrained this worldview was and how *socially dangerous* it was to challenge it are strongly encouraged to read Galileo's Dialogue Concerning the Two Chief World Systems¹⁵ and the associated Letter of (Saint) Cardinal Bellarmine¹⁶ to Galileo explaining to him why his observations and remarks, put forth to support a purely mathematical *theory*, were barely tolerable, but to propose them as *fact* contradicted the divinely inspired holy scriptures and the transcendent, God-given wisdom of Solomon – the officially sanctioned worldview according to the Holy Catholic Church that ran *everything* using a grip of iron backed by deadly force.

Galileo was ultimately tried, convicted, and kept under house arrest for the rest of his life¹⁷. *All* of his works were banned by the Church for *hundreds of*

¹⁴This was a problem that persisted well into the Enlightenment, as nobody had the faintest idea *just how far away* the nearest stars were, how *very many stars there are*, or how *old* the stars and the Earth and the Sun really are until instrumentation and models capable of answering these questions were invented and discovered long after the Enlightenment.

¹⁵Wikipedia: http://www.wikipedia.org/wiki/Dialogue_Concerning_the_Two_Chief_World_Systems. Follow one or the other links at the bottom.

¹⁶See: <http://www.fordham.edu/halsall/mod/1615bellarmine-letter.html> If it has moved, Google Is Your Friend(GIYF).

¹⁷Galileo was lucky at that not to have been tortured and ultimately *burned alive*. He lived square across that lovely period in history known as *The Burning Times*, when the Catholic church issued printed papal bulls that basically authorized the relaxation of the normal rules of evidence and torture and a horrible death for “witches” (and a few wizards and heretics as well). The Spanish (and the less well known Roman) Inquisition was in full swing – six people were

years¹⁸

They had no choice. After all, Bellarmine's concerns are *correct*. Galileo's results *do* refute the assertion that the scriptures are divinely inspired truth and *did* contribute strongly to a revolution that demoted the *ad litteram* scriptural worldview to the status of "extremely implausible" and elevated a worldview that is still under active development today to replace it. Since Jesus and Paul both explicitly endorsed the literal truth of Genesis and the Old Testament, finding any error, especially as blatant an error as this, definitively proved that the entire Bible, Old and New Testament alike was not what it was (and still is, by some willfully ignorant people) asserted to be: divinely inspired absolute truth. It seems unlikely that Jesus could be divine and possessed of preternatural knowledge and yet assert a belief in an earth-covering flood where all surviving species (*millions* of them from all over the world) were preserved in a boat a bit smaller than the average Wal-Mart. This never occurred, and a man who was *really* the Son of God would have known it, and an honest man, a good teacher, would have had at least the courage of Galileo and stated this truth (and many other easily confirmed truths about the Universe) openly even though they contradicted the beliefs of his disciples and the prevailing social religious hierarchy.

Bellarmino notes this explicitly in his letter. He begins his third point with "I say that if there were a true demonstration that the sun was in the center of the universe and the earth in the third sphere, and that the sun did not travel around the earth but the earth circled the sun, then it would be necessary to proceed with great caution in explaining the passages of Scripture which seemed contrary, and we would rather have to say that we did not understand them"¹⁹

burned alive in Spain within a year of Galileo's original observations and announced support for heliocentrism.

Heresy and schism abounded as people started to challenge *all* of the assumptions that underlay the "official" worldview, and the Church did not hesitate to use deadly force and shocking methods to squelch them. Galileo was perhaps too wealthy and popular and known to just rot in jail or be burned in a public square, but if he had not *publicly recanted*, that's very likely precisely what would have happened to him.

¹⁸It is still less than twenty years since the Church finally apologized for mistreating Galileo – sort of, a bit obliquely. Man had *walked on the moon* before the Catholic Church apologized for attempting to obliterate the work and reputation of the man who observed that it was a thing that orbited the earth and could be walked on.

¹⁹Wikipedia: http://www.wikipedia.org/wiki/Cognitive_Dissonance. This is an absolutely perfect example of what psychologists have come to call a reaction to "Cognitive Dissonance": what the human mind often does to protect its own axiomatic worldview and associated self-esteem when it is threatened by contradiction. Instead of *changing his mind* (literally) and saying "Wow, I was wrong, my former beliefs were mistaken, I'm so grateful to you for increas-

than to say that something was false which has been demonstrated.”

What more can one say? Once one has even a *moderately* successful worldview, the human brain (and the extended, collective human brain of society) becomes *extremely resistant to change*. Bellarmine (like many, many Christians who followed and who continue on even today) *refused to contemplate* the possibility that the Scriptures could be *wrong*. He was prepared to go to *any lengths* including the imprisonment or even murder of an innocent seeker of truth to preserve his worldview from challenge, and stated up front that even if the challenge was born out by *any experience*, even if *all evidence* came to support it, that the scriptural doctrine *could not be wrong* and we would have to find an *interpretation* of the contrary passages that protected them from any demonstration of contradiction.

This sort of “mental stubbornness” was frightening then, especially as we look back from our privileged position in a world where *everyone knows* that Galileo is correct and *all of the Abrahamic Judeo-Christian-Muslim religions* are wrong in the specific sense of containing scriptural passages that are *not* the best things to believe given the network of human experience and the data and the consistent reasoning calculus described above – but the Church then (as do many faiths now, in many parts of the world) had both the religious and secular power to prevent the free exercise of reason. It remains frightening now. Bellarmine has been canonized and is officially a Saint of the Church, and the backhanded apology to Galileo was not accompanied by taking back his sainthood.

Hundreds of millions of people have followed down the dark path Bellarmine (and, to be fair, the pope and other church fathers of the time) established, and no interpretation or distortion of the evidence is out of the question for those who do not wish to acknowledge the hundreds of contradictions between observational science and history and the Old and New Testament or related scriptural texts. An entire *pseudo-academic discipline* known as “hermeneutics”²⁰ is devoted to this process of *a posteriori* working out some way of “interpreting” the words of the Bible so that the obvious contradictions are, somehow, transmuted by the magic of the outrageous misuse of language into non-contradictions. Circles

ing the correspondence between my beliefs and reality,” humans such as Bellarmine have an appalling tendency to just *ignore the contradiction* or *edit their own perceptions of reality* to avoid this at all costs. Denial ain’t just the name of a river in Africa...

²⁰Wikipedia: <http://www.wikipedia.org/wiki/Hermeneutics>. Leading to the invention of *hermeneutics* and *exegesis*, two pseudo-intellectual “disciplines” devoted to inventing clever interpretations that (mostly) protect written religious scripture from just plain being absurdly wrong, although it has been somewhat broadened into a slightly more legitimate branch of cultural anthropology or historiography.

become spheres, firmaments aren't, Genesis days last billions of years – whatever it takes, because the Bible was *divinely inspired* by the *Holy Ghost Itself* and can't be wrong.

You see the critical importance of that autobeliefectomy we talked about at the beginning of this book. If you are reading these words in a state of acute cognitive dissonance because you *believe* that the Bible, or Quran, or the Vedas, are *true* – a state you would never have reached, quite frankly, if you hadn't been taught to believe it long before you were capable of analytical skeptical thought, and hadn't granted it a *special exception* to the usual rules of evidence-based reason in the meantime – you may be getting ready to throw *this* book away, or burn it, or ridicule and devalue it in some way just so that you don't have to *confront* the highly uncomfortable fact that it is very, very unlikely that anything like the events described in e.g. Genesis ever occurred, not even as metaphors. Or, you maybe be preparing yourself to defend your beliefs *as* metaphors, practicing hermeneutics yourself so that you can retain your preloaded worldview even though huge portions of it are demonstrably wrong and hence cannot possibly be divinely inspired shortcuts to any kind of truth at all unless the divinity in question is deliberately mendacious and malicious.

All I can do is repeat my statement from then. If you cannot bring yourself to doubt your existing worldview, if you cannot *rescind* any special exception you have granted it because it was a key non-genetic “inheritance” from your parents and your culture, you cannot possibly *change it* to end up believing what it is *best* to believe according to a criterion you actually understand and *agree* is best. All you can do is keep on believing what you believe, knowing full well (whether or not you can openly acknowledge it, even to yourself) that it is not really sensible, whether or not it is *honest*. Cognitive dissonance is all about deceiving *yourself* to avoid the stress of change.

There are many other examples – pretty much all of the world religions, most sociopolitical memetic systems – including several comparatively benign ones in the sciences. The replacement of classical mechanics by quantum mechanics in physics was resisted quite strongly (if generally non-violently) by physicists that had thoroughly mastered the notions and equations of classical causality and felt that some of the key assertions of quantum mechanics literally violate one of the Laws of Thought (and they do violate the law of the excluded middle in a manner of speaking, although the *theory itself is mathematically consistent*).

Similarly, the replacement of non-relativistic physics by relativistic physics still causes headaches in every generation of young physicists as they are required

by their studies to start visualizing, imagining, and working algebraically with a *four-dimensional* space-time where changes in inertial frame are accompanied by hyperbolic rotations mixing space and time coordinates in a tensorially consistent way²¹. It, too, was opposed by physicists (and many non-physicists) that just couldn't accept that time isn't what they thought it was, who *religiously* opposed the notion that spacetime was a manifold with curvature and not just a flat three dimensional space with an independent time variable.

The moral of the story is that worldviews have a sort of *inertia*. Once we have one that is moderately successful, especially one that is taught in schools or in the home as being “true by authority” and not by reason, its plausibility tends to increase in time *wholistically* in our minds, and we become somehow *resistant* to moderate (or even quite large) doses of contrary evidence.

We can understand this from the mathematics of *gradient search* or *hill-climbing* in optimization theory. Let's represent the “success” of a worldview as the height above the “ground” of complete ignorance on some abstract “space” of axioms, beliefs, etc. Nearly all of this space is nearly indistinguishable from the ground, but parts of the terrain where the axioms/beliefs include things like some sort of a law of gravitation, a belief in causality, belief in the persistence of the world in time, a knowledge that injury causes pain and pain is associated with death elevate into the “not too stupid to live” plausibility continent where evolution doesn't immediately eliminate an organism as unfit to survive at all because of flaws in its worldview, instinctive or learned as it may be. Some parts of this continent are higher/better than others, and represent improved worldviews that are in better empirical agreement with our experiences of the world.

When we (individually or as a culture) have reached the plausibility “plateau” of a successful worldview, it tends to be roughly optimal given all of our beliefs (social and physical) and the evidence at hand from both living in the physical Universe and interacting with our social universe, where errors in either one are usually bad for our prospects of survival. New evidence that completely contradicts some aspect of this locally optimal worldview requires that one has to change one's beliefs in some direction that is *differentially downhill*, because a tug in one direction has effects on the *entire network of beliefs*. It is very difficult, sometimes, to reevaluate the entire network to see if a new, higher plateau emerges; it can easily take longer than the lifetime it took to build up your worldview in the first place as you have to *unlearn* many things and *figure*

²¹Yes, the brain-exploding horror, the horror...

them out anew.

Again, examples from history and philosophy abound – we often end up *revering* those iconoclasts that invented or discovered a route out of some non-optimal plateau that eventually led *uphill* to a much better understanding of and control of their cultural and scientific environment. At first, however, they tend to be reviled, attacked, persecuted, tortured, ostracized, ridiculed, and not infrequently killed in various painful and spectacular ways, because entire *cultures* express cognitive dissonance by defending the *cultural worldview* with extreme prejudice²². The last 400 years – the Enlightenment through the present – have been almost nonstop turmoil because individuals go through several such revolutions in thinking in a single lifetime. The human race itself is suffering from ongoing post-traumatic stress disorder that is continually exacerbated by an ever-increasing rate of “revolutionary” discoveries that jump us straight up the face of a *cliff* to a much better understanding of – everything! – but often at the expense of the comfort we drew from thinking that we knew at least *something* about how it all works, or worked²³.

Completely understanding this is not easy – most people are *incapable* of figuring out really complicated things (or even understanding the hill-climbing *metaphor* I just presented as a visualization of a very real and very complex computational optimization process that is literally in daily use all over the world), especially if it involves lots of math²⁴. Human intelligence has increased

²²Not just science, either. Often not science at all. One of my favorite short poems is: “Seven cities claimed blind Homer, dead, through which blind Homer, living, begged his bread.” Socrates was forced to drink hemlock as his teachings “corrupted the youth”. Siddhartha Buddha might ultimately have been poisoned by Hindu priests that suffered from his barbed commentary on the exploitation of the poor by the priesthood. Painters, sculptors, writers, have suffered from social conservatism as much as philosophical or religious iconoclasts.

²³So, is eating cholesterol good for you or bad for you (on average)? In my lifetime, we’ve gone from “what the hell is cholesterol, and can you hand me my plate of bacon and eggs please,” to “what the hell are omega-3 fatty acids, and bacon and eggs are full of cholesterol and are the invention of Satan Himself so that if you eat them every day you will die of a heart attack by age 30,” and then changed again to “dietary cholesterol generally doesn’t matter, eggs are full of omega-3 fatty acids and are good for you, and bacon in moderation isn’t that bad, except for the salt and preservatives and heavy metals in the meat and incidentally, it is *sugar* that is invented by Satan Himself...”. We’re entering yet another phase where eating “real food” is good for you, even if it contains some sugar, but eating TOO MUCH is the invention of Satan Himself, blah, blah, blah. And on the horizon – eating only 600-800 calories a day for weeks or months at a time is going to end up being *good for you*, so that concentration camps are really just a modern form of day spa.

PTSD city.

²⁴I’m not being elitist here, by the way. I include myself in “most people”. Physics at the bleeding edge is *difficult*, and one has to do a *lot of work* to do much of anything.

dramatically and steadily for as long as we have had the quantitative means to at least approximately measure it²⁵, but it still has a long way to go. This *non*-evolutionary increase appears likely to be related to the incredible increase in the enrichment of the developmental environment of humans that has accompanied the industrial and scientific revolution and mandated universal education²⁶.

In the end, we prefer instead in these cases where evidence casts doubt on an entire well-established, moderately successful worldview to *doubt the evidence*. This is actually a *reasonable* thing to do, within reason, and doesn't really violate the meta-axiom that new evidence should cause changes in the direction dictated by common sense, because we have a lifetime of experience with mistaken evidence, with false testimony, with cases where we took the risk and changed our worldview (giving up bacon and eggs for breakfast) only to later discover that bacon and eggs for breakfast is *good for you*, especially compared to replacing it with chocolate-blasted sugar bombs accompanied by whitebread toast. We have *many* lifetimes of experience if we accept the testimony recorded in books, including the very scriptures Bellarmine was so eager to defend.

Humans have such a varied *mental* experience and *social* experience of the world that even today a significant fraction of the population of the United States still hasn't come to grips with Galileo, with Newton, with Darwin, with Einstein. You may well be such a person (although more often than not people in this category will have burned this book long before reaching this point in it, in spite of my fervent request that the reader suspend all disbelief – and judgement – until the end). A Biblically Inerrant Conservative Christian (BICC) to this very day defends the *literal truth of Genesis* and the attendant worldview of a God that created seeded plants and fruit trees *before* creating that Sun that the Bible, that Bellarmine, that the church fathers, that all the “secular” commentators of the early 1600's very clearly had going around the Earth and

²⁵Wikipedia: http://www.wikipedia.org/wiki/Flynn_Effect. This is a surprising but apparently true fact. The definition of intelligence quotient (IQ) is such that the mean is placed at 100. Every few years the test is renormalized so that this remains true. Flynn observed that the mean has been continuously *raised*, by an average of three points a decade, as long as it has been around. In fact, the mean IQ of individuals a mere hundred years ago would have been in the ballpark of 80 on the scale of modern tests, borderline mentally retarded!

²⁶Wikipedia: [http://www.wikipedia.org/wiki/Environmental_Enrichment_\(Neural\)](http://www.wikipedia.org/wiki/Environmental_Enrichment_(Neural)). It isn't *just* humans – rats raised in complex, enriched environments have bigger, better, faster, smarter brains. It isn't just infants and children – adults who deliberately exercise their brains with crossword puzzles, continuing education, engagement in complex environments, brain challenges can actively increase their intelligence and delay the aging of their brains. The brain is like any muscle or aspect of the human body – *use it or lose it!* I extend to you, via this book, a tremendous opportunity to *use it*.

not the other way around. They do this by relying on a strange mix of “biblical hermeneutics”²⁷, a.k.a. – “interpreting the Bible via exegesis so no contradiction with known facts occurs” (the thing Bellarmine suggested might be necessary) and *selectively distorting the science* – ignoring one thing, emphasizing another, rejecting accepted physical law on the grounds that God can do anything that God wants, and throughout the process displaying an appalling ignorance of the very points they debate and things like *simple arithmetic* that would refute them²⁸.

The result is a kind of selective blindness, almost a self-induced dementia, that is more than a bit frightening. And yet becoming *locked in* to a particular worldview to the point where one becomes partially or completely immune to evidence shouldn’t, actually, be a tremendous surprise. It is predicted by optimization theory, because our calculus so far does not *obviously* permit (or even encourage) *far searches* and *long jumps* – strategies in optimization theory for jumping *over* from one dead-end plateau to a new slope with an uphill (metaphorical) path that almost immediately goes higher than the old ontological plateau one is trapped on.

We need to fix this by adding more meta-axioms, ones that create an *irresistable pressure* to abandon defective worldviews instead of rescuing them at all costs, ones that permit the construction of and comparison of *many* competing worldviews, some of them “tentative replacements”, to sample the enormous

²⁷Wikipedia: http://www.wikipedia.org/wiki/Biblical_Hermeneutics. A subset of hermeneutics in general, see link above as well. This entire process is amusing and incredibly frustrating to the physicist or mathematician. Note well the *axioms* of biblical hermeneutics embedded in this article, and the many mutually contradictory approaches taken by different religious groups. This is all a desperate attempt to protect the Bible as the Word of God (and hence *axiomatically infallible*) instead of accepting the *far simpler conclusion* supported by a straightforward reading – where its words are considered ordinary language that can be fairly compared to experience and knowledge of history and nature and modern ethics – that it is simply *wrong*: a book of myths and legends and primitive social rules, written by our relatively *stupid* and extremely ignorant social ancestors.

²⁸For example, to cover the top of Mount Everest with only forty days of rain, it would have to rain at least *five inches of rain a minute on every inch* of the earth’s surface. If Noah were to load his Wal-Mart sized Ark with a species a minute for the mere *ten million* plant and animal species that would almost certainly die as the oceans first flooded all freshwater lakes with salt water, then proceeded to dilute the oceans to far less than half their normal levels of salt (enough to prove fatal to most oceanic species of just about anything) it would take him *nineteen years* to complete the loading and he’d need an aquarium capable of holding pelagic sharks that die if they stop moving and have never been kept successfully in captivity to this very day. The assertion that any of this happened is patently *absurd*, but absurdity is not enough to alter the worldview of a BICC.

space of notions and ensure that our prior beliefs are still the best that can be justified by all of the evidence and experience we have at hand. One can argue that some of these aren't really meta-axioms, that they are meta-theorems that can be derived from the meta-axioms above and just the right mathematics and reason. This may be true, but it doesn't matter to *our* purposes, which is to achieve clarity without slogging through too much math or pure logic. These meta-axioms are intended to govern the *search process* for the best worldview, not the "local" calculus that has been defined so far. In so doing, they will give free rein to imagination, intuition, the construction of competing theories (including some that describe or explain *part* of the evidence available better at the expense of explaining other parts *worse*).

9.2 Honesty (The Meta-axiom of Integrity)

This meta-axiom is so obvious that I almost omitted it altogether, but then I reread a famous graduation speech by none other than physicist Richard Feynman: *Cargo Cult Science*²⁹ and reconsidered. This is one of the most profound and instructive essays I've ever read about science and integrity – Feynman was, after all, a genius – and it clearly exposes the essential element that is missing whenever one attempts to analyze religious worldviews or worldviews that are carelessly or dishonestly built.

I can do no better than to quote a piece of Feynman's article. "They" are the Cargo Cults³⁰ of the South Pacific, primitive tribes that attempted to attract the wealth they associated with U. S. troops that occupied their islands during World War II by means of "sympathetic magic", where they recreated non-functional simulacrums of the airplanes and costumes and appurtenances of those troops.

Now it behooves me, of course, to tell you what they're missing. But it would be just about as difficult to explain to the South Sea Islanders how they have to arrange things so that they get some wealth in their system. It is not something simple like telling them how to improve the shapes of the earphones. But there is one feature I notice that is generally missing in cargo cult science. That is the idea that we all hope you have learned in studying science in school—we

²⁹See: <http://www.lhup.edu/~DSIMANEK/cargocul.htm> Excerpted from his 1974 commencement address, delivered at Cal Tech.

³⁰Wikipedia: http://www.wikipedia.org/wiki/Cargo_Cult. You should really read the whole thing. Everybody should.

never explicitly say what this is, but just hope that you catch on by all the examples of scientific investigation. It is interesting, therefore, to bring it out now and speak of it explicitly. It's a kind of scientific integrity, a principle of scientific thought that corresponds to a kind of utter honesty—a kind of leaning over backwards. For example, if you're doing an experiment, you should report everything that you think might make it invalid—not only what you think is right about it: other causes that could possibly explain your results; and things you thought of that you've eliminated by some other experiment, and how they worked—to make sure the other fellow can tell they have been eliminated.

Details that could throw doubt on your interpretation must be given, if you know them. You must do the best you can—if you know anything at all wrong, or possibly wrong—to explain it. If you make a theory, for example, and advertise it, or put it out, then you must also put down all the facts that disagree with it, as well as those that agree with it. There is also a more subtle problem. When you have put a lot of ideas together to make an elaborate theory, you want to make sure, when explaining what it fits, that those things it fits are not just the things that gave you the idea for the theory; but that the finished theory makes something else come out right, in addition.

In summary, the idea is to try to give all of the information to help others to judge the value of your contribution; not just the information that leads to judgment in one particular direction or another.

...

But this long history of learning how not to fool ourselves—of having utter scientific integrity—is, I'm sorry to say, something that we haven't specifically included in any particular course that I know of. We just hope you've caught on by osmosis.

The first principle is that you must not fool yourself—and you are the easiest person to fool. So you have to be very careful about that. After you've not fooled yourself, it's easy not to fool other scientists. You just have to be honest in a conventional way after that.

I would like to add something that's not essential to the science, but something I kind of believe, which is that you should not fool the layman when you're talking as a scientist. I am not trying to tell you what to do about cheating on your wife, or fooling your girlfriend, or

something like that, when you're not trying to be a scientist, but just trying to be an ordinary human being. We'll leave those problems up to you and your rabbi. I'm talking about a specific, extra type of integrity that is not lying, but bending over backwards to show how you are maybe wrong, that you ought to have when acting as a scientist. And this is our responsibility as scientists, certainly to other scientists, and I think to laymen.

For example, I was a little surprised when I was talking to a friend who was going to go on the radio. He does work on cosmology and astronomy, and he wondered how he would explain what the applications of this work were. "Well," I said, "there aren't any." He said, "Yes, but then we won't get support for more research of this kind." I think that's kind of dishonest. If you're representing yourself as a scientist, then you should explain to the layman what you're doing—and if they don't want to support you under those circumstances, then that's their decision.

There is such a wealth of wisdom in this one short quote. Let's concentrate, however, only on two points. The first is that if we wish to build the best possible worldview, it helps a whole lot if we are *honest* about it. This is much more difficult than it sounds – indeed, it is one of the most difficult parts of the whole search process.

Your worldview is more than just an abstract set of beliefs. It is in some deep sense *you* – the sum total of your knowledge and experience, the cognitive basis for the way you *work* as you make sentient intentional choices that guide your pathway through life, conferring at least a moderate measure of control along the way. There is, therefore, nothing more terrifying to most humans than the thought that their worldview might be deeply mistaken, that the world might not be at all the way that they imagine it to be. Also, as we've already remarked above, changing your worldview can be remarkably *difficult* – you may not just be able to change one small thing about your beliefs, you may have to change the whole ball of wax in major ways to improve the correspondence between those beliefs and your ongoing experience. Finally, humans tend to be locked into a complex social and economic structure, and that structure is often conditioned upon certain accepted "truths" that are part of the prevailing "social norm" worldview. There are often negative consequences associated with changing one's worldview, especially changes that contradict the local social or economic or religious norms.

This unholy trinity of fear, laziness, and personal (dis)advantage all encourage not just dishonesty, but dishonesty on a grand scale. This dishonesty is reflected in a number of ways in the search for an optimal worldview. The first is the one alluded to by Feynman (although not by name) – the tendency of humans to permit *confirmation bias*³¹ to compromise the integrity of the process of searching for plausible truth.

Confirmation bias and its close cousins and support tools, “cherrypicking the data” and “gatekeeping”, are clearly visible in contemporary research, economic theories, religious assertions, and political decisioning involving the allocation of almost the entire wealth of the world – not just billions but *trillions* of dollars, millions of lives, untold human misery, and the perpetuation of complex systems of belief in implausible and inconsistent myths that are quite literally inherited from the most barbaric and ignorant periods in human history. It corrupts published results in the fields of climate research and medical research in particular, but in truth it permeates every realm of human endeavor, not just science. Once we accept some notion as probably true, it is *very difficult for us* to change our mind. If it is *our own* idea, or if there are severe social or economic penalties to changing our mind, it is often nearly impossible. As Feynman notes, the trick to being honest about the things that really matter is to begin by being brutally honest with *yourself* – only then can the more mundane sort of honesty with others have a chance of success.

Ah, just imagine it. Religious sermons that *honestly* point out that the theistic scripture that forms the axiomatic basis of its assertions is either not supported by any piece of objective evidence or egregiously contradicts things that we take for granted as true every day! Politico-economic debates where the communists acknowledge that free enterprise often works better than communism, and where free-market capitalists openly admit the many ways that capitalism fails in practice however well it works in theory! Drug companies honestly pointing out that their latest billion-dollar wonder drug doesn’t seem to do anything constructive about any disease and causes most people who take it to break out in a horrible rash – or even just acknowledging that the studies done so far are inconclusive, marginal results that might well have arisen by chance! Scientists in general criticizing their own results even more harshly than they criticize the results of others! Climate researchers that acknowledge that they *honestly do not know* if the modern era is much warmer than it “should” be, both because they have no model that predicts how warm it should be now (or predicts in hindcast how warm it has been in the past) and because there is overwhelming evidence

³¹Wikipedia: http://www.wikipedia.org/wiki/Confirmation_Bias.

that it has been just as warm in the past without the participation of the alleged primary driver, carbon dioxide!

When did honesty stop being a fundamental meta-axiom of our society? Honestly, never. It never *has* been such an axiom³², but it should be, at least if we want to do our best. We have to have the courage to face the truth *whatever it might turn out to be* and turn our back on notions that describe the way we *wish* it would turn out to be (but doesn't), on notions that might be right or might be wrong. We have to be willing to confront the fact that often our beliefs are self-serving; a person that benefits materially or socially from holding a certain belief finds it all too easy to ignore evidence that the belief is wrong and turn away from it, giving up those benefits.

I'm sorry, but even though it *should* go without saying that a search for the best worldview known to mankind – so far – ought to be an *honest* search, the evidence is overwhelming that it is *not*, and hence the need to openly state it as a fundamental global axiom. As long as we're willing to lie to ourselves and others, as long as we are willing to *misuse* doubt not as a tool that leads us to the least doubttable (and hence most believable) but as a means to selectively promote a relatively implausible set of beliefs by cutting down better supported alternatives, we can never attain an optimal worldview, a fair and balanced global society, mere *happiness* and a measure of personal *social and economic security* in an uncertain world.

So let's write it right on in at the beginning:

6. Honesty – *Axiomatic worldviews that are built upon and supported by an honest and well-founded process are better than worldviews that are based on lies or that deliberately conceal inconvenient (confounding) evidence.*

9.3 Correspondence (The Meta-axiom of Predictivity)

The second meta-axiom is mentioned only in passing by Feynman, but it too is essential, not one that isn't worth mentioning but one that is so obvious (and which would have been obvious to his audience already) that he didn't *bother* to dwell on it, it would have been preaching to the choir! That is that when building a worldview, the measure of *success* is the degree to which the worldview is in

³²Or rather it has always been a rule we *should* follow, but one that we literally never have, with rare, specific human exceptions.

correspondence with the entire body of experience and most-reasonable and most-plausible knowledge – so far. Science also often insists that it go the extra mile and predict *new things*, things that were unexpected or are not predicted in the old worldview but that are *subsequently* observed when we look for them.

7. Predictivity – *Axiomatic worldviews that both correspond well to the world of our past experience and predict or explain new experiences are better than worldviews that have a poor correspondence to our experience and/or have no predictive skill.*

In science the standard of ultimate success is not *just* the explanation of existing phenomena and experiment, although this is generally considered *necessary* degree of correspondence. It is the ability to predict or explain *new* phenomena. As Feynman says, an elaborate new theory or improvement on an old one – and there *is* no more elaborate theory than a complete worldview, truly the “theory of everything” – needs to be able to make some new thing come out right. Otherwise it at best becomes yet another notion in a competing, degenerate space of notions that all equally well explain our experience and with no *evidence* available to help us choose between them.

When this happens – and it happens a lot more often than one might think – we often use additional criteria to decide what the “best” things to believe are from among the competing sets of notions that all work roughly equally well to explain the data. Indeed, the next one is absolutely critical – without it we almost have to give up the whole ball game because leaving it *out* opens the door to a certain class of truly horrible, non-optimal worldviews that *should* violate every bit of our common sense.

In a way this meta-axiom isn’t purely an assumption. One can, with a bit of effort, relate it *to* the Cox axioms, relate it in particular to information entropy. However, that isn’t sufficient to justify it, it merely makes it a bit more consistent with the other meta-axioms.

This is a good thing – one essential principle of an *honest* search for the best worldview is that reality is the ultimate arbiter of truth, that our judgement of a best worldview is fundamentally based on the quality of the correspondence between that worldview and the world.

Perhaps nature is simple. Perhaps not. However, given the *necessarily* finite and incomplete aspects of our worldview, we are almost always well-served by insisting on simplicity, as long as we can achieve close to the same degree of correspondence.

9.4 Ockham’s Razor (The Meta-axiom of Simplicity)

For all of these reasons, let’s move on past the two “Feynman” rules above and continue our search for useful or essential meta-axioms by adding the following old friend.

8. Simplicity/Ockham’s Razor – *Axiomatic worldviews that are simpler (have fewer axioms) are better than worldviews that are more complex, all other things being equal.*

As indicated, the meta-axiom of simplicity (or economy) is also known as *Ockham’s Razor*³³, and has been around for a rather long time. The idea is simple. *Simplicity is good.* How self-consistent is that! Note that I tie simplicity to *number* of axioms (a quantitative measure) but there is more to simplicity than just number. Note also that implicit in this is that any two worldviews being compared in this way *explain exactly the same degree of experience and data*. Often this will not be the case, and one will have to use that pesky old judgement/common sense thing again to trade off simplicity against comprehensiveness, reliability against precision (as Russell originally suggested).

I wish there was some way around this, but there really isn’t – we are optimizing in a space with many dimensions and no objective metric; sometimes making a worldview shift in one “direction” that improves an explanation of one phenomenon will make its explanation of something else worse³⁴.

There are several things that making simplicity at least a *desireable* trait in our belief system buys for us. For one, it prevents an explosion of causes – it eliminates certain axiomatic worldviews that explain *everything perfectly* in the silliest possible way by introducing enormous numbers of axioms to provide a vast and complex network of *ad hoc* explanations that “work” for each specific thing one at a time (and may even contradict one another) but which fail to generalize or fit into a much simpler “big picture” worldview that works *less* perfectly but actually conveys understanding while it does.

³³Wikipedia: [http://www.wikipedia.org/wiki/Ockham’s Razor](http://www.wikipedia.org/wiki/Ockham's_Razor).

³⁴Wikipedia: [http://www.wikipedia.org/wiki/No free lunch theorem](http://www.wikipedia.org/wiki/No_free_lunch_theorem). This is a fascinating topic – it turns out that in *many* contexts that can be thought of as abstractly “information theoretic” modeling – computation, artificial intelligence, testing for diseases – changing a model to predict *one* thing better causes *another* thing to be predicted *worse!* This is known as the “No Free Lunch” (NFL) theorem, and Wolpert and Macready proved that this idea applies to a very wide range of problems, e.g. in building predictive models using neural networks. Even nature gets in on the game, as the *Heisenberg Uncertainty Principle* is a kind of NFL theorem, as experiments that improve knowledge of *position* in the microscopic world can only be performed at the expense of one’s knowledge of *momentum* and vice versa.

It also acknowledges the existence of NFL theorems in general as a limitation on the universality of *any* high dimensional model intended to explain many disparate things. In some problems the best one can do is build a model for each “target” of a NFL result separately and use some sort of higher level decisioning process to decide when to use each one (a less pathological version of explosion of causes/explanations) but in many circumstances we would prefer to use *one* model that works best *overall* to explain the overall data even if a narrower model can do better on some specific feature.

In any event, this meta-axiom suggests that we try to pick worldviews with *powerful and general* explanations over ones that require many individual explanations that cover all sorts of individual experiences and chunks of data. The world abounds with examples, both true and false, that illustrate the use of this idea. Suppose that I rub a balloon on my little remaining hair, and hold it up near a wall. I observe it to be attracted and to stick, for a while, to the wall, then slide down. In my worldview, I seek the best possible explanation for what I just observed. As I do so, the usual whirl of notions appear and disappear, fleeting, in my head.

Perhaps there are invisible fairies that live inside the wall and like balloons! They grabbed it and were trying to go home but couldn't pull the balloon inside. One by one they dropped off, until the last ones could hardly keep the balloon from falling and it slowly slid down. Perhaps a very localized wind sprang up and pushed the balloon up against the wall. Eventually it gave out and the balloon fell. Perhaps a black hole drifted by the wall on the far side and attracted the balloon, then moved on³⁵. Perhaps the balloon picked up a bunch of magnetic monopoles and induced surface currents on the wall that attracted it. Perhaps there *was* no balloon, and I fantasized the whole experience³⁶. Perhaps the balloon was a simulated balloon in what amounts to an enormous MMRPG³⁷ that I'm perceiving only because of a direct Matrix-like neural implant, and its apparent motion was dictated by the central master game computer. Perhaps I am a soul in a created Universe, and the balloon is a manifestation of the mind of God, who made the balloon *appear* to be attracted to the wall and slide down, but tomorrow it could be God's Will that it be repelled instead or just spontaneously pop.

³⁵Yet another example of the problem with Knowing Too Much. Who thinks up these things?

³⁶Which is, after all, the case, while I was writing this chapter. But pretend it wasn't.

³⁷Wikipedia: <http://www.wikipedia.org/wiki/MMRPG>. Massively Multiplayer Role Playing Game. Don't laugh. Full grown adult humans, some of them with Ph.D.'s and lots of money, are openly asserting that this *is* the cause and that there *is, in fact, no balloon or wall!* I'm not making this up.

Or *perhaps* rubbing the balloon with my hair caused it to become electrically charged. The charged balloon induced a surface charge of the opposite sign on the insulating dielectric material wall, which attracted the balloon. Eventually the initial charge neutralized as air molecules (initially attracted by the same mechanism, then repelled once they struck the balloon and acquired some of the charge) carried it away, and the balloon fell.

None of my possible explanations can be positively refuted by evidence. The fairies are invisible; who can say that they *don't* exist when by hypothesis they cannot be seen? The black hole seems unlikely as we have yet to directly observe a black hole and there are reasons to doubt that any are hanging out on the surface of the earth, but proving that this *couldn't* be true is only possible subject to a slew of assumptions that could just be wrong or my prior belief that certain circumstances are themselves unlikely is just plain wrong: perhaps the black hole was part of the intergalactic transport mechanism of a tiny alien spacecraft that was investigating my azaleas at the time, for example. Similarly, just because magnetic monopoles have never been seen *so far* doesn't mean that they don't exist and *couldn't* have attached themselves somehow to my balloon. I couldn't see or hear the wind because it was very localized, but it might have been there just the same, with its *effect* visible as the apparent adherence of the balloon. My hallucinatory imagination, MMRPG and God are extremely pernicious – they are actually very *simple* explanations, on the surface, and each of them is manifestly capable of explaining my apparent sensory input, but – we have (correctly) the impression that all we've done is substituted an entire *inaccessible and completely unknown cosmos* in which the solution *really* (supposedly) lives! *God* isn't an explanation for *anything at all* unless one can explain *God*, something vastly more complex than *any* alternative and at the same time completely immune to reason based on experiment or experience!

In the end, the explanation based on electrical charge is *overwhelmingly* the most plausible one and is what I *instantly* conclude is the (very, very, very,...*very*) probably correct explanation, without really even thinking much about the alternatives *even though there are a near-infinity of them*. You may think Maxwell's equations are complex, but they are really simple, beautiful, general, and *testable*, where the other alternatives are all specific, ugly, far more complex and in many cases by construction impossible to test.

Even if one of the alternatives is true, a claim that we *should* believe some specific *one* of them as the *best* thing to believe is morally – and I do not use the word lightly – equivalent to asserting that the balloon was attracted to the wall because *Sauron* in the *LOTR cosmos* used his evil magic to make the balloon

stick to the wall in *our* Cosmos.

How can anyone prove that this is wrong? It perfectly explains the result, and no experiment we can do in our Universe can *disprove* the “LOTR explanation”, even as it explains *nothing* about the result, gives us no insight into anything else that happens in our Cosmos, and leaves us with far more difficult questions to answer than determining how the balloon stuck to the wall. What could Sauron have been thinking? Why was he worried about the balloon? How the hell did his Evil Magic penetrate the veil between our cosmi when we have no good reason to think that the LOTR cosmos actually exists and is consistent and connected in any way to our own? What will Sauron do next? Will he make a *second* balloon stick *just like the first*?

In the end, there is really no question as to which explanation is most plausible and hence best to believe. We already have an enormous amount of experience with Coulomb's law, electrodynamics, quantum mechanics and physics in general – I *teach* this at Duke. The stability and structure of every atom in my body is evidence that the forces in question exist and work – they explain the entire periodic table and molecular chemistry and by extension just about *everything* I observe in my daily life. I've seen numerous experiments that validate them at the macroscopic level, done numerous computations using them that work out to explain an enormous range experiments to very high precision, and we *understand* how they work and produce this correspondence in a mathematically consistent way.

My degree of belief in Maxwell's equations, gravity, quantum theory, and most of physics in general is enormous. It most certainly is *a* possible explanation of the balloon being attracted to the wall, and requires *no extensions of my worldview* if I select it as the most probable cause. The one I already have is sufficient, and even if I'm mistaken and one of the other explanations is correct, I still cannot get rid of Maxwell's equations so easily as they are needed to explain many other things.

In a trice, in far less time than it takes to write it, I reject the *infinity* of possible reasons the balloon might have been attracted to the wall (or appeared to be) in favor of a single set of axioms that requires no revision of my worldview, no exceptions for special cases, no contorted arguments, and that explains many other things as well.

Simple pictures are the best.

9.5 Beauty

It's worth considering briefly the last three "simple" explanations from the previous section – solipsistic imagination, MMRPG, and God's direct, naked, will.

First of all, they aren't terribly simple. They postulate what amounts to an adjoined *entire cosmos* wherein the things that happen in *this* (apparent) Cosmos are determined by *hidden means*. We cannot ask *why* God made the balloon move towards the wall *exactly as if Maxwell's equations were the cause*, at least not without giving a specious answer such as "because he wanted to, but at any moment he could change his mind"³⁸. We cannot explain *why* the MMRPG computer does the same thing, nor can we deduce its structure, or the program that is running on it – it all just looks like Maxwell's equations. I cannot explain how my imagination imagined behavior that can be consistently explained (when I look carefully) by Maxwell's equations, even though it may not *consciously* be aware of what Maxwell's equation are or how they work until I take the trouble to look and work it all out.

Even if I throw in the less simple fairies, it turns out that they *too* made the balloon simulate the behavior it would have had if Maxwell's equations were the cause. If I did a more careful experiment or did the experiment many times, and tested *all four alternative hypotheses* to see if they actually motivated the balloon, we will learn that each one motivated it *exactly as if* Maxwell's equations and electrical forces were responsible. Smart fairies! Devilishly clever, that Sauron!

Second, the multiplication of axioms has *no predictive value*. Suppose that fairies *were* the cause. Either the fairies *always* make things behave the way Maxwell's equations plus quantum mechanics predict that they should (in which case we might be tempted to give the fairies a quantitative name and theory of their own, and call them "quanta of the electromagnetic field" or "photons") or they have a personality and can be perverse. Today the balloon is attracted, tomorrow it is repelled, the next day it is popped by annoyed fairies who pull your hair in the bargain. We have no experience of things like the latter happening, and in the former case we'll just simplify life and name the fairies photons as a

³⁸BICCs, for example, often explain how our physical observations *now* don't refute the mythology of Genesis by stating that the laws of physics must have been *different* then. Radiometric dating, for example, is false because nuclear force constants and Maxwell's equations were once different in *just the right way* for us to be mistaken about the lifetime of the Universe and the Earth *now*, and we should rely on the Bible to give us the right answers instead.

Right. Talk about backwards, biased anti-reasoning. Even allowing for a worldview that *does* include God, I offer in rebuttal Aslan's reply in *The Lion, the Witch, and the Wardrobe* – "Do you think that I would break the Laws that I made?"

part of a larger body of consistent best belief and be done with it.

Ockham’s Razor imposes a *kind* of beauty of our best worldview, but mere simplicity is not necessarily beautiful, as the God’s Will and MMRPG examples demonstrate. We know our worldview will be incomplete – we have an axiom that says so. Why shouldn’t our ignorance all be tied up in one place: in a God of the Gaps, in a hidden random number generator seed and algorithm used by the MMRPG game computer? Why should we strive to look for patterns, for order, *even* at the cost of some complexity? Ultimately, there is something *ugly* about simple “explanations” with no predictive power and with a hidden multiplication of causes behind a simple facade. We sense that this is a sort of “slight of mind”, deceptive mental “magic” that in the end is smoke and mirrors and not a sound basis for a worldview.

An example at the extreme limit of this is a strange worldview variant that holds that our experience is completely *random*, that the appearance of order ultimately arises from *chaos* in some complex field of being³⁹. This one *works* because a “paradox” of random numbers and real numbers is that the set of either one contains *strings of arbitrary length that appear ordered*. Now mind you, models based on this contain absurdly small plausibilities at first glance⁴⁰.

³⁹As so frequently seems to be the case with strange worldviews, this one too has been explored in fiction in e.g. James Blish’s *The Traveller in Black*.

⁴⁰As students of statistical mechanics in physics rapidly learn, when I say *absurdly small* I really mean it. They are so small that it is completely safe to say that they are “implausible”. A classic example is the often asserted proposition that if a million monkeys typed for a million years at a million typewriters, they’d eventually type out a poem by Shakespeare.

Suppose that we ask for a sonnet – 14 lines, with a mere 50 characters per line (including spaces) and ignoring punctuation. That means that there are $27^{14 \times 50 = 700} \approx 10^{1002}$ permutations that our perfectly random monkeys could type of the 700 characters, giving them a special typewriter with only the alphabet plus a space key, no capitalization, no punctuation, no line breaks. If the present Cosmos in which you are reading these words lasts for 500 billion years (at the moment we’re up to around 14 billion years) that’s around 1.6×10^{19} seconds. If we divide this number into the first, we can estimate – allowing generous assumptions for the number of sonnets and so on – that if you had a million monkeys typing an entire sonnet per second, *each*, they would have to type through the lifetime of well over 10^{970} *Universes* before there is *any significant chance* that they have typed even *one* of Shakespeare’s sonnets.

The chance of getting it within the lifetime of *one specific Cosmos* (say, ours) is 1 *over* this number, which is a number that is ***pretty darned small***. That’s what we mean by “implausible”, or “absurdly small” when it comes to the probabilities of permutations of even moderate numbers of objects.

You know what’s really weird? Shakespeare was a human, that is to say a member of the primate family, a kind of evolved *monkey*, so monkeys managed to produce all of the sonnets well within the expected lifetime of our one actual cosmos. Fortunately, Shakespeare didn’t *type* his sonnets, and it seems likely that he didn’t generate them randomly...

If we suppose some sort of medium that randomly fluctuates with absolutely no order or correlations – think of a TV screen displaying random noise – we can estimate that it would take a very, very long time indeed for all the dots to fluctuate in just the right way so that an episode of *Leave it to Beaver* appears on the screen. The probability of a much larger and much finer grained fluctuation producing an entire Universe’s worth of apparently ordered time evolution is much smaller (but in principle can be *nonzero* or even *unity*, depending on how one chooses to take certain infinite limits). With certain choices, *given enough time* the appearance of apparent order for any finite interval of time for any finite volume of space can approach *certainty* in a random system.

This is the kind of thing our minds cook up when we try to doubt too well. How can we even weigh the evidence that such a hypothesis might be true? There is every appearance of a sort of *esthetic order* in our memories and observations but of course there would be even if our actions were as random and false as Beaver’s “Awww, Mom...” appearing out of static snow, as the works of Shakespeare typed by an \aleph_∞ infinity of monkeys. We need a meta-axiom that prohibits this entire *class* of axioms or we might as well give up right now as knowledge of any sort becomes impossible – we’re right back in the Pit of Existential Despair. Incomplete knowledge of a structured Universe’s *state* is assumed as part of our non-completeness meta-axiom, but randomness *as* the Universe’s fundamental structure is the ultimate *anti-explanation* (however “simple” it might be). It suggests that when you get right down to it, there is nothing to know, only the transient *illusion* of something to know that could return to the true primordial chaos at any time. It is most unfortunate that this *too* is often an axiomatic component of theistic scriptural religions, notably Hinduism and Buddhism.

Ugly, ugly, ugly. Let’s put an end to it. Even if we’re wrong to do so, we don’t care, because if we’re wrong about this then knowledge is impossible anyway as there is nothing to *know*. At the same time, we don’t want to admit absurdity or open the floodgates to the *bullshit reasoning* of Platonic Idealism and other philosophies that made the perception of symmetry, order, and beauty (usually in the eyes of the inventor of the philosophical worldview as well as anyone he or she could convince) trump the far more important and powerful axioms above. We have to preserve *consistency* and *predictive correspondence with evidence* even at the cost of some subjective perception of “beauty” or “symmetry” or “order” in a proposed belief.

We can accomplish this by making it at best a tie-breaker, a rule that is as much a fond hope as an actual meta-axiom. We deliberately make it as *weak as possible* while still admitting it as a criterion.

9. Esthetics – *Given two worldviews of similar complexity that do equally well at consistently explaining experience and evidence, the one that is most beautiful is (narrowly, marginally, barely) best.*

It may seem a bit odd, at first, to have a *meta-axiom* of worldviews that is so horribly *subjective* as compliance with an esthetic principle, until you remember that your worldview is by its very definition a subjective construct from top to bottom. We have to make subjective meta-axiomatic decisions from the get-go or we'll find ourselves paralyzed by uncertainty because reality doesn't come with a set of instructions or a user manual of Perfect Truth (whatever religious theists might say). So let's cut the shit and *accept* this and live with it openly, even in science (which often pretends that it is strictly objective by sweeping its hidden assumptions – like the presumed existence of temporally continuous causal physical law that empirical evidence reveals – under a very opaque rug), and note that like it or not the best physicists *have in the past* and I'm sure will *continue in the future* to give considerable weight to beautiful theories that contain monopoles and Higgs bosons even in the *absence* of direct evidence – yet⁴¹ – that either one exists!

9.6 The Meta-axiom of Open-Mindedness

This still leaves all sorts of problems that have to be dealt with as one builds, or hacks, one's personal worldview. What do you do when you have two worldviews, and one is simple but ugly and it doesn't quite work and one is complex but beautiful and it works better? Or the other way around? Which should have precedence, beauty or simplicity or just plain function, as we have theories like the theory of monopoles that are simple, beautiful, but which don't *work* because we lack any direct evidence for monopoles? What is the *honest* thing to do, when we truly do lack enough evidence to help decide whether or not the Knave Took the Tarts (however beautiful and simple the various theories presented by the D.A. appear to be)?

The best thing to do, when building worldviews out of pieces that don't quite fit, that aren't yet elevated by experiment, experience, or strong argument to a state of relatively high plausibility compared to the alternatives is to *keep them all*, and simply move them gently and reasonably consistently up and down your

⁴¹As of the *day* that I *first* wrote this line, the first hints that the Higgs might objectively exist had just emerged in the early results out of the LHC. At this point it is strongly confirmed and hence “best belief” unless and until somebody finds a flaw in the results and/or a better explanation for what it explains.

personal scale of plausible belief as you learn more, as new evidence emerges. The next section of this book will provide an explicit quantitative example of just *why* it is essential to *never assign a probability of one that any proposition about the real world is true* and by extension, *never assign a probability of zero that any consistent notion about the real world is false*. Certainly, it turns out, is impervious armor to *evidence!*

This axiom applies, or should apply, even to very implausible notions, to things that are absurdly unlikely to be true according to your common sense. Don't assert that *fairies do not exist* as *absolute truth*, simply observe that nobody has reliably reported that they do, and you yourself have never seen one and hence are naturally somewhat skeptical. "Somewhat" in this case might be *very skeptical indeed* but since it is not *certainty* (certainty of most non-contradictory notions or collections of notions concerning the Universe being more or less prohibited by the Cox meta-axioms), you leave yourself open to change your mind if you go outside some evening and small winged glowing beings sprinkle dust on you and you start to fly⁴²!

It is clearly important that our axiomatic theory not assert its own correctness – so much so that this meta-axiom is intimately connected to the Gödel theorems we've already discussed. Simply stating it in bare mathematical terms doesn't suffice, however, because we need our worldview building meta-axioms to be *useful* to us even if we are *not* mathematicians.

For that reason, I've tried to formulate this essential meta-axiom in many ways, and am still not completely happy with the result, but this is very much self-consistent with the meta-axiom itself. Here's what it says a different way: Don't *expect* to be completely happy with any given set of meta-axioms or any given axiomatic worldview consistent with them. We don't *have* a perfect metric in the space of all notions, not even on the "principle axes" picked out by the meta-axioms that lead to a not-too-inconsistent (so far) system of beliefs about the *physical* aspects of the apparent world (also known as "the Laws of Nature") let alone the ethical or economic or social (human) world. Emphasizing one "parameter of worldview excellence" such as simplicity at the expense of consistency

⁴²It is precisely this sort of mental agility that is associated with excellent outside-the-box problem solving skills, high IQ, paradigm shifts, epiphany in general, and the romantic ability to provisionally suspend disbelief and enjoy a rollicking good science fiction novel. Being open minded (but not credulous – note well the need for balance) is an essential feature of the philosopher seeking to build an optimal worldview. It is a kind of *humility* – the knowledge that our experience only goes so far and our vision is terribly finite, and that heck, even the LOTR cosmos might have independent objective reality and one day we could be transported there to fight orcs side by side with the elves.

or emphasizing the ability to explain one piece of evidence at the expense of the quality of explanation of another simply builds a conceptual cage with solid walls through which you will not *permit* your worldview to pass from where it is now to where it (perhaps) needs to be. Let's understand why.

The idea is simple enough. A worldview is *not absolute truth*. this is obvious. It *can't* be, it is incomplete, it is built from limited evidence, it contains a lot of very difficult explanations and an enormous number of "facts" that are themselves nothing more than things we believe very, very strongly (but that could still be wrong). I'm a physicist and know a whole lot of stuff that you probably don't. You almost certainly know stuff that *I* don't. At any rate, our experiences in life have been different, we have a different knowledge of and degree of trust in the data obtained in scientific experiments, we have different abilities to do things like solve logical and mathematical puzzles and problems, and we've had different educations.

Neither of us are going to have the exact same worldview, and *neither* of our worldviews are going to be absolute truth.

Finally, our worldviews are not static, they *change* over time, so my worldview today is not precisely what it was yesterday, and is *very* different from the one I had when I was forty, or eighteen, or twelve, or six years old.

How crazy would it be for me to assert that my *own* worldview as of this instant, today, is absolutely correct given that according to inferences based on my own immediate memory of my own past life, it almost certainly won't be the same tomorrow and yet I'll still think it is the best that I've got (so far) *then* as well? How crazy would it be for me to assert that any major *part* of my worldview is absolutely correct? How difficult is it for us to find the *truth*, the absolute *best* worldview (best by virtue of being completely, perfectly, correct – true in *fact* and not merely apparently true by virtue of *perfect correspondence*)?

Again, we need to draw on the theory of optimization on high dimensional spaces for some spiritual sustenance here. However, you probably have no idea what this even is, let alone why it is relevant. So bear with me while I explain, with only the tiniest bit of arithmetic.

Imagine a rough, corrugated landscape on a two dimensional space, such as the surface of the Earth. Imagine further that you are a very shortsighted creature, such as an ant, but that you are equipped with a very accurate altimeter. You are born somewhere on that surface and are driven to become the Edmund Hillary of antdom and find the *highest point* on Earth.

The very simplest search strategy is to start from wherever you are, and go “straight uphill” from there, following the slope until you reach the top. Initially, this works well enough. Your ant-vision is extremely shortsighted; all you can see is the immediate vicinity of the point you are standing on. This is enough for you to be able to tell what direction is “uphill”, but nowhere near far enough to be able to see across any valleys to locate nearby hills (if there are any) that are in principle in your field of view.

Now, if you simply start walking uphill from any randomly selected location on the planet’s surface (pretend that there is no water, so that the ocean floor just counts the same as the dry land above), the probability is *almost unity* that you will walk right up to the top of the nearest clod of dirt, or anthill, or boulder, or even (with a bit of luck) to the top of an actual hill. The chances that it is the *right* hill are essentially zero, though, because the projective area of the part of the slopes of Mt. Everest where going uphill at every point will take you to the top is a *tiny fraction* of the total projective surface area of the world.

A foolish ant will therefore climb to the top of its own anthill, wander around a bit in its immediate vicinity and learn that there are no higher points nearby, and proclaim itself conqueror of the highest mountain in the world. Only we, possessed of “God vision” relative to the ant, can see that its anthill is tiny indeed. Perhaps it is on the plains not far from the slopes of Kilimanjaro, but much farther than any enterprising ant can walk in its lifetime. Yet it may well be that our intrepid ant explorer that lives in this particular anthill feels very secure in its belief that its very own ant colony represents the highest point in the world, quite unaware that there is an *enormous mountain* just a bit farther away than it or any of its ant-ecedants have ever explored⁴³ And even *that* mountain isn’t even *close* to being the *highest* mountain.

So what does a *wise* ant (one that has some idea of how *large* the problem space is, and how unlikely it is that its easy solution is the best one) do? It needs to use a *global strategy*. It needs to come up with search strategies that gradually explore the entire surface of the planet, not just the vicinity of one particular anthill, because even though a solution may appear to “work” locally, with all directions from a peak being downhill, there are many, many peaks of wildly varying height and width, some of them are peaks on the slopes of peaks on the slopes of peaks, with many long and torturous valleys in between.

Got that so far? Now let’s make the problem a *bit* more complicated. Suppose this rough, corrugated terrain isn’t supported by only *two* dimensions, but *many*

⁴³Oooh, sorry.

dimensions. Most real optimization problems fit this sort of description. Think about how many variables are needed to specify things like the most probable weather tomorrow, the most probable value of the stock market a week from now, the best set of parameters to use to optimize the productivity of a factory making a car, the particular values of the genes required to build a human being out of all possible *kinds* of things genes can build.

To give you a crude idea of how this increases the difficulty of the problem, let's imagine that we have exactly thirty dimensions that we need to explore and that we'll be satisfied finding the best value within a range of 10% in each dimension (so each dimension is more or less discretized in tenths, and we just want to find the best box). There are now 10^{30} boxes to explore! To simply check each box to find the best one (ignoring any surface variations or hill-climbing on a scale of less than a tenth of each dimension's range) would require more attempts than the book or device you are reading has molecules! Finding a needle in a haystack or a particular grain of sand on a beach are *easy* problems in comparison – here one isn't exactly looking for a "needle" as the ranges of each dimension are being rather coarsely partitioned, but it is a *thousand times easier* to exhaustively search a thousand kilometers (a billion millimeters in length) *cubed* (that is, a *billion cubic kilometers*) on a millimeter scale ($(10^9)^3 = 10^{27}$) looking for a particular grain of sand than a mere thirty dimensional finite space at a resolution of only 10% looking for *the* box that optimizes some 30 dimensional function.

Now consider how many "parameters" a *worldview* contains! Some of them are big, binary parameters – is it or isn't it plausible that there are one or more Gods? Some of those parameters examined in more detail turn out to have entire subspaces of additional parameters. If Gods exist, how many Gods exist? One? Ten? A thousand? Is there a (relatively) plausible upper bound? Don't be too hasty to answer, remember our friend the ant, climbing to an easy, but *horribly wrong* conclusion based more on the particular biases inherited from the local beliefs of his particular ant colony. Consider the laws of physics – how many parameters are there – how many forces, how many force constants, how many *possible* force laws are there. We know of at least four spacetime dimensions from observation, but there may be more – far more. Even the dimensionality of the *problem space* of our worldview is a parameter in the space of all possible worldviews, and we may quite literally lack the long-range vision to see Mount Kilimanjaro looming just out of sight in the near distance, let alone Mount Everest.

Hopefully this gives you some *small* idea of how absolutely *enormous* the

space of all notions is, how impossible the task of picking *truth* – or even a very good approximation of truth – out of the whirl of near-infinite possibility is. Fortunately, we are not entirely unarmed against this deep sea of troubles. Nature (and a lot hard work in computation and mathematics) has revealed to us certain global search algorithms that are much better than “just” linear/local gradient search methods, augmented by e.g. Monte Carlo (sampling randomly selected points on the entire available terrain).

One of the most powerful search methods known to humankind is the *genetic algorithm* where a *population* of individuals sample the space and *share* their information in some way, using a selection mechanism to define “uphill” and search for the best volumes of the space sampled – so far. The genetic algorithm is quite powerful – it has produced *us*, for example⁴⁴, and continues to be an important component of the *memetic* evolution of our worldview⁴⁵.

There are several other useful ones, each of which has a place in global search strategies: *simulated annealing* (a way of permitting hops from peak to peak across intervening valleys to find a relatively good one) and *importance sampling Monte Carlo* which relatively quickly finds “promising” or “relevant” fractions of the overall terrain to explore and then explores them in ever greater (weighted) detail. But it is not our purpose to “explore” global optimization strategies in detail at this time; rather we wish to establish that we *absolutely must have them* enabled by our meta-axioms, lest we fall into the trap of the foolish ant.

The moral of this story is quite simple, really. Our “vision” is finite and bounded. We cannot even determine the correct *scales* of the significant variations of the terrain we are optimizing in except by sampling and searching that

⁴⁴And Shakespeare – providing something of an answer as to how monkeys *could* type a Shakespearean sonnet, not as random ignorant keybangers but as participants in a reproductive process that selects for and rewards monkeys that produce *non*-random strings that encode meaning and structure (eventually) in the style known as a “sonnet”.

To put it another way, while celibate, unmotivated, random keybanging monkeys will never succeed, *fucking monkeys* trying to impress potential mates with their cleverness can apparently manage it in a mere million years or so, inventing the typewriter along the way to have something (else) to bang on...

⁴⁵Indeed, in a strange sort of way we are engaging in memetic intercourse right now, literally and figuratively, as I attempt to pass on some new worldview-building memes that you might find better – more “fit” to survive the selection process going on in your own head as you read them – than the ones you began with. And in the course of public debate over this book’s contents and assertions, others who disagree or who note things I left out or missed may contribute those missing pieces, and our worldview-building abilities will *continue to evolve* as they have evolved in the past in meme-space.

Hopefully the entire experience has been consensual and satisfying for you. It certainly was for me...

terrain on ever larger domains, at ever finer scales, and we will always run the risk that no matter how good the best solution that we've found *so far* is (that is, how much it is in agreement with evidence and experience and the rest of our network of beliefs), right over the horizon we might have an experience or an insight that leads *quite suddenly* to a much *better* one that confounds the previous one, at the expense of changing the way we view *everything*⁴⁶.

We absolutely need a meta-axiom for this, one that *keeps* us from having to absolutely choose between e.g. beauty and compactness separately, one that permits us to keep provisional, mutually contradictory worldviews *both ways*, as partial truths that may be eventually connected to a bigger, better picture in still more dimensions or at still greater range that resolves the apparent contradiction or supports one but not the other in an explanatory way. It is the meta-axiom of personal humility, the axiom that openly acknowledges that we don't know everything and that anything we *believe* could turn out to be *wrong*. It is the meta-axiom that leads to happy marriages and prevents religious wars. It is a meta-axiom that might keep you alive one day as you fasten your seatbelt even though you *know* that you are the world's best driver and will never ever skid off of a road.

To provide all of this and more, I give you the *Meta-axiom of Open-Mindedness*:

10. Open-Mindedness – *Don't ever assume that your worldview is the best one, only that it is the best one you've found – so far. Never assume that somebody else's worldview is completely wrong (if it isn't as good as yours in some way), only that it may be less correct – so far.*

I call it open-mindedness instead of “uncertainty” or anything similar because in my opinion its *purpose* in human discourse is to encourage a certain healthy degree of modesty concerning one's worldview; it is an “anti-righteousness” meta-axiom. Yes, your worldview may be much better than mine, but mine *could* have a *key ingredient* missing from yours, one without which yours will never be right! Overall, we will both be better off if we can get together and rationally⁴⁷ compare and share ideas from our worldviews, and possibly both end up with a new one that is better than what we had before⁴⁸. At least, we would be better

⁴⁶For example, one day you might *wake up* and see some tentacled monstrosity you have a strange urge to call “Mom” pulling a wire from your cephalopodic body and hear her croak to you to stop playing that damned neural interface game *Destruction of the Third Planet by Hairless Ape-Beings* and take out the garbage...

⁴⁷...and *honestly*...

⁴⁸I'd add, “and cuddle for a bit afterwards” except that it would make the whole thing *too* weird, wouldn't it? Still, loving thy neighbor does indeed imply sharing, and what could be

off if we can *honestly* agree on the proper *basis* of rationality itself, so that our Cox axiom assessments of plausibility (given the same data) come out at least *approximately* the same. Otherwise we are right back to: “Is so!”; “Is not!”; “Is so!” ... ad nauseam, usually screamed at each other as we battle one another with bayonette-equipped AK-47’s and hand grenades. And hence this book.

It also means that I have something simple to do with notions that are “beautiful” or “simple” or “compelling” but for which there is no direct evidence – things like magnetic monopoles, Higgs particles, and God(s). Without direct (or at least very strong indirect) evidence for them it seems unreasonable to promote them to a degree of plausible belief particularly near “certain” no matter how pretty they are – to you. Similarly, even a very ugly idea may be something you believe with a lot of confidence if it is well-verified by experiment. You might well hope that this ugly idea will *eventually* form part of a *beautiful* theory, but in the meantime you take what you can get, what works best.

Note well: I went to great lengths above to indicate *why* open-mindedness is a *necessary* meta-axiom for worldview building, not just a platitudinous virtue in human discourse. For one thing, certainty poisons the Bayesian Epistemological Loop we will spend a lot of time on later – much of which will be spent *proving* that this is the case. For another, while the Cox axioms alone are not “intrinsically” local as a purely mathematical differential statement, their *implementation* as the foundation of an actual search for the optimal worldview (given experience and evidence) in a world filled with No Free Lunch alternatives quite naturally functions primarily as a local differential search in the space of notions, performed by “fixing” almost all of the basis of one’s knowledge and focusing on the effect of one small stream of experimental data or experience on one’s plausible belief of just one thing, or some small subset of things.

Science is indeed performed almost *exactly* in this way, much of the time – experiments are *designed* to test single hypotheses whenever possible, although sometimes a single stream of data bears on several all at once. When the body of “fixed” hypotheses start to lead to contradictions between data and any sort of local hypothesis conditioned on the fixed ones, however, the fixed hypotheses themselves come into question and worldview revolutions can and do occur. The fixed body of classical physics could not be made consistent with experiments on the speed of light and with spectral data and observations of the stability of atoms once Maxwell’s equations were inferred and proved to be otherwise numerically consistent with an enormous body of data to very high precision.

more important to share than a worldview? Except food, drink, shelter, safety, and Maslovian stuff like that, of course...

The axioms that replaced them to (eventually) lead to *consistency* with both the failed observations and with many more new observations that were subsequently made were those of *relativity* and *quantum mechanics*, which in turn had to be fused into *relativistic quantum mechanics*, which required the formation of *relativistic quantum field theory*. The latter theory is still incomplete and inconsistent in places, and it may well require revolutionary rearrangement in its own right before consistency is achieved. To accomodate this sort of thing science allows for *emergent* or *partial* hypotheses – ones that explain some of the data or even some *aspect* of some of the data at the expense of NFL conflict elsewhere, in the hope that eventually some Einstein will come along and have a moment of critical insight that fuels a far jump, a paradigm shift, that explains everything by synthesizing and correcting the partial theories into a better overall theory where we don't have to play the No Free Lunch game!

Social axioms and the axioms of religion, however, are far more resistant to this sort of radical rearrangement. These axioms contribute to a *locally* optimized worldview that is typically *very resistant to change* and *very intolerant* of alternative worldviews from other regions or cultures. These “intolerance” *meta-axioms* basically function to “lock down” components of the regional worldview and *isolate them from the Cox axioms* so that contradictory evidence is not permitted to alter the degree of plausible belief (or more practically, their implementation as social and religious custom and law). They are removed from the realm of plausible reason altogether and become a part of the *implausible* reason, the *unreason*, that forms an unfortunately large part of the worldview of most people.

The meta-axiom of open-mindedness stands in direct opposition to the far more prevalent meta-axiom of naturally intolerant “religious” belief (and its axiomatic spawn). We are engaged in a *search* for the truth, one where success is never certain, where we ever risk the complacency of the foolish ant, with no real guide but our sensory experiences and the network of consistent axioms that we believe the most because we can doubt them the least *so far*. We must ever be prepared to abandon the tops of our parochial anthills and strike out across unknown terrain searching for Mount Kilimanjaro. And even there, on the top of a real mountain surrounded by a vast plain, we must maintain a real belief that there may well be a mountain range higher still, one where the *average* height of the terrain may exceed the height of Kilimanjaro's lonely peak⁴⁹.

Only if we maintain this sense of romantic adventure, this strong belief that

⁴⁹As is the case, of course – the average height of the high ranges of the Himalayas is higher than Kilimanjaro...

our beliefs themselves may well be wrong in ways large and small coupled to a willingness to *change our minds* when our beliefs are contradicted by experience and reason can we as a species continue to advance, can our collective worldview continue to evolve to an ever better one. We are engaged in a *global* search, and there is no place in such a search for meta-axioms that constrain the global solution and lock them down to the point where they *cannot* be changed, no matter what the evidence that contradicts them.

9.7 Beware the Black Swan

There is one more aspect of the *already observed* degree of complexity in the world that deserves to be turned into a meta-axiom. Once again, it may not be strictly “necessary” – in a way it is a direct implication of some of the discussion above. Nevertheless, it is sufficiently important to merit a careful explanation and its addition to our list, since we are trying to provide good guidance for those seeking what to best believe.

As I mentioned a few times in the sections above, Nassim Nicholas Taleb wrote some time ago a book called *The Black Swan*. Rather than recapitulate or review his own lovely prose (however much I recommend to the reader that they take time to purchase and explore it for themselves) I will simply extend some of the ideas and conclusions laid out above to motivate the exact same thing.

Consider the following: *If* the scientific worldview is at least *approximately* correct about things like the size of the visible Cosmos, quantum theory, relativity, the number of galaxies in the visible Cosmos, the number of visible stars in those galaxies, and so on, we are being influenced in various ways by objects almost 14 billion light years away, from their motions all the way back in that remote past, and by *all the objects in between*, each with its own lag time.

The laws of physics (classical *or* quantum physics) give us predictions for the *future* time evolution of any small subsystem of the Universe that are appallingly sensitive to these remote influences. They don’t necessarily change everything “instantly”, but the changes they produce accumulate and in time they cause both quantum and classical predictions to fail when we extend them too far into the future.

As one proceeds closer to the “experiment” – our own brains, say – there are fewer and fewer objects to account for, but the influence of the nearby objects is potentially a lot more rapid and stronger. Eventually we get to objects like “your spouse” or “your children” that can completely change the otherwise likely

immediate course of your action in a heartbeat, and once this change is made your life will quickly diverge, quite possibly radically diverge, from the track it would have taken otherwise.

Some – perhaps many – of these influences are usually benign and slow, or are reasonably predictable. Physics (and to a lesser extent the other sciences) are something of a success story here – we can usually trace the causal time evolution of much of our local physical environment well enough to successfully “engineer” devices that are useful to us, to understand much of what we see (at least in the short run), and to form a reasonably good foundation for the building of a worldview at larger, but also more subtle and complex, scales.

Others disciplines are not, however, so readily tractable, and it simply isn’t possible (so far!) to construct truly useful, meaningful, explanatory or predictive theories. The reason I am including black swans in the meta-axioms is because the black swan metaphor illustrates a critical weakness of inference in a large, open system. Since black swans per se have already been used as a metaphor, I’m going to present instead two slightly different metaphors that illustrate opposite aspects of the same general problem.

One (one of my favorites, actually) is “pink unicorns”. If I offer up as a hypothesis/notion:

Pink unicorns currently exist as an actual animal species somewhere on Earth.

you will probably *reject* the notion and not grant it much belief, in spite of the fact that we have an actual statistical *adage* that says that the “lack of evidence is not evidence of lack”. Still, we have explored a good deal of the Earth’s surface in some detail, and it does seem likely that if a breeding population of pink unicorns was out there, we would have discovered them and put them in zoos or be raising them on pink unicorn farms for sale to the general population.

At one time, of course, European/Western people viewed “black swans” in *exactly* the same way. They had white swans aplenty, but nobody had ever seen a *black* swan that wasn’t just dyed or melano mutation of a white swan species.

Then Western settlers arrived in Australia, and found – black swans! A lot of them. A whole species of them. Oops. We already have an axiom that reminds us to be open minded (and not be a prig) about axiomatic beliefs, but this is more about how we handle notions unsupported by data – so far – than it is about how we handle competing notions that do explain something.

The moral of the black swan story is that we should avoid stating, even to ourselves, “There are no such things as pink unicorns” simply because we haven’t found them *yet*. We cannot be *certain* that any such assertion is true unless we can somehow look *everywhere* for them. Perhaps when Atlantis sunk below the waves, the Atlanteans survived in secret high pressure domes located underneath camouflaging reefs and preserve there an entire species of – pink unicorns. Have you checked *every* underwater reef, with sophisticated probes, to be *certain* that this is not the case? No? Then it remains a possibility, however unlikely. Then there is the chance that they have long since been discovered but are being kept *hidden* by crazed industrialists hoping to corner the pink unicorn market one day – the pink unicorn variation of the Roswell theory of government conspiracy hiding evidence of space aliens. Maybe those aliens *are* pink unicorns... can you be *certain* that this is not true?

Perhaps there is a mad geneticist out there whose daughter is crazy about the TV show “My Little Pony”. On this show, “Fleur Dis Lee” is a fictional pink unicorn. Perhaps for her fifth birthday, he genetically altered a horse embryo so that it would have pink hair and a perfectly spiral horn growing out of its forehead, borrowing genes like crazy to do it. Just *maybe* that animal is now being ridden around by his daughter, but only on their large Texas ranch where no one can see. It’s a long, complex story, and to be sure it violates several of our meta-axioms above and should certainly be considered to be rather implausible in the absence of evidence and presence of a complex and ugly explanation, but it *could* be true.

This handful of contrived explanations for how pink unicorns might actually exist even though there are no reliable reports that they do in fact exist leave the proposition *unlikely* to be true, for sure, but can you be *certain* that none of them – or any of the eighty million *other* stories one can concoct that might explain why *you* haven’t learned of pink unicorns, so far, even though they really exist – aren’t true? Let’s face it – much as I think pink unicorns probably don’t exist and that it is a bit silly to assert that they do, no matter how cute they are or how amazing the world would be if they were real, *I could be wrong*, and pink unicorns *might* exist in reality and not just in my imagination, right here on Earth.

Note that the argument *against* pink unicorns, or black swans before them, is a kind of statistical argument. This should be starting to make sense – almost *all* of our higher-order knowledge of the real world is based on statistical arguments that equate regular associations of objects, events or experiences with causal linkages and/or membership in organized structures.

Here's the key idea of it: absence of evidence may not be evidence of absence, but it also damn well isn't *evidence of presence*. We would consider it *crazy* to assert "I've never before seen a single shred of evidence that a single pink unicorn exists, let alone an entire species, herds of them, so ***I'm therefore certain they are real!***" Somehow, on a quantitative and qualitative basis both, the more places we look without finding something we are looking for, the less likely we *should* believe that it is that we eventually will find it. If I empty my pockets and turn them inside out looking for a quarter and don't find one, I don't really expect that if I do it all *again* one will suddenly be there.

If I don't own a dog and lock all my doors and windows when I leave the house in the morning, I really don't expect to find a dog in my house when I come home in the evening, especially one that was really there all the time, hiding and living on food scraps in the kitchen late at night! You could therefore easily be forgiven, if asked "Do you have a dog at home?", for replying "No sir/ma'am, I do not" even though you have never actually searched in the attic for a dog and cannot be certain that there isn't a dog hiding up there, somehow. It just seems very, very improbable that you are wrong.

The trouble with this assumption – that things that you *believe to be* very, very improbable are, *in fact*, very, very improbable – is that the assumption is wrong *a lot more often than most of us expect!* We are simply a lot more ignorant of all of the factors that go into our seat-of-the-pants estimates of probability or plausibility than we think we are. True, you left the house with no dog inside in the morning, but your adult daughter (who has a key) has been thinking for some time how *nice* it would be for Pops and Moms if they had a playful little puppy. Or perhaps Moms encountered a dog-a-thon shelter adoption station and fell in love and brought it home with her⁵⁰! Or a neighborhood dog discovered that the latch in your back door didn't quite catch when you left in the morning and has wandered in to help himself to your leftover bacon. You made your estimate in ignorance of these things, assuming that just because they (as far as you know) didn't happen *yesterday* they wouldn't happen today as well.

Think of the weather. I've lived for substantially less than a century, but somehow I've experienced weather extremes that are supposed to be so unlikely that they happens only once in a century, or once in *five* centuries, on multiple occasions. And don't even get me started on politics! Why else would Douglas Adams spoof an "infinite improbability drive" where things have to become *improbable enough* for us to be certain that they are bound to happen at any

⁵⁰This has in fact happened to me with my wife, more than once. I not only had a dog in the house I didn't expect, I had a dog that actually *lived there* and didn't know about it – yet.

instant because of the sheer perversity of the Universe.

There are many ways we could name the meta-axiom that we need to deal with this. We could call it a “humilty” meta-axiom, for example, as it is intended to remind us that we are a lot dumber than we think we are, and know a lot less than we think we know, and that humans generally suck at computing probabilities or understanding statistics *on paper and in possession of a lot of actual data* and should almost certainly refrain from using it off the cuff to somehow transform “I don’t know” into “I’m certain”. We could call it the “black swan” (or pink unicorn) axiom, but that would be a pure rip-off.

Both of these also fail to properly convey the *consequences* of the disrespectful treatment of probabilities. I think it is really, really unlikely that my house (in suburban/rural North America) contains a cobra right now. Indeed, I have a hard time even making up a scenario where it could *plausibly* contain a cobra. But hey, if there *were* a cobra coiled up near my feet right now, ready to strike, that would be very, very bad. Much of today will indeed be like much of yesterday, but the little bit that changes in ways you cannot anticipate or control can have *severe consequences!*

So every now and then, when building your worldview, do a “cobra check”. Some of your beliefs, however well or poorly founded, if wrong, might have severe consequences⁵¹. This is really Taleb’s *point* in writing his book – you might *think* that nuclear war is very, very unlikely to happen, but the consequences if you are wrong are serious enough that you should be concerned. A single unexpected super-volcano eruption can ruin your whole day. Or century. It simply isn’t *safe* to assume that the worldview that seems most likely today, with all of its estimates of improbable notions, is either correct or persistent. The Universe is a lot more perverse than that. Hence

11. The Perversity Principle – *Things that you believe to be unlikely happen all of the time, because your beliefs and estimates of probability are not well-enough informed and are often simply mistaken. Be humble. Beware the Black Swan.*

There, I managed to get all three things in, but “perversity” seems a better

⁵¹This is not completely academic. Last *week* I would have told you that pretty much the only poisonous plants of consequence that you need to watch out for when walking outdoors in the United States are the three members of the Poison Ivy family. Last week, however, I saw the first indication that there is a brand new invader, the Giant Hogweed, that makes poison ivy look downright benign. Is it growing in my own back yard? It *could* be, making my prior belief that only poison ivy and poison oak are at all prevalent in my neighborhood *wrong* in a very costly way...

match than either of the other two for what is missing. As compulsive gamblers know all too well, “sure thing” bets fail all the time, and “long shots” come home a lot more often than you might think they do. That doesn’t mean you should be stupid, and bet on long shots and avoid sure things, but it *does* mean that compulsive gambling is a great way to end up broke and alone, living on the street.

Be warned, this isn’t an open invitation to indulge in *Pascal’s Wager*⁵² – assign large plausibilities to very implausible ideas in the absence of evidence just because somebody attached a very large cost to disbelieving in them. Just because being bitten by a cobra is very bad is no reason for me to hire a special exterminator to check my house for cobras every morning before I get out of bed when I live in *nearly* cobra-free North Carolina⁵³, and just because certain highly implausible religions assert that it is *certain* that you will be tormented for an infinite amount of time if you fail to believe in them in spite of their implausibility is no good reason to indulge in belief in them.

It is time to stop our specification of meta-axioms now, before we give in to the temptation to add meta-axioms that *overconstrain* axiomatic solutions we might look for (and hence violate e.g. open-mindedness, or simplicity). This set is already potentially *weakly inconsistent*, but it nevertheless self-consistently explains that this weak inconsistency is necessary to enable global search for the best *consistent* set of axioms. Before going on to an examination of specific axioms sets that form parts of worldviews, it is worthwhile to write them all down in one place, though, if only as a handy-dandy reference you can come back to from the later chapters.

⁵²Wikipedia: [http://www.wikipedia.org/wiki/Pascal's Wager](http://www.wikipedia.org/wiki/Pascal's_Wager). IMO, one of the worst assertions of any mathematician or statistician born on the planet, especially when he failed to count the cost of making his “wager” and choosing to believe an enormously unlikely proposition but *picking the wrong* unlikely proposition/religion out of N alternatives, *all* unsupported by evidence. What can you do, weight the choices with the nominal *amount* of pain the particular deity of each one will inflict on you over an *infinite* amount of time, so that the wickedest, cruelest deity wins? And yet, this is *precisely* the argument of several of the world’s largest religions...

⁵³See: <https://www.newsobserver.com/news/local/article252468458.html> Sigh. As I said, *not even this* is *certain* to be impossible...

Chapter 10

Summary of the Meta-Axioms

Horatio: O day and night, but this is wondrous strange!

Hamlet: And therefore as a stranger give it welcome.
There are more things in heaven and earth, Horatio,
Than are dreamt of in your philosophy.

Shakespeare's Hamlet: Act 1, scene 5

Here is the list of our meta-axioms so far. Remember that this list is *provisional* (all axiom sets are provisional, plausible beliefs, self-consistently conditioned on their continued correspondence with evidence and experience). It is probably incomplete. It is just inconsistent enough to allow for its own ability to be changed and to self-consistently enable a global search for a consistent *axiomatic* theory that is both in agreement with the data *and* simple *and* compact *and* beautiful while allowing each of these desirable dimensions to be explored independently, considering theories that are beautiful and simple but not yet supported by data, theories that are ugly and complex but that do explain the data, theories that are beautiful and explain the data but are not simple, and so on.

As we've seen, it would clearly be foolish of us to meta-axiomatically insist on any one of these parameters of "goodness" having priority over the others in our search process for the best possible worldview or we can all too easily achieve *perfect* agreement with the data by means of "easy" worldviews such as solipsism or fairy theories or religious theories that make everything "God's will" or risk being stuck in a *beautiful* theory such as classical physics that is also remarkably simple but fails to explain the data where a much more complicated theory (with its own kind of beauty, nevertheless) works far better.

By remaining open minded, we can safely explore all sorts of emergent theories and use *judgement* to determine what particular set of axioms works *best*, and can even cover different aspects of our experience with “patches” of belief that work well locally but still contradict other parts of our belief (hopefully minimally), as long as we maintain our perspective and remain willing to *change* those patches to something more globally consistent (and/or simpler, and/or more beautiful) when the data demands it or insight reveals it.

So here they are:

Primary Meta-Axioms

1. **Unprovability** – *An acceptable axiomatic worldview must be unprovable and incomplete (to allow it to be consistent, so far).*
2. **Mathematics and Logic** – *Axiom sets leading to consistent theories of symbolic reason are acceptable for inclusion in a worldview.*
3. **Real Plausibility** – *Degrees of plausibility (of the truth of proposed worldview axioms or consequent theorems) may be represented by real numbers (or well-approximated by discretized e.g. binary representations or ordinal analogue electromechanical states of e.g. neurons).*
4. **Common Sense** – *Plausibilities can only change in qualitative correspondence with common sense.*
5. **Consistency** – *The complete network of mutually related axioms, theorems, and beliefs with their real-number plausibilities should be quantitatively consistent.*
6. **Honesty** – *Axiomatic worldviews that are built upon and supported by an honest, open, and well-founded process are better than worldviews that are based on lies, on contradictory propositions, or on evidence corrupted by (de facto dishonest) confirmation bias.*
7. **Predictivity** – *Axiomatic worldviews that (both) correspond well to the world of our past experience and predict or explain new experiences are better than worldviews that have a poor correspondence to our experience and/or have less predictive skill.*
8. **Ockham’s Razor/Simplicity** – *Axiomatic worldviews that are simpler (e.g. are parsimonious, have fewer axioms) are better/more plausible than worldviews that are more complex, all other things being equal.*
9. **Esthetics** – *Given two worldviews of similar complexity that do equally well at consistently explaining experience and evidence, the one that is most beautiful*

is (marginally, narrowly, barely) best.

10. Open-Mindedness – *Don't ever assume that your worldview – or anyone else's – is the best one, only that it is the best one you've found – so far. Never assume that somebody else's worldview is completely wrong (if it isn't as good as yours in some way), only that it may be less likely to be correct based on what your experience and most plausible belief set indicate – so far.*

11. Perversity – *Beware the general perversity of the Universe; it has many parts. Allow for it in your worldview. Be humble, you know less than you think you know (no matter what you think you know). Check for metaphorical cobras under your metaphorical bed while building worldviews or at least, don't be too surprised if one shows up and bites you.*

There are indeed more things in heaven and earth that are dreamed of in our philosophy. There are more things in heaven and earth that *can* be dreamed of in *any* finite philosophy, and yet the *space* of possibilities spanned by our dreams almost certainly dwarfs the set of axioms required to completely specify reality, the *correct* set of *true* notions, as it contains these truths and all permutations of the ways that they could be false besides.

To build the best possible collective worldview from this enormous space of notions and dreams given the brief span of a lifetime and our own unique set of experiences along the way, seems like a suitable activity to *self-select* as our *human purpose*, the self-determined reason for our existence. All other goals, all other activities we engage in, are subsidiary to this process, because knowledge and the choices knowledge enables are our sole source of enlightenment, the characteristic thing that differentiates the human from the mere biological animal (at least to our self-aware egos). If the term “soul” has any meaning in our worldview, what we are knowing – that amalgam of our thoughts, sensations, memories, perceptions – is our soul. Our ever-improving knowledge gives *honest* meaning to life itself (as opposed to the complex set of wishful thinking, lies and myths that arise from perpetuated ignorance, vested interests, and assertions not supported by experience), pulls us out of the Pit of Existential Despair and into a state where things – for better or worse, predictable or perverse – *make sense*.

In order for us to make good progress, however, it is essential that the *process* of developing the best possible set of plausible beliefs be understood. Even if you are no mathematician, no logician, not a physicist or “hard” scientist, you are fully capable of understanding the meta-axioms above and can see how each one of them is somehow *necessary* in order to enable a search for meaning in

our lives, for meaning can only come from understanding and deliberate choice. The rules above are the rules that govern reason itself, not just as dry and empty mathematics, but as mathematics and reason *about* something. About *everything*, both the real and the imaginary, everything that is true and the terrible \aleph_∞ infinite space of notions, of propositions that *might* be true, of ideas that we dream up as we build worldview-castles in our minds and compare them to our ongoing sensory stream, seeking the best possible, most consistent fit.

We have carefully left room not only for “science” but for *ethics*, even for *religion*¹. As we select worldview axioms for our society and government, we can freely do so on the basis of the *beauty* of the final result, as long as we don’t egregiously violate our most plausible beliefs in other domains such as science to get there (which would be ugly and inconsistent both). Theist and atheist can differ in many of their personal worldview axioms and yet agree on a common foundation for an ethical society. Things like torture and genocide – however much they are strongly represented in our cultural history – may or may not be “sinful” (since “sin” refers to a judgement rendered by a hypothetical authority, e.g. a supreme being, whose existence we might well freely doubt) but we are certainly free to consider them *ugly* or undesirable in any society we might wish to live in using no judgement or authority but *our own*.

My purpose from the beginning has been to bring you to this point, where you can finally *choose* your own axioms with a solid foundation of meta-axioms that will help you make *reasonable and honest* choices, and that help you understand why one choice can be *objectively* better than another (given these meta-axioms). If we can at the very least *choose* to agree that these meta-axioms are reasonable ones to guide the future development of our personal and cultural worldviews, we may not agree about *all* of the specific axioms of the “best” worldview (how could we, given different data, different abilities, different experience), but perhaps it is

¹Sure, sure, I’ve been pretty hard on *ancient theistic scriptural religions* (and will be harder still in later chapters), simply because they are really enormously silly; they are immediately contradicted by all sorts of history, science, and quotidian experience. Yet as superorganismal worldviews, they have a life of their own because of their extremely efficient defensive axioms, their wealth and political power, and their peerless mechanism for memetic transfer between generations.

However there is, as I will discuss later, a single axiomatic assertion of deity that is not overtly self-inconsistent or contradicted by evidence: panendeism – the self-organized sentience of the Universe itself. Is it proven (or disproven) by my personal experience in life *so far*? It is not. Is it *plausible*? Are worldviews that include such an axiom *better* – more beautiful, simpler, more honest, do they provide better insight or understanding?

This you must ultimately decide for yourself, while remaining, as always, open minded and tolerant of those who choose differently.

enough for us to be able to arrive at *general* agreement about the most important parts of a common worldview while still not being so rigid as to inhibit further search and the accomodation of the differences.

This could, quite literally, usher in a golden age of reason, world peace, and much more. There is *no rational reason* for the human species to live in constant and violent conflict, but there is no *rational foundation* for a system of globally accepted beliefs and government that would permit us to avoid it. We are still the prisoners of our memetic evolution, living with Bronze Age moral rules and standards in the Information Age, where the only thing that stands between us and the ability to fully use our knowledge for our collective good are *myths* and *traditions* and *laws* that memetically evolved to support a tribal culture engaged in a state of more or less constant genocidal conflict with its neighbors².

With the right axioms, some open-mindedness, and a dollop of actual reason to replace the unreasoned authority-derived myths, we can surely do better. Much, much better.

Let's see how.

²See, for example, Numbers 31 in a handy copy of the Bible, or read the *Mahabharata*. Yup, that's Moses ordering infanticide, genocide, theft, and the inevitable rape of the surviving virgin slaves. *That's* the guy that supposedly wrote down the "commandments" that are a major axiomatic component of our society and you *wonder* why we are eternally at war? Or consider Krishna, sitting in his chariot and preparing to help Arjuna wipe out all of his cousins...

Part III

The Rational Worldview

Chapter 11

Bayesian Epistemology

Experience is a hard teacher, but fools will have no other.

Benjamin Franklin

There are three kinds of men: The ones that learn by reading; the few who learn by observation. The rest of them have to pee on the electric fence and find out for themselves.

Will Rogers

It is time to begin our examination of explicit worldviews and worldview components. If I have done my job well, you should be in a state of remarkable mental clarity going in.

We have established that it is best to believe the most what you can doubt the least, which certainly *sounds* plausible – the alternative being to believe the most what we doubt the *most* or something randomly selected from a list of ideas sorted by doubt, both of which sound silly if not openly contradictory of the idea of “best”.

We have established the Cox meta-axioms as the eventual basis (as you will very shortly see) for a *quantitative measure* of doubt expressed in real numbers that manifestly *works* to provide us with an *extremely sound basis* for knowledge in the form of notions to which we assign an extremely high degree of belief in a process of *evidence-based inference*. This will provide you, quite possibly for the first time in your life, with a complete understanding of *why* it is best to (for example) believe in the law of universal gravitation instead of assigning a law of whimsical invisible fairy attraction as a plausible explanation for falling objects, or (worse) the idea that every apparent example of an object falling is

a *statistical accident* and might change at any instant on the flip of an invisible coin. It will provide you with a very concrete basis for belief in the objective reality of the outside world and the laws of nature we infer from examining it that collectively form the *most plausible explanation for everything we see* that we have inferred (on the basis of many experiments and a lot of hard work over several centuries) *so far*.

Finally – and this may be the best result of them all so far – we have established that it is *not reasonable* to assert that *any* vagrant notion from the terrible sea of possibly correct notions is *true*, and then defend a decision to actually believe it with the observation that nobody can *prove* that it isn't true. In order for any belief to be “the best, so far”, it has to be supported by *reliable, trustworthy evidence, honestly obtained* that can be *independently verified by anyone seeking to do so*. Sauron may be mighty and powerful in some notional LOTR cosmos that we invent in our *mindas*, but we have no good reason to think that he *actually exists in the one real Universe of things that actually exist* based on evidence obtained in *this* Cosmos, the one we seem to inhabit!

We have established a set of “global” meta-axioms and structural meta-axioms that pretty much self-consistently establish the framework of our basis of knowledge as *good* reason for an easily defensible meaning of “good”, and not its evil negation, *unreason*. And yes, I'm attaching the good/evil value judgement to these terms and giving them *moral weight* quite deliberately, because some of these global meta-axioms also provide us with an *esthetic basis* that can factor into our choice of beliefs and make them subtle, slightly ambiguous, subjective, and *human*. They give us room for *intuition*, room to make glorious mistakes or to create beautiful myths such as the myth that we have a right to life, liberty, and the pursuit of happiness and incorporate these myths into our worldview even though they clearly did not exist in nature until we, a natural species, invented them. As a consequence, they (as we will see) provide us with a basis for a human ethic in which we *tell ourselves the best story we can imagine of our own self and species* and then use *reason and deliberate action* to make the story come *true*. Or at least, *truer*.

Finally, they establish the honesty, the open-mindedness and the humility that any reasoning being should incorporate in an axiomatically incomplete and unprovable worldview, a recognition that the search for truth is a *search*, and one that *cannot be fully realized* in a finite lifetime with finite resources and a finite window onto the walls of our personal caves, no matter how much “graffitti” our ancestors and contemporaries left there to help us out¹. A true philosopher

¹Yes folks, one very amusing and instructive way to view the Bible, the Quran, Plato's

never *completely disbelieves* any notion or proposition that doesn't contradict a proposition that they *completely believe* as true, and there is only one true thing that we as self-aware beings know for certain. Even though sure, most of the notions out there we assign *absurdly small plausibilities to*, plausibilities that are very, very, close to zero, so close that we can be fairly comfortable saying that they are "false", we can recognize that there is a *strictly greater than* symbol in there next to the zero, not a greater than or equal to symbol, and that, surprisingly, makes an enormous difference in the way we should carry out debates and discussions over what best to believe.

We are fortunate to live *now* in relatively enlightened and modern times, and so we do not have to start with a *tabula rasa*². There are *already* a number of "major" competing axiomatic worldviews out there (and countless relatively minor variations – pretty much one per person alive on Earth). Note well that most of these individual worldviews decompose what humans generically refer to as "knowledge" in different, frequently contradictory, ways. Individual worldviews contain very different mixes of evidence-based knowledge, reason, faith-based belief, social customs, practical wisdom, and ethics, on almost a case by case, person by person basis. For some (arguably most) people, the prime axioms are purely religious and are carefully exempted from the process of methodological doubt outlined in our meta-axioms above (in most of the orthodox religious worldviews this is – necessarily – the case). For other people, empiricism and reason and secular ethics hold sway.

Because much of what we believe to be true is dictated by how we were taught or raised when we were far too young to think clearly or critically, it is not uncommon to find people who use cars and computers precisely as if they really

Republic, the Declaration of Independence, Gonick's The Cartoon Guide to the Universe, and every other book or media presentation that constitutes information transmission from another human living or dead to yourself is as *graffitti*. These are all things scrawled on the walls of our personal caves by others for us to read, preserved in time, just like the cave-paintings of antelope and mastodons still visible in caves around the world. Obviously we should doubt their veracity – who can trust graffiti, even such *appealing* graffiti as the work you are scanning in from the wall as you read these words? Still, they are as powerful as any other shadow in helping us to form the best worldview, especially when they help us to see the tree over there as the *shadow* of a tree, not the tree itself. The tree itself is one thing, our direct perception of the tree another, and our beliefs *about* the tree still another. The map is not the territory, however plausible and apparently accurate it is as we navigate the territory using it.

²Clean slate. Sorry, I took Latin in high school and can't resist dropping a bit into the text from time to time to sound erudite. Oops, that's *another* of those words. Ahem, I mean "well educated". Because by most objective standards, I *am* pretty well educated. I have a Ph.D. and everything! That doesn't mean, of course, that you should believe a word I say just because I'm all erudite and use fancy-schmancy words from time to time, of course...

believe that the scientific knowledge upon which their operation is predicated is “true” and “works” at the same time they openly profess to believe in the supernatural and magical interventions that can violate natural law. Cognitive dissonance and conditioned beliefs established early on in the development of our egocentric psychology probably plays a greater role in determining our personalized beliefs than any sort of systematic analysis of belief sets and evidence. This confusion, nay, this *chaos*, makes it very difficult to present any of these personalized worldviews as significant contenders for the *best* thing to believe. They are simply too internally inconsistent, too individually variable.

Presenting a slow, reasoned account of the historical evolution of broad-strokes “named” worldviews (or partial worldviews), on the other hand, might be informative as such a presentation would allow one to see the evolution of ideas laid bare. One could begin with the most primitive prehistorical worldviews we are aware of (as far as they can be inferred from archeological and paleontological evidence) and work forward. This might give one a good feel for the historical evolution of the dominant memes of things like tribal/rural societies vs urban societies, Christianity vs Hinduism, Capitalism vs Communism, and the Scientific Worldview vs Magical Thinking per se, but again, these for the most part are not “complete” worldviews; they are at best partial and again are almost invariably strongly conflicted both internally and between different components within the *individual* worldviews of people claiming to be e.g. “Capitalist Christian Biologists” or “Communist Hindu Fashion Designers”.

In any event, we will not follow this path. There are many other books that present an overview of history (including philosophical history), and the time and/or topically ordered presentation of many of them subtly or not-so-subtly urge us to accept certain components of the material they present as *evidence* in favor of some conclusion that the author desires you to draw regarding those components in isolation from everything else, often with no explicit statement of their own personal worldview. For example, are they magical thinkers or scientists? Socialists? Fascists? They probably won’t tell you, but it is unreasonable to think that their own worldview isn’t going to significantly color their presentation even of the most mundane string of historical events.

This may be a bit confusing. To be more explicit, a history written by a BICC and a history written by an atheist are going to be quite different and will present entirely different views of the same thing, with one presenting as a fact that humans have been on the planet from the sixth day after the creation of the Universe only 6 *thousand* years ago (compressing history so that at one time humans rode dinosaurs to work just like Fred Flintstone but that Noah failed to

give them room on his Ark and they all perished in the flood), and the other presenting as a fact that the last dinosaur perished at the end of the Cretaceous some 60 *million* years ago, most likely due to a huge asteroid that struck the Earth in the Gulf of Mexico at that time, in a Universe around 14 *billion* years old.

Sure, this is an extreme example, but works such as *Guns, Germs and Steel*³ by Jared Diamond are *written* (quite honestly, in the case of this particular work) to convince you to accept some desired conclusion in your view of history that translates directly or indirectly into an isolated component of your global worldview (one you might even agree with!) while at the same time insidiously bending other components into line in order to support this argument where you might *not* think they are the best things to believe or want to incorporate them into your worldview. You can easily spend as much time trying to figure out the hidden belief set of the author as you do trying to figure out if you agree with or care to learn from what they present as plausible truth.

This encourages cognitive dissonance and confusion. Sure, we understand perfectly well that you can be correct about one thing and completely mistaken about another even in a single sentence, such as “Robert Brown is a handsome young physicist” (one plausible fact, one implausible falsehood, and one neutral opinion that is strictly ‘in the eye of the beholder’...). We don’t even need to reach the sublime realm of human *social or political ethics* to find more subtle examples in abundance – there are plenty of places in *pure mathematics* or *science* where rules work for certain subsets of numbers or data but which fail in general⁴. There is even a named logical fallacy or two that warn against e.g. believing authority just because it is an authority or transforming being correct and plausible in one matter into being correct and plausible in another.

A second problem with this is that when studying (say) Greek Philosophy (which is to say, studying the partial writings and nominal beliefs of certain *Greek Philosophers* since there never is and never was any such thing as “Greek Philosophy” as a coherent, named worldview) one rarely studies the ways that their beliefs are (almost certainly) *wrong*⁵. Otherwise the course would be named

³Wikipedia: [http://www.wikipedia.org/wiki/Guns, Germs, and Steel](http://www.wikipedia.org/wiki/Guns,_Germs,_and_Steel).

⁴For example, a formula discovered by Euler, $P(n) = n^2 + n + 41$ generates prime numbers for all of the integers n from 0 to 39, but it doesn’t generate *all* of the primes, only primes between 41 and 1601. In the case of physics, well, all of classical non-relativistic physics works in the macroscopic low-relative-speed world of baseballs and automobiles, but fails utterly at the microscopic and/or high-relative-speed scales. We won’t even touch sociopolitics, as *that* rat’s nest needs no examples or explanation.

⁵This used to drive me crazy back when I was taking philosophy courses for my undeclared

something like “How and Why Greek Philosophers Got it All Wrong (and Should Have Known Better)”. But sadly, there are no such courses taught in even the most enlightened philosophy departments⁶.

Finally, it is a simple fact that we live in an uncertain world surrounded by lying frogs: humans who often lie, are mistaken, or otherwise tell us or (worse) *teach us fables and myths as if they are true*. Many of the beliefs that are most firmly, passionately, and even violently held to be true fall quite clearly into this category, and many of the fables and myths thus elevated to the status of “true belief” have successfully been protected from epistemological challenge for well over a thousand years. Indeed, for a huge number of very good (and in my opinion, fairly obvious) reasons it seems rather *more* likely that worldviews based on ideas out of ancient history are mistaken than more modern ones, as we have *made a lot of epistemological progress in the meantime!* Our ability to reason and the tools (axioms and actual tools like microscopes and telescopes) we use to reason with have come a long way and are beyond all reasonable doubt far more powerful now than they were (say) three thousand years ago. This suggests that if anything we should work *backwards* from the present in developing the best worldview, not forward from the past, if it came to that, and throw out *almost everything* developed over a thousand years ago with a few rare (but very important) exceptions⁷.

However, we are going to follow an entirely different approach. One of the worldviews – the Scientific Worldview – mentioned above has proved to be *far more functional* than all of the others. It is the worldview that more or less *directly* embodies and complies with the meta-axioms above, and it incidentally is the most modern of worldviews worthy of the name. If it has a failure, it is that (so far) it has not attempted to address the thorny issue of *ethics* and *human affairs*, leading the entire human species to live in a kind of willful schizophrenia where *different criteria* are used to determine plausible truth in different more

second major in philosophy at Duke, by the way. Sadly, philosophy majors don’t *start* with epistemology and ontology – the only sane way to teach the major since without a defensible standard of truth, the *de facto* basis often but not always ends up being “your professor’s beliefs regarding this are always right if you want to pass the course” – and end up as indifferently taught history classes as a consequence.

⁶OK, OK, this statement is so broad that it is almost certainly false. However, anyone who has actually sat through a class studying, for example, Plato, or Kant, or Wittgenstein, fully understands that the textbooks and professors of those classes at best *hardly ever* say “Of course, this was all a load of bollocks and it is hard to see why anyone would actually take it seriously and the main reason we are teaching it at all is as an example of how *not* to think...”

⁷You know, like “algebra”, “geometry”, “arithmetic”, “human language”, “fire”. Stuff like that.

or less completely arbitrary contexts.

This inconsistency is at the heart of the epistemological *disease* that infects pretty much all of human civilization. There is literally no question more important than the question of just how we all decide what is true and what is false. If we cannot agree on this, there is *no hope of resolving any argument by means short of naked force!* Yes, the most enlightened and democratic sociopolitical groups have compromised by granting blanked permissions for people to just agree to disagree, but as we have seen demonstrated repeatedly, on a global scale, *that doesn't work* because some of the things we disagree on are religious rules that more or less call for the violent suppression of competing religions, political and economic beliefs that call for the violent suppression of competing political systems or economic systems, and just which grouping of nation-states is going to dominate the global economy and maintain optimal access to *scarce* global resources. And then there is plain old greed, plain old lust for power. Ultimately, large, powerful groups of people insist on pushing *their* perceptions of “obvious truth” onto everybody else, even when they are *completely indefensible by any rational standard* and usually *exist to benefit only a select set of the “chosen”* out of the seven billion *human* inhabitants of this planet and damn all of the *non-human* ecosystem whenever and wherever it gets in the way!

To do better, we *must* begin by coming to a mutual understanding of just how *reason and observation* lead to beliefs that are literally *more likely to be true* than nearly all of their completely or partially contradictory competitors. We need to see exactly why we should *never* elevate any of the concepts floating below the surface in that vast and terrible sea of notions to the status of probable truth without sound, reproducible evidence that the particular notion is *true*, or at least, more *likely* to be true. We need to understand the epistemological cost of violating this rule – any axioms held to be “true beyond all doubt” as “self-evident truth” or “true because they are written down in the following clearly authoritative compendium of perfect truth” quite literally *poison the system of mere common sense reasoning* that we used to navigate the world every day.

Finally, we need to realize that the methodology for determining probable truth *cannot be split up into realms* such that you can use “religious” reasoning to decide which of the dazzling array of world religions past, present or future to believe in, “moral” reasoning (often religious reasoning in disguise) to decide what actions are “good” or “bad” on the basis of unassailable, a priori true moral *axioms*, that we can't use yet a different criterion to decide what economic system is the ideal one for all humans to live under (usually with considerable input from equally unfounded religious or moral “reasoning” systems). There really is only

one way to decide what is true or false in the world – by observation, experience, and experiment.

After all, *the Universe doesn't care*, as far as we can tell, whether we get our beliefs “right” or “wrong”. However, the Universe *does* make believing in falsehoods *dangerous*. You can believe all you want to that fire won't burn you, but if you fall into a blast furnace you will (in my opinion, almost certainly) discover that you are *wrong*. You can believe that space aliens will land on a particular field to lift all true believers off of the Earth right before it is destroyed because a self-styled “prophet” tells you that it is true, but when you go to that field having sold all of your possessions (most likely to give the resulting wealth to this shaman or otherwise have it stolen away) and *it does not happen* you will be forced to confront a different kind of consequence. Experience is a hard teacher but fools will often have no other⁸.

To do better, we will start by figuring out just what evidence *is* and why we should believe conclusions supported by evidence *more* than conclusions that are contradicted by evidence before we start using evidence to support the presentation and development of a “best” worldview (so far). This is especially important because the worldviews held by the majority of humans on the planet openly *deny* the primacy of evidence in favor of “pure reason”, divine revelation, authority of one sort or another, magic, or worse, in at least some contexts.

The notion that our mental image of the Universe, our worldview, our *map* inferred from an apparent memory of our past experience of an apparent external reality, mediated by our senses, can be judged by judging how *well* that map seems to correspond to the territory that it supposedly represents, how well it functions as a reliable guide as we try to navigate that external reality and predict beforehand the serial destinations of our ongoing experience, is one of the core ideas of *science* (and a meta-axiom of our list above). However, the notion that a particular chunk of mathematics is at the heart of the scientific method itself is *not* taught. We have the paradox that most individuals learn it to the extent that they ever understand it on the basis of authority or silly science fair experiments that completely miss the point.

E. T. Jaynes (one of my heroes as I'm sure you can tell) did his very best

⁸This is an odd statement, since I just asserted that experience is the *only* teacher that we should embrace. In this case the experience that *should* have been embraced is the one that suggests that belief in space aliens and pseudo-religious “prophets” has, historically, produced absolutely no benefit to the believers, has indeed levied heavy costs upon them, and in *no* case has objective, material, reproducible, verifiable evidence emerged to seriously suggest that beliefs of this sort are *true*. Yet.

to do better, to present the underlying mathematics for *how* scientific reasoning leads to probable truth in *science*, but failed to propose it as *the only sound epistemological criterion that we can ever self-constently use!*

We'll try to do better, but first, I have to teach you something that you almost certainly have never seen unless you are a member of a tiny subset of all humanity that directly studies this sort of thing or works directly with it. It *should* be taught somewhere in high school at the latest to *everyone*, but fortunately, the basic idea is *not that difficult* and its efficiency at obtaining the best possible result is easily obtained in many simple example problems. This is the application of Bayes' theorem in statistics to the development of the "best thing to believe" as one begins in a state of complete ignorance and then has to use an incoming stream of *data* to *continuously update* an *increasingly accurate* description of (literally) the (range of) things that are the *most reasonable to believe*, given one's prior beliefs if any and the data.

This is what I call the Bayesian Epistemological Loop, or just Bayesian Loop if I'm feeling lazy. Let's get on with it. Don't worry – I'm not even going to write *down* Bayes' theorem in the chapter below, or show *why it works* – I'll concentrate on *how* it works, in such a way that you can understand how it leads to the best answer to a few very simple problems – and why it *also* works in the case of notions drawn from the terrible sea to demonstrate exactly why they should remain there, considered extremely improbable until Bayesian analysis of evidence says otherwise.

Chapter 12

The Bayesian Epistemological Loop

In a bit, I'm going to be arguing that – contrary to what many individuals will assert, usually in order to defend one or more “religious” beliefs (which need not be about religion, e.g. Capitalism vs Communism, Republicans vs Democrats) – there is *only one way to establish what it is best to believe* and that that method, if employed with good will, will *always converge to the same most probable belief set* if the possible answers are analyzed with regard to the same data.

This methodology is going to be *Bayesian*, root and branch. However, this particular book isn't intended to be a *textbook* or *critical mathematical deconstruction* of Bayes' theorem and associated methodologies. It is intended to help you understand some of the peculiarities of using it to determine best belief, primarily through simple examples.

In this chapter we will walk through a few examples by answering “interesting” questions with both real and simulated data. In the process, you will hopefully come to understand precisely why it is a *really bad idea* to elevate arbitrary ideas from the Sea of Notions to Probably True Belief without first applying this methodology to it formally or informally.

Let's start with an example that is somewhat simpler than that of determining how many angels can dance on the head of a pin. Statisticians like two problems in particular for demonstrating how things like this work: “urn” problems, where one draws colored marbles from a bag and tries to e.g. determine the probability of retrieving a marble of any given color, and “coin flip” problems where one wants to determine the probability of getting e.g. a head on any give flip. I'm

going to use the latter because the problem (and arithmetic) is somewhat simpler – simple enough to do by hand for at least a few steps, and by computer to almost any desired precision.

12.1 Fat Tony and Flipping a Coin

Let me start this section by noting that – for those that have read it – it works pretty well as a rebuttal to Nassim Nicholas Taleb’s parable of “Fat Tony” versus “Doctor John” in *The Black Swan: The Impact of the Highly Improbable*. Specifically, it demonstrates that real statisticians, especially *Bayesian* statisticians, aren’t so silly that they’d fail to identify a biased coin; indeed, they’d identify it even *faster* than Fat Tony, and with strict bounds on how certain they are of the answer best supported by the data. His Dr. John thus comes off – to anyone that actually understands statistics, modeling, sampling, hypothesis testing, and all of that – as a straw man¹

That doesn’t really weaken his general argument about high-impact low-probability events being missed by naive models, especially in the context of money and markets, but it does mean that things are perhaps not quite as dire as he portrays them among *professional, well trained* statisticians, however prolific they may or may not be among fund managers who rely on analytic tools others have built without really understanding them or the assumptions that went into their construction.

This is an argument that is near and dear to my own heart, as I’m the author of *Dieharder*, a random number generator *tester* that is integrated with *R*, the open source statistical analysis environment, as well as freely available in standalone for in most open source e.g. Linux distributions. *Dieharder* is literally designed to test a null hypothesis that is *precisely* equivalent to “is this coin a fair 50-50 coin” at a level of subtlety likely to be out of the Fat Tony’s reach².

A “perfect” random number generator can be viewed is isomorphic to an engine that generates a string of 0 (tail)/1 (head) bit values of arbitrary length that has *precisely equal probabilities* of getting 0’s and 1’s (or heads and tails) and further, has *no detectable serial correlation* within the strings so that the

¹The “problem” is that one is presented with the evidence that a coin is flipped 99 times, and produces heads every time. What is the probability of getting tails on the next (100th) flip?

²...unless Fat Tony is secretly attending graduate school in statistics. Which he might well be! I certainly offer no disrespect to Fat Tony, as I don’t want to be “taken for a ride”...

probability for each bit/flip is *completely independent of the history of bits/flips produced so far*. Indeed, a coin *is* a “random number generator” one could test with dieharder, provided only that one built an apparatus for flipping the coin in an unbiased way and transforming the result into a (very, very long) binary string!

Here is a very, very, simple way to estimate the probability of the 100th flip of the coin producing a tail (assuming only that the coin flips were *fair*, that is, that there is no prestidigitation involved – swapping of coins or a skilled flip that can turn out any way the flipper likes). Assume that you don’t know *anything* about the probability of heads versus tails – as far as you know, this could be 0.7 heads, 0.3 tails, or the other way around, just as probably as it could turn out to be 0.5 heads and 0.5 tails. This is called the Principle of Indifference³ and has a very long history in the theory of probability. Now – without actually working with the complicated mechanisms of Bayes’ Theorem that follow – we simply take the data given – 99 heads, 0 tails – and *assume* the coin is unbiased. In that case, the probability of observing a sequence of 99 heads is $1/2^{99} \approx 1.5 \times 10^{-30}$.

This quantity is known as the *p-value* of the experiment. The *p-value* is crudely the probability of getting the observed string of heads, given the “null hypothesis” that the coin is a fair 50-50 coin. We note that the *Universe itself* has been around only for $\sim 4 \times 10^{17}$ seconds⁴, so if one flipped this particular coin once every 0.01 seconds (and used 0.01 seconds to check to see if the result was all heads), it would take roughly **two trillion times** the lifetime of the Universe – so far – to have a particularly high chance of seeing **one single string** of 99 heads in a single sequence of 99 flips corresponding to the data we are given.

A *sensible* person will then do two things. First, he or she or they will *reject the null hypothesis of a fair coin*. Your odds of winning the powerball lottery and becoming a millionaire after buying a single ticket are immeasurably greater than the probability that this coin is a fair coin and you *just happened* to see the sequence of 99 heads the first time you flipped the coin, and no, this isn’t suggesting that you go buy powerball lottery tickets as it is *really, really unlikely* that you will win if you do!

³Wikipedia: http://www.wikipedia.org/wiki/Principle_of_indifference.

⁴The lifetime of the Universe so far in seconds is the kind of number physicists collect for their presentation “impact” when considering probabilities, especially ones that take “many lifetimes of the Universe” to be observed. It emphasizes that it *could* happen the first and only time you look for it in *this* Universe – but it won’t.

It’s incidentally related to the reasoning behind the Second Law of Thermodynamics, if you care about that sort of thing.

This leaves us with two questions, though. One, what *is* the best guess for the probability of heads for this coin, given the data, and two, can we use the data to form a meaningful epistemic estimate of getting heads on the 100th flip, something better than “less than 1%”? Bayesian analysis, as I’ll show you, provides both. Even though the coin is known not to be unbiased, that doesn’t mean that the probability of getting a tail even after 99 heads is particularly close to zero...

Here’s how it works. We start by breaking up the interval from 0 to 1 into small pieces – I used 1000 of them. We set our *prior expectations* – referred to as the (Bayesian) *prior* – for the coin having a bias (probability of heads) for each value from 0.000 to 1.000 in steps of 0.001 to be equal and small, around 0.001 per value so that they add up to 1 as the coin has to have *some* bias. We then flip the coin, and compute the *likelihood* of getting the result given the prior. Here are some prior probabilities chosen according to the principle of indifference:

$$\dots pr(0.257) = 0.001\dots pr(0.5) = 0.001\dots pr(0.9) = 0.001\dots$$

The likelihood is computed as follows. Pick a value in the allowed range of possible coin biases, say 0.5. *If* the probability of getting heads is 0.5, *then* the probability of getting heads on a single flip (the likelihood) is (easily computed to be):

$$\ell(0.5) = 0.5^1 \times 0.5^{(1-1)} = 0 = 0.5$$

On the other hand, if it is (say) 0.9 – a coin much more likely to return a head – the likelihood of getting a head is:

$$\ell(0.9) = 0.9^1 \times 0.1^{(1-1)} = 0 = 0.9$$

Similarly, if we consider a coin with a bias of 0.257, then:

$$\ell(0.257) = 0.257^1 \times 0.743^{(1-1)} = 0 = 0.257$$

This is basically a quantitative way of saying *it is easier to explain the result of getting a head on a coin flip if the coin is biased to produce more heads*.

Next one turns this vector of likelihoods into the so-called *evidence* by weighting each one with the current prior probability we assigned to each possible bias. In equationspeak, this is:

$$e(bias) = \ell(bias) \times pr(bias)$$

To make this a bit more concrete, this produces (for these three example biases given above):

$$e(0.257) = 0.000257 \quad e(0.5) = 0.5 \times 0.001 = 0.0005 \quad e(0.9) = 0.0009$$

These numbers are *proportional* to the new *posterior* probability – the guess for the distribution of possible biases for the coin that *best agrees with the data obtained, so far*, but it isn't normalized. To make it a probability, we have to divide the evidence for each possible bias by the sum of all of the evidences so that the sum of the posterior probabilities equal 1 as it must:

$$po(bias) = \frac{e(bias)}{e(0.001) + e(0.002) + e(0.003) \dots}$$

Specifically again, if you tediously work this out (computers do it much faster and better) you'll find that after a single head, the posterior probability of our three example biases is:

$$po(0.257) = 0.000513 \quad po(0.500) = 0.000999 \quad po(0.900) = 0.001798$$

The net effect of flipping a head has been to make biases *larger* than 0.5 a bit *more likely*, and make biases of 0.5 and *smaller* a bit *less likely*. This *particular* distribution – which is at this point a straight line with a tiny positive slope – maximizes the agreement between the evidence and the posterior probability distribution of *possible* values of the bias.

Now we simply repeat the process. Since our coin is going to produce heads over and over, 99 times in a row, for possible biases ranging from 0 to 1 in steps of 0.001, there is no point in *showing* the arithmetic, but every point in the world in showing the *result*.

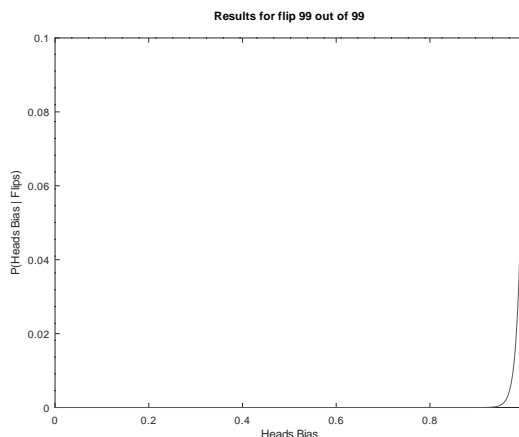


Figure 12.1: The *best* posterior distribution of probabilities after 99 flips, all heads.

As you can see, the highest probability is that the coin is a single sided coin, that the bias is to produce *only heads*, but it cannot be ruled out that the bias

of the coin towards heads is some value just *under* one, say 0.995. That could still explain the data without *too* incredibly unbelievable great a coincidence.

Our answer is thus intuitively reasonable, and evaluating it requires no particularly onerous assumptions on our part. As noted, it is actually pretty easy to generalize this process, program it into a computer to do the actual computations. This makes everything (much!) faster, and makes it less likely that an arithmetic error will occur (once the code is debugged). We can actually employ the general algorithm even if we have a *multivariate* problem where the “bias” of the coin is a function of several variables, not just a value for a single binary possibility. But my purpose here isn’t to teach you all of this – that’s what universities, the internet, and good books are all for if you want to learn more.

We do have one more chore, though. Fat Tony estimated that the probability of tails on the hundredth flip was “less than one percent”. He was right, of course, but how *much* less? It’s not really possible to tell from the previous graph – it looks like the posterior probabilities of *any* bias less than around 0.9 is indistinguishable from zero on the scale of the thickness of the line used in the plot, but we *do* want at least an estimate of the number.

Zooming in is a pain in the buttocks, and we actually have a similar problem on the *right* where we can’t really tell what the probabilities of 0.999 and 1.000 are from the graph as they blend in with the right side of the box. This sort of situation occurs a *lot* in modeling and probability theory. It is frequently the case that nearly all probabilities are *almost* zero, but that a small set of possibilities have finite, even large, probability of being true.

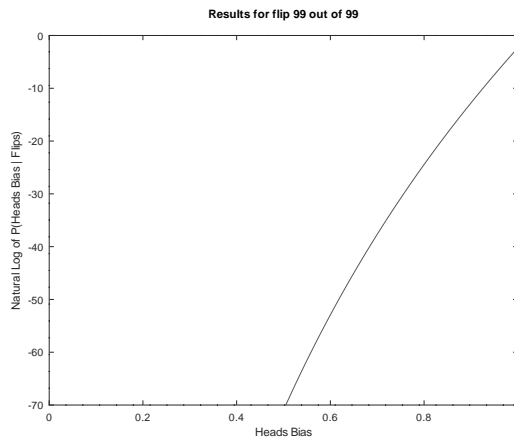


Figure 12.2: The *log base 10* of the posterior distribution of probabilities after 99 flips, all heads.

To illustrate this, statisticians, information theoreticians, and physicists (in statistical mechanics) employ the *logarithm* of the probabilities, not the probabilities themselves. Indeed, the log of the probabilities turns out to be an all around more useful concept, *especially* when dealing with problems with a very high dimensionality! Let's take a look in figure 12.2 at the *log* of the posterior probability distribution we just looked at above.

As you can see, the value of the log of the posterior probability is just about -70 at a bias of 0.5. From this we can conclude that there is basically no chance that the coin will ultimately turn out to be indistinguishable from being a fair coin as we accumulate more data. The probability that this is so is actually *significantly less than* a mere thirty orders of magnitude less than 1. Even if we add up the probabilities of the coin having a bias *near* to 0.5, we are still going to get pretty much zero at the granularity we selected for the bias.

The actual probability of getting a tail at this point is a bit more difficult to obtain, because we have to do things like sum up the probability that the bias is 0.001 times the 0.999 chance that the flip of a coin that produces heads only 0.001 of the time will produce a tail. This is going to be summing a bunch of numbers that are more or less zero – *until* we reach the bias values that aren't absurdly low way over on the right hand side of the graph. Again, this isn't terribly difficult to do – *it is almost the same calculation we just did for the likelihood* – but it is a lot easier to do with a computer than by hand.

It turns out that here, Fat Tony is shooting straight from the hip, so to speak⁵ The *best guess* for the probability of getting a tail on the 100th flip is 0.00941419, which is indeed “no more than 1%”.

We're not yet done with this example. What about Dr. John? He was a pretty good straw man for Taleb, and I certainly don't want to fail to exploit his straw man utility here.

12.2 Dr. John's Problem

Dr. John illustrates a *terrible weakness* in Bayesian reasoning, one I have hammered on repeatedly above but am now prepared to demonstrate *numerically*. For example, suppose we use the value that Taleb clearly used for Dr. John – naive *certainty* that the coin had a bias of exactly 0.5 *a priori*. Since the prior

⁵Meaning that *either* he *or* Taleb actually *used* Bayes theorem to compute the probability of a tail after 100 flips of a coin that has at most two sides and an initially completely unknown chance of getting heads.

probability of getting heads is 0.5 with certainty, the vector of biases are all *zero* values except for 0.5, where it is 1 exactly. Let's quickly walk through through the exact same arithmetic a second time for same three values of possible bias.

The priors:

$$\dots pr(0.257) = 0.0 \dots pr(0.5) = 1.0 \dots pr(0.9) = 0.0 \dots$$

We flip our first head as before and obtain the likelihood vector:

$$\ell(0.257) = 0.257^1 \times 0.743^{(1-1)} = 0 = 0.257$$

$$\ell(0.5) = 0.5^1 \times 0.5^{(1-1)} = 0.5 = 0.5$$

$$\ell(0.9) = 0.9^1 \times 0.1^{(1-1)} = 0 = 0.9$$

Note that these three values don't depend on the priors – they just tell you that a head is more likely for larger biases, less likely for smaller ones in the range from 0 to 1.

The evidence is (recall) given by:

$$e(bias) = \ell(bias) \times pr(bias)$$

and we begin to see the problem! When we multiply the likelihood vector by the prior vector, *zero maps into zero!* The evidence vector turns out to be:

$$e(0.257) = 0.0 \quad e(0.5) = 0.5 \times 1.0 = 0.5 \quad e(0.9) = 0.0$$

when we divide by the sum of the evidence vector to normalize, we get for a posterior probability estimate:

$$po(0.257) = 0.0 \quad po(0.500) = 1.0 \quad po(0.900) = 0.0$$

which is identical to our prior vector! Because we were *certain* that the coin was unbiased before we flipped it, we aren't about to let a little thing like *contrary evidence* convince us that we are wrong!

This process simply *repeats* with additional flips, all heads. Or all tails. Or any pattern of heads and tails, no matter how unlikely (one hundred flips producing HTHTHT... – alternating heads and tails, for example – is *almost certain evidence* that the coin is not a *random* coin, however “unbiased” it might appear, as that particular pattern is *as unlikely as HHHHH... all heads* in the grand scheme of things). No matter what the evidence, Dr. John's beliefs remain unshaken because he began with *certainty*.

This is a clear, quantitative description of the danger of belief in “certain truth” in one’s epistemology and ontology. The minute you become *certain* that God exists, or that Newtonian gravity is precisely correct because of its formal beauty (and the difficulty of managing general relativity based gravity), you *armor yourself against any and all evidence that contradicts this belief*. And this happens! We see it repeated throughout human history, usually resulting in great tragedies when some belief held to be true beyond all doubt turns out to *almost certainly be incorrect* according to the *Universe itself* (which doesn’t care a fig for your beliefs).

It is worth noting that as long as one doesn’t make the prior probability of any of the alternative “biases” or competing hypotheses, in a computation either equal to zero *exactly* or one *exactly* (in which case the rest of the possibilities are necessarily zero), *enough* evidence will eventually pull the posteriors into good agreement with the data. If Dr. John merely thought that it was 99% likely that the bias of the coin was exactly 0.5 at the granularity of our scale, and that the remaining 1% was distributed uniformly across all the other possible values for the bias, he won’t get exactly the *same* final posterior distribution that Fat Tony arrives at with the principle of prior indifference, but after 99 flips it would be difficult to tell the difference with the human eye.

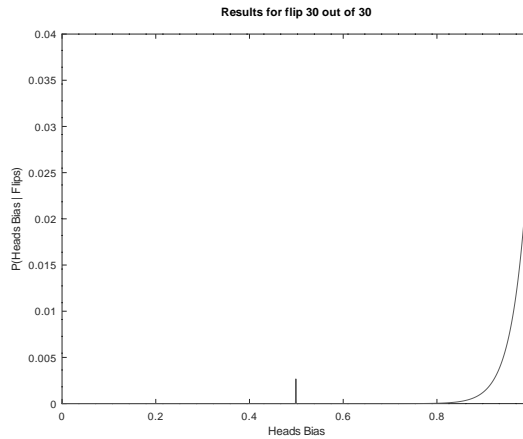


Figure 12.3: The *open-minded* Dr. John’s posterior probability distribution after only *thirty* heads in a row, assuming he started 99.999% certain that the coin was unbiased ($p_{\text{heads}} = 0.5$) and distributed the remaining 0.001% over all the other possible values of the bias, probability 0.00001% each.

This is clearly illustrated in figure 12.3. If Dr. John is even *slightly* open-minded in his assignment of prior probability to the coin, starting with a prior

belief that the coin is a “normal” unbiased 50-50 coin with a probability of 0.99999 (99.999% certain) and distributing the residual 0.001% chance among the 1000 or so alternative values at this granularity, the graph shows that only 30 coin flips, all heads, have hammered away at his original *strong belief that most coins are approximately unbiased* so he now thinks that there is only a tiny chance that this is true – far less than 1%.

At the same time, his belief that the coin is in fact biased *heavily* towards heads has grown to roughly 99.8%. This is more than enough to make him re-evaluate his original assertion that *this* coin was likely to be close to 50-50 heads vs tails and consider redoing the computation (on the same data) with uniformly indifferent priors to eliminate his *personal* bias).

But if he doesn’t, it *doesn’t really matter!* By the time he has flipped the 99th head, his computation of the probability that the 100th flip will turn out to be tails will *match that of Fat Tony* to *six significant figures!* We see that the problem with straw man Dr. John isn’t his strong belief that the coin is probably unbiased – *all* of us would initially expect a coin pulled out of our pockets at random to most likely be *close* to 50-50 heads vs tails, so close that a really long sample of flips would be needed to *significantly* resolve any discrepancy or shift it a bit towards tails or heads. And all of us, Dr. John included, would tend to grow suspicious that this baseline belief was correct if the first and only data we get from flipping it is head after head after head.

Indeed, if you think about it, our straw version of Fat Tony’s prior belief that the coin could be have *any* bias originally with *equal* probability was in truth a *far worse prior* than open-minded Dr. John’s. Both of them have encountered far, far more coins that were close to 50-50 than they have encountered two-headed coins! Truthfully, Dr. John’s prior belief would have *worked much better than Fat Tony’s* for nearly all coins one is likely to encounter that *aren’t* deliberately gimmicked to turn up (almost) always heads, or any other value not terribly near 50-50 heads vs tails.

We see that the problem with the straw Dr. John in Taleb’s book is his *certainty* in his prior belief, nothing more. Assuming that he was *competent* in his statistical training and *knew* that he should use Bayesian methods to analyze the data string – something he hardly could avoid knowing if he worked in the *insurance* industry that lives or dies by how finely it slices data-based actuarial risks – and if Dr. John had just a tiny bit of humility, allowed for a tiny chance that the coin could be arbitrarily biased at any of the *other* possible probabilities of flipping a head, the *evidence* produced by flipping the coin itself

would remarkably quickly *shift his beliefs* that whatever his *original* prior beliefs were, his *posterior* beliefs given the priors *and the data* a) prove that his prior beliefs were almost certainly false; and b) give him multiple pathways to a nearly identical prediction of the final “best” posterior probability distribution that Fat Tony obtained from uniform priors after 99 flips.

This is why I asserted above that one should never assert that any notion in the sea of notions is *impossible*, merely extremely unlikely, a very large negative number on a log scale of probability. You might not believe in pink unicorns or black swans, and if as far as you know none have ever been observed your prior assignment of a very low probability to either possibility would be *reasonable*, but it should never be zero or you’ll come out a fool if one is discovered, more likely to reject reality itself than your confounded pre-existing belief. This is the *mathematics* underlying Cognitive Dissonance. Again, it is a good idea to chuck your priors and start over if evidence reveals a pink unicorn in this shiny, new Universe where you would have sworn that the prior probability of pink unicorns being observed was 10^{-300} simply because you’d never seen one.

There is one more way in which good, healthy, Bayesian refinement of probable truth as the output of posterior probabilities in a network of interconnected Bayesian priors mixing with the ongoing data of our experiences and experiments in the real world (there’s a mouthful for you) can be corrupted, and it is extremely relevant to the chapter on religious beliefs below. In that case it isn’t just the presence of certainty where there should be none, it is the problem of *the lack of evidence* supporting *anything resembling reason at all*.

12.3 Angels Dancing on Pins

Let’s now try to apply this reasoning system to what *should* be a simple question about the real world. It has – seriously – been debated, albeit only apocryphally, from at least the 17th century! There are even arguments for what the question really is – the earliest known surviving reference to it asks how many angels can dance on the head of a *needle*, not a pin. And of course, like anything else of serious philosophical or religious interest in the world, it has, I kid you not *its own Wikipedia page!*⁶ .

⁶Wikipedia: http://www.wikipedia.org/wiki/How_many_angels_can_dance_on_the_head_of_a_pin?. Let me take this opportunity to add a word urging anyone who has actually *followed* these links carefully spliced into the e-text version of Axioms or who even more amazingly has tediously typed in the references and filled in their knowledge of the topics I’ve linked on the side: ***Please don’t forget to donate!*** Wikipedia is a crowdsourced public resource and IMO

How many angels *can* dance on the head of a pin⁷?

Note well that – in case you hadn’t figured this out already – we won’t answer this question. We will use it in precisely the same way that its creator(s) likely intended, to demonstrate its unanswerable *absurdity*, but in the specific context of evidence-based (Bayesian) reasoning.

This problem is just perfect for this purpose but as written, is a bit ambiguous. Using my prerogatives as both a physicist who has written *way* too many quiz questions in the subject (and hence is well aware of the dangers of giving students an incompletely or ill posed question) and the *current* poser of the question, I’ll give some explicit parameters that may be of use:

- The pin in question has cylindrical symmetry and has a smooth, flat head with a radius r . (I’m using algebra so that we can – eventually – *scale* any answer to encompass pins with larger heads or, by taking $r \rightarrow 0$, the head of a needle.)
- The pin is oriented *vertically*, with the head facing straight up. The tip of the pin is held in a strong vice so that it cannot move in any direction.
- Gravity is “near Earth gravity” (the local field is $g \approx 10$ meters/second²) and points *down* along the shaft of the pin).
- The pin is an ordinary, inexpensive pin and was actually used to pin down the collar of a white shirt I once bought at WalMart. It can therefore withstand no more than 20 Newtons of force – about 4 pounds – before bending over and dumping any or all entities that might be dancing on it on their entity-buttocks, if any, and it might bend at an even lower stress if those entities concentrated their weight, if any, on a single edge of its head and thereby introduced torque and *shear* stress instead of mostly *compressive* stress. We’ll use 20 Newtons as a given, though – dancing under ideal circumstances and with balanced if-any weight.
- Fractional answers are not permitted. Yes, I can drive a pin into the ground and dance on the ground in such a way that I step on the head of the pin, but that doesn’t count as 1/500th of a human “dancing on the head of a pin”. Specifically, the entire entity has to have all of its weight on the actual head of the pin on structures strictly within the perimeter of the head.

is quite possibly *the* greatest collaborative invention of the human species so far...

⁷I’m making an arbitrary choice to go for a pin here, since the idea of dancing on the head of a *needle* makes me wince...

- Any answers given, and the methodology used to validate them, has to apply equally well to more mundane entities – for example, how many *Paramecium biaurelia*⁸ can “dance” on the head of a pin, how many common dog fleas can dance on the head of a pin, how many unicorns that may or may not be pink can dance on the head of a pin, etc.
- A major point of contention in the past – and I am not making this up – has been that the answer is *zero* because “dancing is a lewd and lascivious activity” that no self-respecting sexless messenger of a supernatural deity would ever engage in. It is therefore necessary to sigh, and add the following explicit specifications constraining “dancing”. We will neatly dodge for the moment the somewhat debatable gender identity of angels (although we might come back to it later as a separate question), and whether or not any activity performed by a completely genderless entity that does not reproduce is capable of being referred to as “lewd”. I will simply – as I did in the footnote referencing *Paramecium biaurelia* – define “angelic dancing” as “being in physical contact with the head of the pin, with said point of contact being fully inside its circular boundary, and moving at least a bit in time with ‘You Make Me Feel Like Dancing’, by the BeeGees” (a song that, I must admit, does *not* make me feel like dancing or even slightly lewd and lascivious, more’s the pity, sorry Brothers Gibb...).
- Immaterial forms of dancing, such as “light dancing on the waters” *does not count* as an answer to this question. We are only seeking an answer at the macroscopic classical level, not at the level of quantum field theory. For example, projecting my *image*, vastly reduced in size, onto the head of a pin while I dance on the *ground* does not count as “me” dancing on said pin, and we are utterly disinterested in how many *photons* can dance on the head of a pin if photons could, in any non-poetic sense, be said to dance.
- Finally, dancing is a *self-willed activity of a sentient being*, which eliminates photons (which are not) a *second* time. I mean, I’ve already reduced dancing to the point where a middle school nerd standing on the edge of dance floor swaying just a bit to the music counts, but we’re not going to count the *chairs* even if they do “vibrate a tiny bit” in time to the music.

⁸Wikipedia: http://www.wikipedia.org/wiki/Paramecium_biaurelia. We’ll simplify the relevant data for this species of paramecium to make computation easy and assume that the paramecia in question are exactly 0.1 mm (100 μ meters) in length, 0.001 mm in radius, and have cylindrical geometry. Oh, and we’ll assume that sitting on head of the pin and waving their cilia around counts as “dancing”, at least for this species.

Hopefully, this is sufficient to eliminate any “wobble room” in the discussion and prevent any irrelevant debate about lewdness or whether or not a thick pillar with a wide iron head being driven into a river bed as part of the process of building a bridge counts as a “pin” (as it would for certain not particularly common values of r , but not for a common “let’s pin up the hem of those curtains” pin). Given the general perversity of human nature, I doubt that it has, but at least I tried.

We can now attempt a few answers. Here’s the way the “physics-based” answer might proceed to obtain at least the geometric bounds on the answer. Assume that angels (like paramecia in general) have a roughly cylindrical body form with cross-sectional area A and mass m . If either $A > \pi r^2$ or $mg > 20$ Newtons, the answer is “zero”, because angels, like humans, elephants, and mice, are all too large to *fit* on the head of our pin with radius r and/or angels weigh too much to stand on the pin without bending it and hence could not possibly “dance” on it. A useful *upper bound* is hence determined by the equations:

$$N_{\max} = \min \left\{ \text{trunc} \left(\frac{\pi r^2}{A} \right), \text{trunc} \left(\frac{20}{mg} \right) \right\}$$

where “trunc” is the integer “truncation” of the division, and the “min” operator selects the smaller of the two alternatives.

This doesn’t quite *solve* the problem, of course, unless angels are large and heavy beings so the answer is zero – it only establishes upper bounds on the answer. To do better, we have to have a more precise specification of angel geometry in order to determine how many we could fit into a circle of radius r with optimal packing and still leave room to “dance”, and what the peak impulse imparted to the head of the pin is, per angel, as the perform at least the minimum motions associated with “dancing” (a number likely to be somewhat larger than just their weight). Nevertheless, we know how to proceed once we have this useful... erm ... **data?**

And with this *single word*, the entire argument comes crashing down. There are a few *Bayesian priors* – one is tempted to call them *axioms*⁹ – that are the unwritten assumptions upon which the argument above is built. Let’s list a few of them:

- First and foremost, it assumes that *angels actually exist* in the one real Universe (and not just “exist in our imaginations”). Note well that as noted throughout this work, “actually” is semantically equivalent to “very, very

⁹Snark snark.

probably”, that is that one can *compute*, on the basis of *evidence* that the probability that angels materially exist approaches unity. If not, note well that I’ve carefully excluded *immaterial* angels, or *spiritual* angels (whatever that means – imagine an entire *mountain* of Bayesian priors, all requiring data-based posterior probability confirmation to near-unity, specifying a *complete immaterial/spirtual adjunct to the physically observable Cosmos we apparently inhabit*¹⁰.

- Given that they exist, that angels have (or can take on, don’t care) *physical form* with properties like *mass and spatial extent*.
- That those properties can take on a *range of possible values*, just like those of humans or paramecia – big ones, small ones, thin ones, fat ones, etc. Further more, that those values form a *compact distribution* at least so far, in this Cosmos (that is, it is an obvious empirical fact that no material angel that spans the ~ 28 billion light year sphere of the *visible* Cosmos has existed in the last 14 billion years or so, or its violent interaction with pre-existing mass-energy would have had – “consequences”. Highly visible ones, since we are looking *back in time* as we look far away and can see at least *some* part of the Cosmos all the way back to the end of the “Big Dark” following the Big Bang.
- That the angels are sentient, free-willed beings. Note that this is a specific, tiny *hillock* in the aforementioned vast mountain range of supernatural assertions connected to the existence of angels (as opposed to, say, sentient space aliens or pink unicorns) in world religions, folklore, and myth.

¹⁰Quantum Field Theorists do this sort of thing *all of the time* – in a sense, it is their *job*. Yes, they postulate things like hidden dimensions where critical parts of QFT take place, and argue about whether the correct number of dimensions total ought to be ten, or eleven, or some other number. Their arguments at many times are dangerously *similar* to the one we are beating like a dead horse here, except in one absolutely critical way. The QFT theorists *never assert that their theories, however “beautiful”, are true!* They offer them up as *possible* Bayesian priors to the empirically founded system of physics that works best, and both they and many experimentalists then *subject them to rigorous tests* to try to eliminate some of the theories or support others *as the objective, reproducible, data mandates!*

Basically, they *are* Bayesian priors with generally *low* probability of being true, and the evidence (one hopes and expects) will eventually cause the *posterior probability that one is correct* due to it being in the *best correspondance with the data* to rise to where it is, at least, significantly higher than the rest of the pack of competing theories. Note that one doesn’t do actual Bayesian *computations* here like those in the example above – this is something our brains do all of the time when reasoning about the real world. In a sense, our brains *are* fuzzy, messy, imperfect, easily fooled Bayesian inference engines, greedy pattern matchers and extrapolators.

All of these assertions (and, in all probability, a lot more as material angels require some sort of *metabolism* and *energy source* along with their mass and spatial extent to be able to *act* (as dancing is an *action*, at least according to very probably true beliefs in the physics of the real material world). Even the tiny hillock that consists of *angels* in a *supernatural* worldview requires assumptions that sprout and proliferate, questions on top of questions. Of course, the beauty of supernatural explanations is that those that propose them can always avoid the questions by throwing their hands up in the air and replying “magic”, or some other term such as “God’s will” that is semantically equivalent to “I haven’t got any sort of coherent model in mind, and literally haven’t a clue in the real world to support a model if I did, but I want you to accept this as true *beyond all doubt* whether or not it can be *tested*...”

And there’s the rub. Here’s a recipe for rabbit stew.

1. ***First***, you catch yourself a rabbit...
2. (Details expunged as they might offend the sensibilities of vegetarians).
3. Place pieces of rabbit meat in a well oiled heavy skillet along with diced onions, green peppers, carrots, potatoes, garlic, pepper, paprika, and fry together over medium high heat until the meat and vegetables are well-browned. You might want to do the vegetables first to get them properly caramelized before adding the rabbit if you like your onions a bit crispy.
4. Add a cup or so of dry sherry and some stock of your choice (vegetable, chicken, whatever) to deglaze the pan and cover its contents, then cover the pan itself and simmer over low heat for an hour or more until the carrots are tender and the meat is well cooked.
5. Mix 2-3 tablespoons of corn starch with a cup or so of sherry and add the pan, stirring it over medium heat until the sauce thickens. Salt to taste and serve.

Note well that it begins with *catching* (or otherwise obtaining) an *actual rabbit*! This recipe could easily be adapted for “dragon stew”, but only if one can in fact *catch a dragon*!

The following *recipe* for determining N_{\max} , the number of angels that can dance on the head of a specified pin with $r = 1$ millimeter is somewhat more demanding:

1. *First*, find not one angel, but *many* angels. By “find” I mean perform many reliable, reproducible observations of angels in contexts where their physical size and shape and weight can reliably be measured within some reasonable precision! Anecdotal accounts in antique myths, legends, religious scriptures, or stories told by stranded motorists who assert that they were rescued from certain death in a thunderstorm by an angel *do not count* – they are at best hearsay, at worst pure fiction.
2. Using the Bayesian loop method illustrated above from some reasonable prior, build a distribution function of their physical characteristics based on these observations. As the number of observations increases, one expects this distribution to converge (possibly slowly) to the *actual* probability distribution of angelic characteristics such as size, shape, and weight, and to be literally our best estimator of the range of angelic properties given the data and a (mostly likely indifferent/uniform) initial prior.
3. Use the final posterior distribution function to find a best (most probable, given the data) answer for N_{\max} *so far* using the geometric and physical reasoning process described above.
4. If the data permits, refine this estimate by determine the *social* characteristics of the angels. Do they avoid one another, so that if one is on the pin, no others will draw near? Or the opposite, are they maximally gregarious? This matters¹¹!

It is left as an exercise for the reader to determine *just how we can be sure that any observed angel-like entities are actually angels*, since their *anecdotal* accounts make them generally humaniform if sometimes possessed of physically unreasonable feathered *wings*¹² and it isn’t like they showed up – if they showed up at all – wearing a tee-shirt that said “I am not a space alien visiting the Earth and pretending to be a supernatural messenger so that the locals don’t try to stab me with pointy sticks when I’m not looking – honest!”¹³.

There are only two sane, rational explanation for reports of “angels” in folklore and mythology but *not* written or natural history:

¹¹In other words, are angels social *fermions* or are they social *bosons*? Or merely social *bozos*? I love physics metaphors...

¹²I could easily digress here into the practical physical scaling limits of flying animals as represented thus far by animals like Wikipedia: <http://www.wikipedia.org/wiki/Quetzalcoatlus> known from the fossil record. But I won’t.

¹³A bit long to fit on a tee shirt, to be sure, and besides, how would a flightless mammaloid but genderless being with a ten-plus meter wingspan put *on* a tee-shirt? Questions, questions...

1. Angels exist(ed) but are rare, hidden, selectively visible – basically *deliberately evasive* so that it is impossible to establish in any reliable way that they exist *at all*, let alone that they are observable in any context where key things like size, shape, and mass can be measured and recorded with objective instrumentation. Like cameras, scales, that sort of thing. Angels are not only “black swans”, they are black swans that deliberately conceal themselves for no obvious reason.
2. Angels don’t exist and reports that they do (or have, safely in the anecdotal past) are pure fiction, mythology, and/or a deliberate or accidental deception wherein so-called “angels” are in fact simply other humans – or space aliens – observed by people in a confused or gullible state.

The first, as suggested above, implies the existence of an entire hidden *cosmos* in most models that include angels as a component of that hidden cosmos that manifests one way or another in our Cosmos. There is literally no bound on the number of distinct cosmi one might imagine wherein those angels might live, and no sensible way to describe or model or hypothesize the physical laws that hold in any of those cosmi. There is no evidence even for the *far more reasonable* additional dimensions in *this* Cosmos proposed by QFT theoreticians, and no mathematical or physical model for how living beings could exist in those dimensions and somehow “rotate” into the physical 3+1 dimensions of our everyday world. All of this complexity, and the enormous multiplication of possibilities, makes any *particular* notion in this sea of angelic notions extremely unlikely to be true *a priori* when applying anything like the principle of indifference. Finally, hypotheses that rely on complex, mostly unknown Bayesian priors that add up to a question-begging *assertion of magic* in place of an actual model are in and of themselves *a priori* unlikely, at least as unlikely as their necessary priors.

None of that really matters. Unless and until the *first* requirement in the Bayesian recipe for determining reliable knowledge of the real world is satisfied – finding at least one angel that will stand still for photographs, step on a scale, and verify their angelic nature¹⁴ – the value of N_{\max} cannot even be meaningfully *estimated*. You can’t make rabbit stew without an actual rabbit, and you can’t answer questions about the properties of angels without an actual angel with properties to be observed and measured.

¹⁴You know, show you their ID badge or something. Perform some angelic magic. Permit a spectroscopic analysis of their halo to determine that it has no material source. I dunno, *you* figure out how to differentiate an angel from a citizen of a more advanced (to be sure) but still mundane alien civilization when ***any sufficiently advanced technology is indistinguishable from “magic”***, see Wikipedia: [http://www.wikipedia.org/wiki/Clarke's three laws](http://www.wikipedia.org/wiki/Clarke's_three_laws).

This is, as we shall discover in more detail later, only *one* of the deep, fundamental problems with religious “reasoning”, believing as a matter of “faith” that things in anecdotal reports or written mythologies are *automatically* true by virtue of their purported *authoritative source*, certain in a way that *insulates* them – as we’ve seen worked out in detail above – from any chance of being corrected by evidence, or being left in the no-good-reason-to-believe category (hence extremely improbable) without it.

12.4 Summary

This chapter is important enough to the overall thesis put forth in this book to deserve its own summary. It is difficult to overemphasize the importance of the “Bayesian loop” illustrated above with the analysis of data returned from an imaginary but nevertheless *almost certainly extremely biased* coin. It is, at heart, *all of*:

1. A damn useful methodology in the theory of probability and statistics, with an illustrious history.
2. In one incarnation, the foundation of statistical mechanics in physics.
3. In another, the foundation of information theory in computation (and physics).
4. In essence, the foundation of the so-called “Scientific Method” and hence the foundation of the scientific ontology engaged in the process of iterative refinement of knowledge describing the real Universe we live in.
5. In essence, the foundation of *mere common sense*, the ability to use knowledge, experience, and reason to navigate the world safely and effectively every day.
6. In essence, the foundation of sentience itself. (Almost) *everything* that we believe derives, in some profound way, from the looped processing of the input data stream from our senses combining with our preexisting memories (our “fundamental” Bayesian priors, if you like) in a brain seeking to discover patterns that best explain, and compress, the entire experience into comparatively compact and simple “knowledge”¹⁵.

¹⁵Wikipedia: http://www.wikipedia.org/wiki/Kolmogorov_Complexity. It is *so* tempting to wax poetic about “programs” running in the brain that can generate “data strings” representing

Finally, the main purpose of this book is to establish it as a *moral* imperative, to convince you, dear reader, to *give up alternatives*, however tempting or comforting they might be, that claim to provide “direct” knowledge of the real world, that assert that they, and they alone, provide “perfect truth” that requires no verification or evidential support worthy of the name, that rely on “feelings” instead of observations. It truly is *best to believe that which you can doubt the least, when you actually try to doubt very hard, given the evidence of your senses and the entire network of evidence supported, mutually consistent beliefs* that constitute your own *personal* set of prior beliefs as of *their last update into posterior beliefs given the ongoing input of evidence*. And yes, this sentence *deliberately* spoke of evidence twice, once of (long) past evidence, the second time of the way your beliefs are being shifted and alter *right now* on the basis of your sensory input *right now*. Specifically, reading this paragraph in this book. At least, I hope so.

In this chapter I have demonstrated *mathematically* how treating an axiom as a *self evident truth* instead of as a *contingent proposition, an assumption that might be false* is b-a-a-a-d. Axioms accepted as being absolutely true *a priori* ***poison the well of knowledge and reason*** as they are *immune to revision* by the Bayesian loop of mere common sense reasoning in the light of continuing experience, more data, contradictory evidence. You wouldn’t want to sit on a jury – or be tried by a jury – that contained a member that just *knew* that policemen never lie or that defendants are always guilty because the prosecuting attorney is certain to have established guilt even before bringing charges or presenting evidence! So why use that same kind of hubris, that intellectual certainty, in applying “judgement” to the real world?

The history of the world (and history of science) is *full* of instances of people believing something very, very strongly – often because the evidence up to a point strongly *encouraged* that belief, or because it seemed to *make sense* and hence allowed reason (even corrupted reason) to be useful at all – that then *turned out to be incorrect*, or only *part* of what is correct-er, or only an *approximation* of what is correct-er, as revealed by further experiments, experiences, analyses that include assumptions thought to be irrelevant but that turn out to be important. The most interesting parts of physics beautifully exemplify this process, tracking

“knowledge”, but – even though this is almost certainly relevant stuff, it is also *so complex* and the deep functioning of the brain still *so unknown* that it might do science a disservice by suggesting that cognition is likely to be an evolved, and hence extremely efficient, *program* that fits into the very category being discussed here, running on the wetware of the brain. It certainly isn’t a little homonculus watching porn in between doing boring database lookups in a Searlian Chinese Room...

the epistemological history of the Enlightenment through to the present, with multiple paradigm-shifting discoveries and refinements, each one supported by specific, reproducible observational data that clearly shows that the new models work *better* to explain “everything” than the older ones, *so far!*

It demonstrates the incredible importance of our “axiom of open mindedness” – not ever believing that some non-contradictory assertion concerning the real is *necessarily false*, only that it isn’t supported *yet* by data suggesting that it is probably *true*. It shows us why we should always be prepared for “black swan events” – something that might well be *rare* or *difficult to observe* like a Higgs particle or magnetic monopole but that has *enormous explanatory power* in our best Bayesian models built so far. This includes acknowledging that there are almost certainly swans out there with precisely this kind of impact that we don’t even have in our models yet. Some of them *may* be so well hidden, so difficult or expensive to hunt down, that we *never* discover them, but that are real nevertheless. Angels – like Sauron and Frodo and the LOTR cosmos – *could* be real, even though we haven’t anything like reliable evidence that they are, or a model for angelic existence with even a hint of explanatory power that improves on what scientific reasoning tells us already. All the lack of evidence tells us is that it is a waste of time to invest much belief in them *even on a log scale, so far!*

Human knowledge isn’t a set of known truths. Not ever. It is a set of best beliefs, so far. It is, and will ever remain, a *work in progress* as we, and our descendants¹⁶ perform more experiments, obtain more data, try new, possibly better ethical systems on for size, as we *change* our belief set so that our posterior beliefs are in *ever better correspondence* not only with the Universe as it appears to be but with our deliberately chosen *vision* for what we would *like* it to be for ourselves, the human species in general, the entire ecosystem of the world, and in time, possibly in the greater Cosmos if we ever figure out how to move around in it in less than absurdly long times and at absurdly great costs.

So please! Think critically! Doubt! Demand evidence! Reject assertions of “perfect truth” and maintain the *humility* needed for your beliefs to be able to *change* on the basis of experience and evidence! Insist on at least *approximate* consistency in your overall set of beliefs! Finally, *think hard* about the kind of world you would *like* to live in, and invest at least some of your time and money and effort trying to bring that world into existence!

¹⁶If any, given that we have the capacity to pretty much exterminate ourselves and a corrupt and irrational collection of mutually contradictory ethical systems that seem to inevitably draw us along a path to self-annihilation.

Chapter 13

The Scientific Worldview

Do not believe anything simply because you have heard it
Do not believe in traditions because they have been handed down for
many generations
Do not believe in a thing because it is spoken and rumored by many
Do not believe anything simply because it is found written in your
religious books
Do not believe anything merely on the authority of your teachers and
elders
But after observation and analysis when you find anything that agrees
with reason and is conducive to the good and benefit of one and all
then accept it and live up to it.

Kamala Sutta, Buddha

Nowadays, everybody learns at least some science in school¹. One is forced to memorize the steps of the scientific method, for example, and to use it in some horribly contrived and boring “experiment” in e.g. a science fair. In addition, a student minimally is exposed to a little simple biology, a bit of astronomy, some elementary chemistry, maybe even a bit of physics before they are either carried forward on the basis of their intelligence and interest into learning *real* science or recoil backward to avoid and often reject science altogether as the basis for

¹At least, we are all *taught* some science in school. A simple thing like exposure in the classroom is, however, not enough to overcome the brainwashing indoctrination many children receive at home from theistic parents, and it may be too much for less intelligent or more lazy children to ever grasp, making them easy prey for the much “easier” answers of the theistic worldviews, answers that don’t require them to *understand* things like algebra and logic or the scientific method and that axiomatically promise them eternal life in paradise besides...

any part of their *worldview* even though they (of course) continue to enjoy all of the technological fruits of science in their daily lives. Like “electricity”. And “medicine”. And “cars”. And “air conditioning”. Consistency isn’t important to them because they simply don’t understand why it is necessary in a sane, rational belief system.

The one thing that very few students ever are taught (or learn on their own) is *why* believing the conclusions of science is better than believing something else that contradicts them (such as the contents of The Book of Genesis in the Old Testament). One reason it isn’t taught is that it is very likely that their teachers do not fully understand the reasons themselves. Another is that the reasons aren’t *articulated* anywhere, and hence aren’t part of a textbook-based curriculum. Again ***we don’t teach epistemology, ever***, so that whatever epistemology a student ends up with (you can’t avoid having one, of course) is some horrendous hodge-podge that most people can’t actually articulate².

Finally – and this is one of the greatest tragedies imaginable – all too often students never learn that learning science is *fun* because the way it is taught it *isn’t* fun, it is awful, horrible, demanding, boring, and authoritarian, requiring – or so they are told – rote memorization of a large body of “facts”. Science is taught without any sense of adventure, without any of the fun of search and discovery, and without exposing the students to any hint of the system of *reason* that has allowed people to take a body of observations and discover patterns within it, invent possible reasons that might explain the patterns, and systematically test the predictive power of these possible explanations as well as their consistency with other similarly evidence-supported beliefs that eventually allows those *successful explanations* to be *incorrectly* considered to be *facts* that must be memorized straight out their clearly authoritative textbook³!

This is an enormous failure on the part of our educational system at *all levels*. The whole point of science is that it is what we should best believe, given the

²Can you? Find out. Sit down and write a short essay on “Why I believe what I believe about the world”. Then read what you have written. No grade will be assigned.

You might find that this is *not easy* although I’m hoping that having read this work this far, it will be a *lot easier* than it might have been before you started.

³This is too bizarre for words. We force students to *memorize* the steps in the scientific method as if it is some sort of *religious* revelation, secret knowledge too difficult for mere mortals or uninitiates to understand, and then we wonder why students taught in this way later come to consider conclusions drawn from its use to be *no better* than those that they learn by reading religious scriptures that contradict them that are *also* considered too difficult for mere mortals or uninitiates to understand. Scientist (or Science teacher) and Priest (or Sunday school teacher), placed on the same epistemological footing... but they’re ***not!***

evidence, *independent of all authority*. Scientific knowledge is what we truly believe that two rational individuals would arrive at, given the entire body of evidence accumulated by the human species and the same axiomatic priors, if they were both armed with perfect reason and insight⁴. For example, we truly believe that a young Chinese student, armed with the methods of science, would study the world and arrive at rules of near-Earth gravitation that are precisely the same as the rules that a young African student or a young American student would arrive at, from similar experiments and evidence. Yet we initially *teach* it, almost without exception, using *authority*, not as something the students are encouraged to discover in a guided way, or even presented as a hypothesis to *doubt* and test for themselves until they come to trust it.

I'm hoping that by this point you can already see for yourselves that the second "problem" with our entire educational system, top to bottom, is this insistence on teaching *true facts*. There is no concept that is more pernicious, and more dangerous, than the idea of some belief about the real world being absolutely true, *true beyond any doubt*, true at a level that makes competing or alternative beliefs *equally certain* to be *false*.

Many, perhaps most, of the problems of the world would be eliminated once and for all if we made some tiny changes in our language. Instead of the term "fact", which implies *definite known truth*, we might use "factor", which has as one of its definitions "One of the elements, circumstances, or influences which contribute to produce a result; a constituent." Or we could just make up a new word, such as "factish" (a sort of a fact, not quite a fact) and rank things not with plausibility but with "truthiness" (with a hat tip to Stephen Colbert) if it weren't for the fact that Colbert has already co-opted truthiness with a very different definition...⁵. Or, we could all just redefine the term "fact" to *not* actually mean "a thing that is known to be true" and replace it mentally with "a thing that is very strongly/plausibly believed to be true (in at least certain contexts) on the basis of evidence and sound reasoning", which is exactly the way physicists use the term when they teach near Earth gravity as a "fact" when they full well know that it isn't *exactly* correct but is a local approximation of a theory that is *also* an approximation of a theory that is *known* to not yet be consistent with the general body of fundamental physics, but naaaah, that's too difficult, so let's explore the use of "factor" a bit further even if at the end you

⁴This is, almost verbatim, one of the Cox meta-axioms, as I hope you realize. Indeed, E. T. Jaynes used the idea of *reasoning robots*, which all had to *mechanically* arrive at the same conclusion from the same data and priors even if they reasoned in nominally different ways, as his metaphor to teach this epistemology.

⁵Wikipedia: <http://www.wikipedia.org/wiki/Truthiness>.

decide to keep using fact.

In the language of previous sections, a factor might be considered to be a notion (from the infinite sea of possibly-true ideas) that actually *works* to at least some extent as an explanation, as a constituent of “knowledge”. It allows us to split up that sea into a vast body of notions that either don’t work or that we have no good reason to believe do work in accord with our general set of axioms and prior beliefs and a much smaller body of ideas that *do* work well enough, consistently enough, to be taken more seriously than all of the rest, without ever elevating any factor all of the way up to being a *fact*, true beyond doubt.

This all by itself is an excellent substitution. Rather than teaching gravity as a “fact”, we might teach it as a *factor* – one of the elements that *contributes to producing the result* of rocks falling down, but also is part of why we see helium balloons falling – up. Sometimes. However, a second simultaneous change is equally essential. The word “true” should be more or less expunged from the English language (or at least, from the languages of logic and science and epistemology). We might replace it with the word “works” to gain much and not lose anything important. It is no longer *true* as a *fact* that gravity makes rocks fall down; it is instead the case that the theory of gravity *works* as a *factor* – along with other factors, like calculus and proper treatment of things like buoyancy and drag – to explain the falling of rocks and rising of helium balloons.

Notice the difference! Gravity is something that I imagine. It is part of the map of the Cosmos that I have built up over my lifetime from all of the evidence of my perceptual data and memories of experience. Parts of my sensory experiences I’ve learned to think of as rocks in a spatiotemporal field, released, appear to act in a way I’ve learned to call falling towards another entity in that spatiotemporal field that I’ve learned to call the Earth. “Gravity” is the name I’ve given to the factor that *works* (so far) to explain this ongoing body of direct experiential and remembered evidence.

It isn’t the only factor – as one can systematically develop by a series of experiments testing additional factors, the mass of the rock and the mass of the earth are other factors, as is the distance of the rock from every bit of mass that makes up the earth, with still more factors (more distant masses plus the factor of gravity, factors such as atmospheric density and surface composition and shape of the rock) serving to modulate things so that they work even better to explain the observations and their systematic variation with other parameters

that describe different e.g. rocks.

Do I know if gravity is “real”, a True Fact, something that I must believe in Beyond All Doubt according to a Definitely True Rule? Of course not. The map (in my mind) is not the territory (the presumed reality of the rock and the Earth and all of the rest). I don’t know if it is real or not, and have no way to find out, but I can and do *know* that it is a *successful factor*, something that *works*, to explain past observations and (so far) to predict future ones every time I’ve tested it against the future in the past.

That’s as good as it gets. No facts. No certain beliefs. Only factors that *work*.

Imagine the changes in human civilization if we could make just this one simple pair of substitutions. Nothing is true (or false). It simply works (or doesn’t work). There are no facts, as in definite truths, only factors, things that appear to work. They may work very well indeed, as does Newton’s Law of Gravitation, but Newton’s Law of Gravitation isn’t a *fact* and no philosophical principles will be harmed if this mathematically expressed *factor* turns out to *not* always work, to be replaced by a theory of gravitons and/or curvature of space as factors that *work better* to explain the *full body of observations* in a way that is more consistent with other factors that work.

Imagine the changes to logic and its application to human affairs! We would no longer be able to talk about whether it is a *fact* that Capitalism is better (or worse) than Communism. All we could do is talk about various *factors* in systems that aren’t pure this or pure that and whether or not those *factors* in those systems *work*. It would be impossible to assert as a definitely true fact that God created the Universe and all of the animals in it; instead one would have to ask whether or not “God” as a possible explanatory factor for “the Universe” and “biological life” *works*, specifically works in a way that is consistent with the meta-axioms and axioms of best belief and all of the *evidence of our senses, our observations, our experiments, and all of the other best beliefs we have consistently worked out so far!*

Sadly, it is not so. The *illusion* of “true, factual knowledge” is too pervasive, our belief in the reality of our immediate sensory experience too compelling⁶.

⁶This in general is not a *bad* thing, it is a *natural* thing and usually is best belief. Right up to the point where you start hearing voices or seeing things that nobody else seems to be able to see, even when you *haven’t* taken any hallucinogens recently.

I’m not kidding, by the way. Our brains are delicate, highly nonlinear instruments, and the brains of a small but significant fraction of the population are through no fault of the owner’s *impaired* – mental illness is a “fact”(or). Somebody suffering from schizophrenia or other

Worse, the strength of our conditioning when we are too young to resist the input of pure nonsense as “true beyond all doubt” without subjecting it to the challenge of methodological doubt and skepticism and an insistence that the explanation actually *work* in a common-sense way to explain the entire body of observation and evidence is, for many, too great to overcome. Hence we perpetuate propositions that are almost certainly false in the face of overwhelming evidence gathered and affirmed over centuries that those propositions *do not work* in a sensible way to explain the world we appear to live in and contradict the entire Bayesian network of factors in the scientific system of provisional knowledge that most consistently works top to bottom to explain reality – so far.

No *wonder* we still have fights over silly things like teaching evolution versus teaching creationism in Kansas⁷ ! The individuals who sat on the Kansas State Board for Education apparently hadn’t ever learned the basis for scientific knowledge *themselves*, and sought to make their decisions concerning “intelligent design” based on a thinly disguised belief in an antiquated desert tribal creation mythology that they had been taught *never to challenge or doubt* lest they be tortured in a notional posthumous Universe by a vindictive entity, forever, even though there isn’t a shred of evidence worthy of the name to support the notion!

How could they be expected to realize that “Creation Science” is an oxymoron because science has to *work*; it requires this pesky thing called *evidence*, supported by a *parsimonious* system of knowledge based on the judicious use of *consistent reason* and isn’t permitted to invent entire hidden worlds populated with invisible beings that can be made to explain *anything*, and hence actually *explain* nothing at all⁸?

But we have gotten ahead of ourselves. In order to fairly compare *any* set of propositions (hypotheses, possible factors, provisional “knowledge”) intended to “work” to explain some body of observation and evidence, we have to all agree on the basis of comparison. Otherwise we will devolve right back to playground

psychoses should *not* trust their own immediate sensory knowledge of the Universe, especially when the voices tell them to harm somebody or themselves...

Show me somebody who has not seen things with their own two eyes, as certain as they can be, only to discover that what they saw was not, in *fact*, reality, and I’ll show you somebody that ... isn’t married.

⁷Wikipedia: http://www.wikipedia.org/wiki/Kansas_evolution_hearings.

⁸Of course, another excellent question is “how did morons like this end up on a state school board in the first place”, but that’s another *highly political* story. Besides, we *know* the answer. Other morons, who were equally powerfully conditioned to believe in invisible fairies when they were too young to know any better, voted to put them there! Democracy is all well and good, but one cannot vote to make $\pi = 3$ no matter how much trouble it is to remember and multiply it out at some precision the other way...

mode “Is not! Is so!” argument, quite possibly punctuated with automatic weapons or nuclear missiles. So what *should* we pick as the axioms that lead us to the fundamental basis of probable knowledge? Clearly, one segment of the Earth’s population would answer “use the Bible as the ultimate arbiter of truth”. Another might pick the Quran; another still the Puranas and Vedas. Some might pick the Old Testament over the New, some the other way around. Others (who are more sophisticated) might pick verificationism axioms as the basis for epistemology – still others falsificationism.

If we attempt to rank order these according to how well they comply with our *meta-axioms* from the previous section, all but the last two simply do not work. **All** of the surviving “great” religious texts are *chock full of internal contradictions*. They are filled with statements that *directly contradict observations*. They are *enormously and arbitrarily complex*. They are *lying frogs* that assert explicitly that they are “true” (so you can be quite certain that they are *not* true).

Finally – and it is the most damning criticism in the lot – it is a simple observational fact that individuals and social groups in different parts of the world, presented with *exactly the same observational evidence* all arrived at *completely different* mythologies for how the world came to be and how it works today and what happens to us after (and in some cases what happened to us before!) our one undeniably real life right here and right now. This alone is more or less the signature of pure evil, of unreason run amok and writ large and bloodily across the pages of history. If well-intentioned, reasonable humans, given the same data, arrive at different, contradictory, conclusions, then *at most* one of the contradictory conclusions can be true. It is also a direct symptom that the fundamental problem is the lack of a working epistemology, because *with shared axioms establishing the foundations of reason*, they would necessarily *arrive at the same conclusion* (or a small family of conclusions that differ in *small*, nearly irrelevant, ways, not completely different conclusions supported by metaphysical assertions and axiomatic assertions that do not even form a consistent system of reason in the first place).

Compare any argument concerning a religious belief to an argument concerning the probable behavior of dropped rocks near the Earth’s surface. In one it is quite literally the case that *no sane person, presented with the evidence, would disagree* that near-Earth gravity causes massive non-buoyant objects dropped from a table top to a floor to fall *down* with an acceleration of approximately 10 meters per second squared, *every time*. In the other, well, is God masculine? Feminine? Genderless? Is there one God? Three? A whole pantheon? Do(es)

God(s) Itself/Themselves work magic that violates the law of gravitation? If so, how do you *know* this given the irresistible, universal agreement of observations with the law of gravitation? Did God(s) create the Cosmos and if so, when, where, how and how do we know?

And you know all that this is true *how*, exactly⁹?

With most people on Earth claiming to adhere to one religion (while claiming that all other religions are false and with quite literally *no way to resolve the competing notional claims of either one* it is no surprise that we live in a state of irrational sociopolitical chaos. Religions have co-opted social and political reasoning *forever* – from right after the first religion was invented *as* a provisional worldview, with God(s) of the many, many gaps in human understanding taking the place of reason – and they utterly fail every reasonable requirement or condition we would like to place on admissible worldviews. In particular, it is impossible to differentiate between all of their manifold arbitrary pronouncements by means of any sort of actual application to or attempt to predict the real world they purport to explain. To avoid being summarily rejected, they openly encourage the *closing* of the minds of all of the children of adherents to any epistemological challenge – one of the reasons that our schools don’t teach epistemology is no doubt because it is literally a mortal threat to religions in general simply because a functional, rational epistemology simply can’t get radically different answers given the same observational data, which means that all but one of the disjoint world religions of the past or present are *certainly false*¹⁰ as a matter of *pure logic*!

Because of their deep epistemological uncertainty, they more practically rely on precisely the sort of schoolyard bully-based conflict that has maintained the entire world as a place of immense human suffering and woe. When it is literally impossible to convince people of the (probable) truth of a proposition by any commonly accepted *objective* means, when the worldviews in conflict haven’t a

⁹This is the really interesting question. If you ask it (and I have, many times) you get answers ranging from “because the (fill in your favorite antique scriptural mythology) provides eyewitness testimony and it says right here in this scripture that the scripture itself is divinely inspired perfect truth so it must be true” to “I just *know* that it is true” or “because (fill in your choice of ‘unlikely hence miraculous’ event) occurred, therefore it must be true” or (most scarily) “because I hear voices that tell me it is true”.

¹⁰...and the one that remains is *probably* false given the lack of universally convincing observational support and the fact that given N religions, the unbiased prior probability that any of them are correct is $1/(N + 1)$ (the 1 being “no religion is correct”), and there are a *lot* of disjoint religions out there in the past and present combined and an infinitely greater number if we take all *possible* inventions of religious mythology...

shred of “humility” in them or means by which they can change and improve as we learn more about the world in which we live and as we try different ways of living together in harmony with it and each other, all that is left is naked physical violence and the ruthless oppression of dissension.

And that’s what we’ve got today – faith-based, authority-based, mythology-based religious, political, social, and economic systems that are in a state of near-perpetual *violent conflict* because there is quite literally no way for the named belief sets that form key parts of many worldviews to change and for the people who have those different worldviews to peacefully resolve their differences as they evolve towards a *commonly* accepted system that *works*. Indeed, all of these systems tend to protect themselves by exempting themselves one way or another from the direct application of the only common set of worldview axioms we have that *actually* works!

I am going to defer discussing verificationism and falsificationism until later, in part because it should be pretty obvious that both absolute verification and absolute falsification are essentially *impossible* – both preserve the illusion of perfectly known factual truth and factual falsehood (as they apply to the real world, as opposed to pure logic where it is indeed fair to say that a contradiction is inherently false and a tautology inherently true). It should also be pretty clear at this point that this is *not how our brains themselves or the worldviews they develop actually work*, as humans obviously have little difficulty understanding and even believing in the truth of propositions that cannot be verified *or* falsified, such as the proposition that on what would have been January 16th of the year 1,213,337 BCE (working our calendar carefully backwards) the sun apparently rose on the east coast of the North American continent as the Earth rotated and revolved about the Sun as it does today.

This statement cannot be verified by any sort of direct experiment. It cannot be falsified by any sort of direct experiment. Yet I’m pretty certain it is *probably true*, because of its consistency with a network of most probable beliefs that permit me to *extrapolate* probable knowledge from the contexts where it can be verified or falsified into realms where it cannot, at the cost of certainty¹¹. But as I’ve pointed out repeatedly above, we have *already given up* certainty in any discussions about the real world, and it is “certainly” better to believe that the Earth on January 16th of the year 1,213,337 BCE behaved pretty much like it does today than to believe that *chaos reigns everywhere outside of the immediate*

¹¹To put it another way, it is a provable *theorem* given the observationally supported *axioms* of physics, astronomy, and geology, but is itself utterly untestable.

range of our immediate senses as an alternative¹².

So, what *are* the axioms that we can rely on to be a) consistent with our meta-axioms; and b) capable of generating an entire ontology, top to bottom, including a workable religious, political, social and economic component? Well, they pretty much *are* the meta-axioms of the previous section, now transformed self-consistently into the *axioms of the scientific worldview* and extended (as we shall see) to apply a similar criterion to determine what *works* to accomplish the evolution of social and ethical rules we can all *agree on*.

Of these meta-axioms, the ones that serve as the most fundamental axioms of this worldview are the *Cox axioms* – the “desiderata” of Jaynes that allow one to derive the algebra of inference as Bayesian probability theory¹³, plus the meta-axiom of correspondence. These axioms (at the very least) show how to *comparatively* assess whether or not any given assertion about the real world *works* better, or worse, as a possible explanation or descriptive rule, *relative* to alternative explanations, based on whether or not it is in *good agreement with past evidence*, has *predictive value*, is *consistent with the entire network of mutually interconnected rules that work the “best so far”*, and so on.

This is enormously important – arguably the greatest philosophical accomplishment of the human species as the basis for an *evolving, self-optimizing* system of *probable* (or provisional, or contingent) knowledge – and yet tragically unknown explicitly to anyone outside of a small, select community. Let us recall the axioms themselves:

1. **Real Plausibility** – *Degrees of plausibility are represented by real numbers.*
2. **The Calculus of Common Sense** – *Plausibilities can only change in qualitative correspondence with common sense.*
3. **Consistency of Plausibility** – *The complete network of mutually related plausibilities must be numerically consistent.*

If one massages these axioms in symbolic terms and uses them to derive an algebra of symbols that stand for the real number plausibilities, one ends up with:

¹²No, this is not an arbitrary statement. To the best of our ability to tell, chaos does *not* reign everywhere outside of the immediate range of our immediate senses, so yeah, it is better to believe this even though it might not be true.

¹³Interested parties are especially encouraged to read *The Algebra of Probable Inference* by Richard T. Cox and *Probability Theory: the Logic of Science* by E. T. Jaynes, listed in more detail in the bibliography.

Part IV

God

Chapter 14

The Standard Model of God

Potthapada: Now, lord, does perception arise first, and knowledge after; or does knowledge arise first, and perception after; or do perception and knowledge arise simultaneously?

Gotama: Potthapada, perception arises first, and knowledge after. And the arising of knowledge comes from the arising of perception. One discerns, ‘It’s in dependence on this that my knowledge has arisen.’ Through this line of reasoning one can realize how perception arises first, and knowledge after, and how the arising of knowledge comes from the arising of perception.

Potthapada Sutta, from the Pali Canons

This is a book about reality. In particular, as hopefully by now is clear, it is a book that specifies quite clearly what we can hope to fairly reliably *know* about reality from inside of our personal caves, through the application of systematic doubt. As we have seen, we cannot reasonably doubt our own existence, and the *simplest* explanation for the parade of sensations and memories and thoughts that seem to pertain to an objective external reality is that such an objective external reality exists and our sensations, memories, and thoughts – our *beliefs* about it – represent a *map*, or a *web of belief, so far* – an imperfect, but systematically improvable knowledge of it.

This viewpoint is hardly new. The quote above is attributed to Buddha, and if this is indeed an *accurate* attribution (something we are always free to doubt given the obvious imperfections in the chain of transmission of the evidence even after it was finally written down) then the idea that “higher level” *knowledge* – something beyond the mere instantaneous *process* of experience of

sensation – arises *out* of and *after* our “mental” processing of that experience can be dated back to at least (around) 500 BCE, some 2500 years ago. There is other documentary evidence that Buddha favored an empirical worldview over the predominant Vedic scriptural religious worldview of that time, and actually preached against belief in a Benevolent Creator God due to the problem of theodicy/evil (see below)¹.

Similar arguments, attributed to Greek philosophers such as Aristotle and Epicurus, were also recorded some 100 to 200 years after the Buddhist version (note that the dates of the Buddhist version are less certain than the dates of the Greek versions, and that Epicurus’ empiricism is known more indirectly than that of Aristotle).

All of these assertions are in some sense meta-axiomatically self-consistent – we learn that empirical induction from sensory experience to useful knowledge works because, well, it empirically/inductively works! Hume embraced this general approach but was unable to find a logical justification of it of the sort we formally laid out above as a cycle of Bayesian probability theory seeking *probable* truth: start with almost any reasonably consistent network of prior “possibly correct” beliefs with any reasonable estimate of the probability that those beliefs are actually true, accumulate evidence pertaining to any or all elements in the network, and incrementally recompute the posterior probability distribution for the possible truth(s) in the network, increasing our degree of belief in some, decreasing our degree of belief in others.

Mathematically, whether one performs an actual computation based on actual systematic evidence in statistical analysis problems or applies this process conceptually within the neural network of our brains, this process of iteratively refining experience into knowledge works *amazingly well* as long as one carefully avoids the inferential trap of *dogmatism*, a prior assignment of *certain* truth or *certain* falsehood to any of the prior beliefs about the real world in the network. Boolean/Aristotelian certainty of truth or falsehood is a dangerous trap, when applied to *beliefs* about the real world as it literally blocks the critical posterior recomputation/reestimation of the probable truth of *some* of the initial/prior network of beliefs about the world, protecting them from any or all confounding evidence and distorting our probable beliefs in everything else as a consequence.

The Scientific Worldview is the result of the systematic application of this

¹It is more than a bit ironic that his empirical social/psychological/ethical teachings were transformed *into* a religion as well as being absorbed into the Hindu/Vedic belief set by the simple expedient of making Buddha yet another avatar of the Mahavishnu, transforming someone who essentially preached atheistic social ethics into a God to be worshipped.

Bayesian approach to the construction of a consistent web of reliable, useful, empirically verifiable knowledge. Science does not assert *definite* truth or *absolute* truth, it asserts *probable truth* on the basis of this mix of reason and empirical observation. It is *literally* that which we (at any given time) can doubt the least when we try doubting very hard, and even allows us to hold a number of competing propositions in our minds and consider them *all* moderately plausible (all work reasonably and equally well) without forcing us to claim one of them as “the” truth, a nearly certain true fact, when the evidence does not (yet) support it and allows us to reject *even* things that we at one time believed quite strongly to be true in this almost certain sense once we encounter and accumulate evidence for which the beliefs simply do not work. Science is quite comfortable stating “I was wrong”, or “I don’t know”², even as it says “Let’s try to find out”.

We are now about to embark on a much more difficult metaphysical quest, one that (I’m absolutely certain) will end up being the most controversial part of this book. What do our worldview axioms (that supposedly sketch out how reason and experience tell us the best thing to believe about *any* notion(s)) tell us about the peculiar notions associated with *God*? Or Gods, as one’s particular brand of theism dictates?

This is a remarkably difficult question to answer; or rather, it will turn out to be a *very easy* question to answer for the most part, but roughly 85% of the people on Earth won’t *like* the answer, according to the most recent polls.

To even begin to address the question, however, we have to first come up with a *definition* of God, or a *model* of God, because God is a rather elusive entity, defined *differently* by every religion³ Indeed, many religions further obscure the

²Well, *Science* doesn’t exactly say this, because Science isn’t a sentient being and therefore can’t actually say anything, but *I* say it all the time, based on my best knowledge of Science, my own personal assessment of arguments and evidence, and of course my own awareness of my own profound ignorance about so *very* many things. You probably should too...

³And often, by every subgroup, sect, cult, schism, of that religion, so much so that it isn’t clear at all if Baptists and Methodists and Catholics and Presbyterians and Mormons and Jehovah’s Witnesses and Quakers and ... I tire listing them ... should all be considered *one* religion or *myriad*. Are all the Abrahamic religions *one* religion, as they all claim to worship the same God, with the same historical roots, by whatever name the particular cult in question chooses to use as a symbolic representation for the hypothetical entity? Note well that they are *all* technically cults – the first definition in the dictionary for the word cult being “a system of religious veneration and devotion directed toward a particular figure or object” – or heresies – again using the term precisely in accord with its original meaning of “choices”, in context a set of choices that were eventually given a name that differ in some specific ways from a set of alternative *equally arbitrary* choices that were *also* given a name? Or does every single individual with their own particular heresies, nothing really bad about it – have their *own*

question by on the one hand using the word God as if it refers to a very specific being with very specific properties and then turning around and asserting that this being is basically unknowable and that its properties are uncertain. Naturally, this deft maneuver makes it difficult to apply reason to any concrete question concerning God even as it allows those who claim to speak for God to assert that they know just what It is thinking and what It wants, with no possibility whatsoever of ever being proven *wrong*, by logical argument or evidence or both.

That won't do for us here. We have to have a concrete model of God, something we can apply reason to, because our axioms require our best worldview (so far) to be *consistent* (so far as we can tell); if a definition of God is *inconsistent* we face the Scylla and Charbydis of knowledge – on the one hand we know that the definition is false; on the other we know that if we accept it as true anyway we can prove anything we like to be true, and be equally certain that we have *actually* proven nothing at all⁴!

Furthermore, our definition has to be completely independent of history! As a colleague and friend⁵ once pointed out to me, if God is accessible to reason, God's properties (including the property of actual, as opposed to imaginary, existence) should be (just like physics, chemistry, and all the rest of scientifically supported probable knowledge of actual things) as accessible to a race of space aliens with an entirely different planetary history than our own, and if any particular reasonable model of God is supported by actual evidence, all reasonable people (or space aliens!) should be able to verify and confirm the evidence. This is utterly impossible when the evidence in question is *only* assertions about things that were purportedly seen or done in the remote past by our human ancestors as part of many entirely distinct and mutually contradictory bodies of multicultural scriptural mythology⁶. This is especially so when those claims are often

personal religion? Note well that for every one of these variants of "Abraham's God-ism" all the *other* variants are heresies if not cults!

⁴Because you can prove anything – literally anything – to be true, once you have admitted an actual inconsistency into any theory, which is why mathematicians, logicians, philosophers, scientists, and people with plain old common sense work so very hard *not* to accept contradictory assertions as *truth*...

⁵Knujon Mapson, in a private conversation concerning an article I was contributing to Pan-deism, an Anthology.

⁶Sure, you can – and probably do, if you "belong" to one of the religions based on one or another of these mythologies – try to convince yourself that it is only the *other* scriptures for all of the *other* religions that are myths while yours alone is true, but the problem is that the only evidence you have for this in fact *being* true is lying-frog evidence – documentary evidence that asserts its own truth. And the other religions you reject have exactly the same thing.

extraordinary, things that *directly contradict* our evidence-supported, reasonably consistent set of best beliefs, things that we can and do verify by repeatable experiments and daily experience *all the time!*

Let me be clear about this last point, as it is crucial: to the extent that the first and second laws of thermodynamics, the law of mass-energy conservation, and all of our knowledge of biology and chemistry and physics are *correct beliefs* that are well-supported by easily reproducible evidence and consistently interlocked in a mutual web of evidence supported belief, the claims of miracles as evidence (safely in the remote past where they cannot be objectively or reproducibly observed and checked by observers who *very much doubt that they are true*) are *very unlikely* to be true, as they *violate* these laws. Note well that every time we investigate similar claims in the modern world we find that the claims are *almost certainly false* – and often false in a specific way: false, inconsistent, and intended to deceive, as opposed to the not reproducible (so far) but consistent and hence conceivably “possible but rare” label that gets stuck on uncertain but plausible scientific hypotheses that lack empirical support, such as magnetic monopoles. This point is sufficiently important that we will devote an entire section to the general inconsistency between the evidence for natural law and anecdotal reports of law-violating miracles.

Even so, models of God are sufficiently varied that we will need some “general” specificity even at the risk of excluding some *irrelevant details* in the description of God asserted by this major or minor religion. We need a “lowest common denominator” model of God, one that allows us to concentrate our logical attention on some very specific properties common to all, or almost all, of the deities asserted by the major world religions and their many sub-variants.

To address this problem, I therefore offer up the *Standard Model of God*⁷ for our immediate examination. Note well that I am not attempting to introduce Red HerringGods, StrawGods, or True ScotsGods etc with this model. I’m only trying to avoid analyzing the logical consistency of some amorphous and ill-defined entity so fluid and plastic that one can always manage to slither around any counterargument or evidence with a “yes, but...” objection. I *am* largely excluding from discussion the possible existence of a *multitude* of gods (lower-case “g”) with finite powers as such deities can easily be confused with powerful space aliens who aren’t ‘gods’ at all (and for whose existence we *also* have zippo

⁷See: <http://whywontgodhealamputees.com/god3.htm> I’m not using precisely the same model that this site proposes because it concentrates a bit too much on the Abrahamic religions and hence the fill-in-your-choice from: The Torah, the Bible, the Quran, The Book of Mormon. There is, however, sufficient overlap to justify using the same term.

in the way of reliable evidence) or, to the extent that one of them *does* possess one or more of the “infinite” properties below, equally susceptible to the following analysis.

The God of most monotheist/monist religions (and some specific gods in a few of the polytheistic religions, with the properties divided in different ways) has the following general attributes. Each block of properties refers to a different *kind* of attribute:

***Infinite* (universal) properties:**

- Omniscient
- Omnipotent
- Omnipresent (in space *and* time)

***Sentient* properties (God’s mind):**

- Aware/alive
- Omnibenevolent/loving
- Capable of *action*

***Causal* properties:**

- Non-contingent/necessary
- Creator of/cause of physical Universe
- The uncaused “first cause” in *ordinal* (not necessarily “temporal” as this term presupposes time) causal chains

Let’s go through these systematically.

Omniscience God is all-knowing. Without this property, God Itself couldn’t be certain It *was* God, and couldn’t achieve the kind of control required for the next property. *With* this property, as we shall see, it isn’t clear how the *state* of God’s knowledge can change, and this will have dire implications when it comes to awareness and action. It is also worth pointing out that this property necessarily *explicitly violates* the proposed path from experience to knowledge *that we know empirically works*. Indeed, it is almost the exact opposite, a perfect contradiction of the ordered relationship between knowledge and experience.

Omnipotence God is all-powerful. Without this property, God again would not be in control of all things and hence would not be the monotheist God, but rather at most a very (but *finitely*) powerful *ordinary* being. The point is that God isn't just a natural being that is powerful by contemporary human standards but that lives *in* the Universe and is subject *to* natural law; by that standard a very advanced race of space aliens might be "God" compared to us and yet might themselves have Gods consisting of still more powerful aliens. God controls the laws of nature, not the other way around, and can break them on a whim.

Omnipresence God exists everywhere, and is eternal, existing at all points in space at all times in the past, present, and future, on a *Universal* basis. This has to be true, furthermore, quite independent of how many dimensions the Universe really has – God has to fill *all* of them. Otherwise there might exist (possibly undetectable!) completely disjoint parallel cosmi with different Gods, in which case God wouldn't be the monotheistic God of *all* things, only all things in our Cosmos (if that). God would indeed once again be just a player *in* a much larger Universe, most of which It did not control, and hence would not be a (standard model) God at all, merely a god/space alien overlord of *some* of everything.

Note well that *mathematically*, there simply *is* no way for any sentient being to empirically or logically exclude the possibility of disjoint Cosmi. It's as impossible as proving that truly invisible (to us) fairies don't exist. Just because you can't "see" them – detect them *by any means* – doesn't prove they aren't there, it just makes it a waste of time to believe that they are. Or, for that matter, that they aren't!

These "omni" properties differentiate God from any finite, "ordinary" being, however powerful that being might be, that one might empirically encounter. Pretty much *all monotheistic religions* consider these attributes to be necessary properties of God; if any of them were lacking, God would be nothing but a natural being much like ourselves; perhaps more powerful or long lived but not really *God*.

Awareness God must be *self-aware* and *other-aware*; to put it bluntly, *God must have a mind!* This is an enormously difficult property to satisfy, because minds *exist in time* and have certain properties with regard to entropy and information, that seem rather inconsistent with the "omni" properties above. Also, all the minds we can actually observe or infer the

existence of (including our own) are based on a *complex mechanism* that makes it quite literally impossible for the mind to be aware of its own complete state in any nontrivial sense. But if God is *not* aware, both of itself and of other things that are not-self, then it is difficult to see how God can be self-willed and hence *act*. All of the usual problems with determinism and free will apply to *God*⁸.

Omnibenevolence This is, perhaps, the most controversial property in the Standard Model of God, and it is also one that is *not* quite universal in monotheistic theisms, perhaps because it is so very obvious that the Universe in which we live is filled with suffering and injustice, as the short quotation from one of the *Jakatas* (the texts that supposedly tell the story of the Buddha's former lives) at the beginning of one of the next few chapters demonstrates. The philosophical incompatibility of a *good* Standard Model God and the existence of Evil⁹ thus dates back to at *least* 500 BCE. It is also strikingly incompatible with the reported *behavior* of God in all of the great world theisms, in particular those that include the hell meme/axiom. Such a God then has to be *simultaneously* omnibenevolent and yet (reportedly) be prepared to inflict *infinite* punishments for the "sin" of actually doing one's *honest best, given the evidence* when deciding what to believe. This is clearly "benevolent" for a meaning of the word that is pretty much equivalent to "malevolent", a direct contradiction.

Volent In order to be benevolent *or* malevolent, God has to be both aware and *volent* – self-willed and capable of *action*. This is (once again) a remarkably difficult thing to consistently imagine. Change, action, occur in *time* and God is eternal, timeless (according to the "omni" properties above). As we will see in the next chapter, omniscience is *mathematically* incompatible with the ability to *choose to act* because one can never change one's knowledge of the past, present or future of anything at all, including (in God's case) itself.

As we can already begin to see, coming up with *any* sort of plausible model for God's Mind that doesn't conflict with the "omni" properties is going to present us with insuperable difficulties. Note well that because we do *not* lay any claims to certain knowledge or perfect truth as long as we adhere to the maxim of

⁸Wikipedia: [http://www.wikipedia.org/wiki/Free Will](http://www.wikipedia.org/wiki/Free_Will). In spades, in fact. Consider: If God is omniscient, then you are no more free than the characters in a book that is already written, and *neither is God!*

⁹Wikipedia: [http://www.wikipedia.org/wiki/Problem of Evil](http://www.wikipedia.org/wiki/Problem_of_Evil).

believing most that which we cannot easily disbelieve, we are freed from the necessity of proving that God' Mind is *logically* or *mathematically* impossible – although some of the efforts in this section will take a pretty fair stab at just this – all we really need to do is show that standard model God is *implausible* and that all simple models that might realize it appear to be contradictory, and the burden of proof is then on anyone wishing to assert such a mind to come up with a plausible model that is not similarly contradictory ***and present evidence supporting their model!*** Evidence is going to be an enormous problem for any assertion of theism no matter what, but without a viable model we won't even know where, or how, to look.

Noncontingent According to the Standard Model of God, God cannot be a contingent entity. That means that God cannot rely on *something else not God* for its being. For example, if God is material, then God's existence and structure is contingent upon the existence of matter. If God is mental, then God is contingent upon the existence of mind. A material God, we are tempted to say, inherits its nature from the matter from which it is made. A mental God would similarly inherit its nature from the "mental stuff" from which it is made. This leads us to a singularly tough dilemma. An omniscient, omnipotent, omnipresent being must be *at least as complex* as the Universe that they know *perfectly*, control *perfectly*, and are *everywhere and everywhen in*, because omniscience requires that they have a *perfect representation* of the Universe – including themselves – in their *mind*. It is difficult to imagine how this complexity can exist in a mind without *structure*, since complexity *is* structure, but the structure of *what* if not some sort of "stuff" hypothesized (openly or *sub rosa*) to be a contingent prior for God?

First Cause Noncontingency is often expressed as being *necessity* – God is *necessary* and *nothing else is*. This is often expressed in *causal* terms (which have a most unfortunate temporal signature in most apologist arguments for a monotheist God): God is the uncaused cause, the First Cause in a causal chain that leads, eventually, to the Universe and everything in it. Alas, this is logically, mathematically, and empirically unsound.

Logically unsound because an uncaused cause could very well not be aware, omniscient, and so on; even if an uncaused, non-contingent cause *does* exist, its existence alone does not suffice to support any claim that it is *God*. It *must* have the properties above in full measure as well!

Mathematically unsound because there is no mathematical requirement

for all dynamical chains (suitably defined with successor/predecessor operations) to terminate in the past any more than there is a reason for them to terminate in the future. The set of all positive and negative integers stands as a very simple example of an *infinite* chain with a successor/predecessor operation that never terminates in either direction. One can traverse *any closed path* in space in *either direction* without ever reaching a beginning or end. We *do not know empirically* whether even our *Cosmos* is “open”, or “closed” in a mathematical sense or has any *special* point that could be considered a true “beginning”, and it is in *my* opinion unlikely that physics will ever be able to definitively answer the question as it involves energies and length/time scales that are fundamentally inaccessible at this point in the time evolution of the Cosmos.

Empirically unsound because what we actually observe in nature is that causal chains do *not*, in fact, terminate in the past or future, at least where we can see it or even strongly infer it. In fact, the most important physical laws are *conservation laws* which more or less state that the “stuff” (mass-energy) of nature is *not* created or destroyed but simply changes form in a causal dance. In other words, the term “cause” used in an argument that asserts God as the “cause” of anything at all is *completely incompatible* with the discussion of causality in the *science* of causality, physics. In the real world we live in, as far as we can observe or tell, *nothing* is ever “caused” (created out of nothing, caused in complete isolation from the continuous chain of dynamical evolution) in the sense that is generally used when discussing God-style creation and causality.

This is puzzling, until one realizes that primitive people *did* see things “appear” without any real understanding of their cause in the rearrangement-of-preexisting-stuff sense of physics, chemistry, biology. A snowflake, a tree, a baby, lightning – God has to a tremendous extent always been the God of the Gaps, a catch-all explanation for how many things came to be, “created” or “caused” to be structured in particular ways by God’s Naked Will. However, creation *ex nihilo* in the sense used to describe God’s action in some sort of time to create space and time, or disconnected causal chains internal to the Universe with no prior cause, have quite literally never been observed to occur anywhere, ever. There is no empirical reason to believe that causality in this sense is *possible*, let alone *necessary*; as an explanation of *anything at all*, let alone *everything*.

Creator of the Physical Universe This is a *universal* feature of the Standard Model of God. Indeed, all of the properties above are more or less

subordinate to this (desired, essential) property.

As noted above, Creation *ex nihilo*, in the specific sense used here to describe God's role as a "creator" of the Universe, has quite literally never been observed to occur anywhere, ever. There is no reason to believe that it is even possible, let alone *necessary*, as an explanation of anything at all, let alone *everything*.

The general idea is that if God did *not* create the Universe, then God exists *within* it, or perhaps separate from it¹⁰, and is not the standard God of monotheism. God is omniscient, omnipotent, omnipresent and omnitemporal because the aware and living God *made* the Universe as a deliberate, perfectly benevolent act of will, acting as the First Cause of the causal chain of the Universe, as the non-contingent originator of all of contingent reality. This is really pretty much the *sine qua non* of monotheistic Godhood – any being *less* extensive than the Universe itself simply doesn't qualify.

This seems like a genteel sufficiency of properties for the Standard Model of God. Although there are still more properties ascribed to *specific* versions of God in particular theisms – such as a (Christian) three-in-one deity, a (Jewish) deity that really, really likes the smell of burning animal flesh, a (Muslim) deity that intends to burn the skin off of unbelievers and then cause the skin to regrow so he can burn it off again, forever, a *different* (Hindu) three-in-one deity – the properties above are more than enough to get ourselves into serious trouble already if we try to make them consistent with our reason and experience. Besides, all of these deities are generally presented at some point as a more or less standard model intelligent Creator of the Universe – if that model fails, so do they all fail.

As we will see in the next chapter – the Standard Model of God is *fundamentally impossible*. It is surprisingly easy to formally disprove it using some of the well-known results of modern mathematics and logic; a simple one-paragraph ontological proof suffices to prove the *impossibility* of a Creator God, for example. It is also not only unsupported by experience and common sense, it is unambiguously *contradicted* by both experience and common sense. The Standard Model of God is, to put it bluntly, wrong – not merely a notion that there is no good reason to believe might be true but rather an inconsistent notion that there are excellent reasons to believe *false*.

¹⁰Note well that this latter possibility is precluded by our precise specification of the *meaning* of the term "Universe" way back at the beginning of this book, as *everything that exists* in the most dimensionally general sense of the word "exists". Anything that is anywhere anywhen in any real dimension is in the set we call the Universe, so God (if God exists) cannot exist independently of it.

Chapter 15

Disproofs of the Standard Model of God

I promise nothing complete; because any human thing supposed to be complete, must for that very reason infallibly be faulty.

– Moby Dick (Chapter XXXII 1 “Cetology”) by Herman Melville
(and damn close to Gödel’s theorem!)

*...These greedy lying priests practice deceit
And fools believe the fictions they repeat.*

*If the creator of the world entire
They call God, of every being be the Lord
Why does he order such misfortune
And not create concord?*

*If the creator of the world entire
They call God, of every being be the Lord
Why prevail deceit, lies and ignorance
And he such inequity and injustice create?*

*If the creator of the world entire
They call God, of every being be the Lord
Then an evil master is he, (O Aritta)
Knowing what’s right, he let’s the wrong prevail!*

– in the *Bhuridatta Jataka*

We now undertake the task of completely, utterly, *destroying* the Standard Model of God. It is wrong; not simply wrong because of a lack of evidence

but *provably* wrong because it is *impossible*, because it is mathematically and logically contradictory in critical ways.

This task is not undertaken lightly. Religion fills many important *social* and *psychological* niches in human cultures and societies (note plural) – we as a species have literally co-evolved with religious beliefs structuring our social order and permitting us to cope with our empirical knowledge that ***we ourselves and everyone we know or love will suffer in life and then die!*** It is the ultimate refuge for our utter impotence to alter that unpalatable fact and to “explain” and cope with a seemingly whimsical reality that is largely beyond our control. It permits the sufferers of diseases or misfortune to pretend that their suffering is not in vain but the gateway to vast rewards, that the injustice of their affliction will be compensated for by an eternity of bliss. It permits the downtrodden and powerless to pretend that their social and economic masters will be eternally cast down even as they themselves are uplifted, permitting societies with vast social and economic inequities to exist *at all* by providing an alternative to revolution, violent or otherwise. It allows people to cope with the loss of a loved one by letting them pretend that the separation is part of a vast *game* being played by, and with, a supreme overlord that reigns over death itself and rewards mere “*belief*” (adherence to the requisite social/religious norm) with eternal life so that the separation will only be temporary!

For individuals, religions are the institution that provides important rituals for being born, marrying, and dying. They provide a common, safe meeting place. They provide communities with an organization that teaches ethical principles (for better or worse – these principles are often based on “supernatural” God-given axioms laid down in self-affirming scripture written by primitive patriarch’s seeking to cement their own authority and in many cases do not stand the test of reason and time). They are a useful base for organizing community actions based on higher ethical principles and human compassion. For many individuals, an image of God in their mind’s eye functions as a superego, augmenting their ability to turn away from destructive activities and the suffering they cause themselves and others.

For better or worse, religions are fundamentally supported by *cognitive dissonance*¹, a kind of *organized form of self-deception*. They are a constant drain on

¹Wikipedia: http://www.wikipedia.org/wiki/Cognitive_Dissonance. This is the natural tendency of humans to believe in something – or *anything* – that makes them “significant”, in the face of all evidence to the contrary. Being insignificant, weak, ignorant, poor, powerless makes us feel *bad*, so we re-invent reality to make it Not So and feel *better*, if not *good*. The 2020 presidential election illustrates cognitive dissonance on a truly massive scale – losing the

individual resources that are donated to support not the good works the religions (sometimes) do, but the organizations themselves. They are non-democratic political powers that all too often attempt to force their *particular* supernatural axioms into law, requiring all of their neighbors (many of whom belong to a *different* religion with *different* axioms, or to no religion at all) to believe *x* but behave as though they believed *y* or face sanctions ranging from social ostracism and fines all the way through to imprisonment, torture, and death.

None of this is really subject to argument – if you are alive on Earth to be reading this in the time frame in which I’m writing it² then you cannot help but be aware of things like “In God We Trust” printed on currency used in a country that explicitly prohibits governmental support of religious beliefs in its constitution, blue laws, the persecution of smaller religious groups by larger ones, sometimes by or within entire countries with a specific religious majority (for example, Jews by Christians and Muslims, Hindus by Muslims, Muslims by Hindus, Sunni Muslims by Shia Muslims and vice versa, and even Muslims by Buddhists). You cannot help but be aware that many countries still consider homosexuality to be a crime – even a capital crime – for no sane reason except religious scriptural mythology of the form “Our God doesn’t like it and is going to make you burn in hell anyway so we might as well kill you, or beat you, or imprison you in a camp devoted to your ‘re-education’ as a non-homosexual now”. Women all over the world are second-class citizens in all but a handful of countries and cultures, but in some – many – countries the prevailing religion makes women into actual chattel, possessions that at all times belong to some male, not allowed any of the freedoms a male in those cultures possess.

The Abrahamic religions, by sharing the Old Testament as a common scriptural assertion of the supernaturally revealed Word of God, all *also* share the explicit endorsement of slavery and brutality, marriage by rape, the slaughter of animals in a blood ritual to appease God, and the death penalty for anyone exercising the slightest freedom to choose to believe and live by anything else besides the scripturally asserted rules. Historically, religions have backed – really, a better word is fomented – war and atrocity, torture and death, tyranny and slavery, and the formal organization of societies in ways that perpetuate the power of the religion in question, as violently as need be, against all challenges. There are few world religions or variants thereof indeed that do *not* have a history of

election made many people feel bad, so they simply reinvented affairs (without a shred of evidence) so that it never *really* happened. This process was aided by having a pathological liar and narcissist in office to begin with who spent an entire presidency weakening people’s grip on reality whenever it contradicted his own personal CD narrative...

²Across far too many decades of the late 20th and early 21st century.

overt violence or complicity in overt violence. Perhaps the Quakers. Maybe the Amish. Arguably the Jains.

At best, then, while religions serve many purposes in all of the many societies and cultures in all of the nations of the world and some of those purposes are good ones, by offering actual logical proofs of the inconsistency of the Standard Model of God we do the world an enormous favor, because most of the versions of the Standard Model of God that have come down to us from the Bronze or early Iron Age in the great world theisms are – as explicitly detailed above – logically flawed, morally horrific, economically and politically exploitative, and consequently the source of much evil in the world.

None of that really matters though, as we are on a quest for best belief. If reason and evidence objectively support belief, it should be easy to demonstrate it and everybody should believe. If the evidence ultimately supports some specific religion, say, the religion of the Aztecs, then we should all be able to agree and we should all get together and plan to ritually cut out the hearts of the losing football and basketball teams in every championship game!

Note that the Aztec deities were not quite standard model gods, but they were indeed creator gods. The Aztec creation hypothesis was that the great gods Quetzalcoatl and Tezcatlipoca ripped the female reptilian god-monster Tlaltecuhli into pieces to create the earth and sky. The rivers, mountains, springs came from repurposing her various body parts. This made Tlaltecuhli feel bad, and just because her body was gone doesn't mean that she was actually dead and powerless and incapable of making life miserable for the Aztec people. It was – and presumably remains – thus necessary to feed and appease her spirit, and the gods promised her *human* hearts and *human* blood in exchange for her sacrifice. Other gods made similar sacrifices and required similar payments. So when the Aztecs gathered on top of the pyramids at Tenochtitlan to rip out hearts, they were *feeding the gods* while *repaying them for the sacrifices the gods made* creating the world and humans and animals therein. If this were not done, and done fast enough and religiously enough, the gods might cause earthquakes or bring in foreign invaders from over the sea to completely destroy the Aztec culture and society and maybe even eventually the world³.

Oops.

³Oh, wait, *this happened!* There is *evidence* that heart ripping works, and the entire European invasion might have been avoided if only they had ripped them out *faster!* Especially if they had ripped them out of the European invaders themselves to the last human so none of them returned to Europe with tales of gold and slaves for the taking...

Note that this belief set has to go into the big hat of possibly true explanations for the world we experience through our senses, along with the Abrahamic sets, the various pagan belief sets, the Hindu belief sets, the belief sets held only briefly on chains of small islands in the South Pacific, and countless other supernatural sets that humans haven't even imagined yet. You might assert that there is no *evidence* that the Aztec creation myths are actually *true*, and you'd be right. But note that – following the time honored traditions of the Abrahamic religions – we can always interpret them as a *metaphor* – the “ripping” is the Big Bang, Tlaltecuhltli is the primordial “prior” bundle of mass-energy (that happened to be reptilian, female, and sentient, why not?) and look! Suddenly the Big Bang is transformed into “evidence” that this belief set is *true*, by simply bending the myth to fit the evidence and repurposing words to mean something entirely different from what they actually say!

Those of who have been raised to believe the competing assertions of the Abrahamic religions (quite possibly including you, dear reader, so pay careful attention) are likely at this point to assert the multiple absurdities in this hypothesis along with the horror of sacrificing people by ripping their hearts out as an offering to something that almost certainly doesn't exist should pause for a moment to examine the shared creation assertion of this family of religions, and the careful detailing of the sacrifice rituals *they all* explicitly require. They should examine the “bending” commonly used to transform the literal account of creation actually recorded in their scriptural creation hypothesis into something that is not in the obvious violent disagreement with observation of the unbent, non-metaphorical account.

They should note that the fundamental foundation of Christianity, at least, is *almost exactly the same* as that of the Aztecs – God required the blood sacrifice of Jesus by people in order to be appeased and allow Itself to forgive the humans It created for behaving precisely the way It omnisciently and omnipotently predestined them to behave. And finally, they should read historical accounts of how, in the name of this God and Jesus, the Spanish invaders in a remarkably few years killed far more people than were sacrificed to the gods over decades if not centuries, destroyed the Aztec civilization itself, stole all of its wealth (a substantial fraction of which eventually made its way to the Catholic church) and enslaved the indigenous people, who then spent centuries as at best second-class citizens under a ruling class that could claim semi-pure Spanish descent.

One might wish that humans had the wisdom and courage to face reality as it most nearly appears to be in the sober light of day on the basis of systematic

observation and inference instead of inventing an entire imaginary layer of reality, unsupported by any evidence worthy of the name, just so that they can pretend that they won't actually die when all of the evidence in and of the world makes it almost certain that they will. One might also wish that they would not twist this self-deception into a thick bundle of supernaturally endorsed, self-affirming (lying frog) axioms to be accepted as absolute truth without exposing them to the withering effect of critical thinking, comparison with evidence, consistency with the set of rules found to be in best agreement with evidence, to the point where they almost invariably (judging by history) are easily manipulated into at the very least acquiescence in horrors committed "in the name of God".

Perhaps this work will give at least a few people who read it the wisdom and courage required to face the fact that there is *no good evidence-based reason to believe that any of the world religions are correct*. This is especially the case when at most *only one of them can be correct* and there are a *lot* of choices! If one applies the principle of maximum ignorance, the *a priori* probable truth of any given one of the possibilities is very small, even *before* we examine their fundamental tenets for consistency and look for reliable evidence.

Those tenets are invariably *inconsistent*. It is time to examine the Standard Model of God and prove that *no God with any reasonable subset of the properties of the Standard Model is logically consistent*, so we can definitely state that the religions that assert such a god as The God are *false religions*. We will then move beyond purely *logical* arguments where precision and mathematical rigor matter and broaden the class of deities being discussed while we consider the *evidence-based and moral arguments* against both God and Gods in a wider range of (variants of) religions.

In the end, we will see what remains. It might well be nothing at all, no support beyond the observation that we cannot *prove* that a God, or Gods, don't exist that aren't *quite* Standard Model Gods (weakening key properties enough to squeak them through the consistency check) so that they *might* exist, but are buried in the Sea of Notions with little reason to believe them in the absence of any solid, reproducible evidence that they really *do* exist.

As pointed out in great detail above, while lack of evidence isn't "certain" evidence of lack, the Bayesian process of reasoning systematically increases the *probability* of lack in the direction of unity the longer the lack of evidence persists. In the sea of notions, one shouldn't actually *believe* any particular one of them more likely than "no good reason to think so, probably false" without some pretty solid supporting evidence that a given notion is *true*.

15.1 Logical Disproofs of Standard Model God

We'll start with logical arguments as they have the greatest force. Basically, these arguments show that the description above of a Standard Model God is *inconsistent* in critical ways and hence *cannot* be true in *any* Universe. The difficulties will usually come from the inconsistency of the “infinite” properties attributed to God – *all*-knowing, *all*-powerful, *perfectly* benevolent. Some are remarkably straightforward. Some are subtle. Any *one* of them is sufficient to prove that the Standard Model God is inconsistent and hence that religions that propose one on the basis of divine revelation in place of evidence are themselves false.

Most of you reading this will have thought about one or more of these arguments yourselves at some point in time in your past, even if you “belong” to a major world religion and spend time every week affirming your belief in spite of the inconsistency and lack of evidence, as an expression of *hope*, a *wish* that your religion is true, that there is perfect compassion and justice and benevolence and knowledge *somewhere* because there damn sure isn't any visible *here* on our flyspeck of a planet in a vast, vast Universe.

If this describes you, you will almost certainly find it to be *enormously difficult* to perform the “autobeliefectomy” suggested in the first chapters, at least as far as your God or Gods are concerned. First, your religion *probably* threatens you with infinite posthumous tortures if you merely *fail to believe in it*, no matter how “good” or “bad” you have been in life according to any major prevailing ethical standard including that of your own religion. The Abrahamic religions, especially, have profited from the “hell meme” used to literally extort belief on the basis of threats. Second, removing the religion would leave a huge hole full of nothing but existential despair where otherwise you could at least *pretend* that it was full – of hope. Hope that death isn't death, that the vast suffering we all experience during life will be redeemed, that no matter how bad your life is now on Earth, if you endure it *and believe*, you will be rewarded with a *perfect, eternal life* – wait for it – *after you die!* In other words, in an utterly safe, impossible to meaningfully test, future where even if you are wrong, at least at that point you will be *dead* and no longer susceptible to the fear of death.

All I can say is try, for now, to reawaken all of the skepticism you have ever felt for your religion. Open your mind. I promise to come back *later* to help you rebuild something to refill that good old existential pit of despair, even refill it with hope. Just not hope that a Standard Model God actually exists, when the proposed model is *inconsistent*. Beware too of cognitive dissonance – the

closing of your mind's eye to the arguments because they propose something that threatens your own self-image, that suggests that instead of being somehow *important* (at least in the metaphorical eyes of Standard Model God) that you, and I, and everybody that ever lived or will live, has precisely that "importance" in the grand scheme of the Universe that they manage to achieve in life *while* they live, and that ten thousand years, or a million years, or ten *billion* years after you've died, when the Sun itself has *also* died and *no two atoms* that once made up your body are still physically connected, we will all be *gone*, unremembered, never to be repeated.

Wow, that sounds so scary! But you *have to stare into the abyss* in order to overcome your fear of it, and in order to free your mind to believe the most that which you can doubt the least, you can't grant a special exception to notions in the infinite sea of possibility just because they scare you or make you feel bad. Yes, we're all going to die. Get over it. Then we can actually think about what we are going to do while we *live*, because it is our choices and actions *in life* that fill the existential pit, day after day.

Ahem. Have you – yes, I mean you, you know who you are – cranked up your general skepticism to the point where for at least today you will *permit yourself* to entertain the possibility that your belief in a Standard Model Creator God might actually be *wrong*? Well, if that is the best you can manage for now ... we'll get back to the task at hand.

The simplest logical disproof uses Gödel's theorem more or less directly, applied to God and omniscience. Here it is.

- God's knowledge must be *complete*, because if there was any true statement concerning either the Universe or Mathematics God did not know, God would not be omniscient. In particular, God must *know as certain truth that its own knowledge is complete*.
- God's knowledge must be *consistent* because inconsistent knowledge of the real Universe *by definition* contains falsehood, again violating the property of omniscience. God's knowledge of everything must be *true*, as false knowledge is not, in fact, knowledge. In particular, God must *know as certain truth that its own knowledge is complete and consistent*.
- God must be able to *prove* the completeness and consistency of its own knowledge or it cannot *know* that its own knowledge is complete and consistent. But given that the body of knowledge possessed by God in Its worldview must be sufficiently complex for it to be able to formulate arith-

metic (if not, this too is a failure of omniscience as even *I* can formulate arithmetic – incompletely) it must then, according to Gödel’s theorem, be *either* incomplete (in which case God is not omniscient as there are true things that God does not know and cannot prove) or *inconsistent* (in which case God is not omniscient because some of what God *thinks* It knows is *false*).

- Worse, since even an *approximation* to Standard Model God, one that knows a *lot* but maybe not quite *everything* must know and be able to prove and understand Gödel’s theorem (not to mention, can generate *itself* all of the arguments in this section), not-quite God must *know* that it is not and can never be omniscient and hence is not, in fact, the one true Standard Model God.
- God(s) therefore *cannot be omniscient*, and *the Standard Model of God is false*, Q.E.D.

Basically, Gödel’s theorem has as a metaphysical corollary that *omniscience is impossible* even in the realm of *pure contingent reasoning*, in **mathematics**, let alone in the much trickier realm of the objectively real Universe. Not even God can know and prove all of the true theorems of effectively generated axiomatic systems at least as complex as that of arithmetic, in particular ones that contain the axioms of arithmetic as part of their basis.

To recapitulate and discuss this argument a bit further, if God can prove the consistency of its own knowledge (presumed to be greater than my own and hence capable of expressing arithmetic), it merely demonstrates that its own knowledge is inconsistent⁴. If it cannot, then it *might* be consistent but God

⁴In order to prove the completeness and consistency of any theory in logic, one has to use higher order logic, but then the completeness and consistency of the higher order logic itself cannot be proven without still higher order logic. No sufficiently complex mathematical theory can be proven to be complete and consistent from *within* the theory, and indeed Gödel’s theorem states that if a theory can prove its own consistency then it is inconsistent! For e.g. arithmetical theories this is no big deal, but there can *be* no higher order, **unprovable** “theory” in the case of an omniscient God – it has been shown that one cannot simply hypothesize an infinite chain of axioms to make e.g. arithmetic complete and consistent with each new axiom “fixing” a problem in the finite set that preceeded it because *its addition perpetuates the problem*.

Incidentally, there are quite a few *concrete cases* of propositions in number theory that *empirically* appear to be true, but that at least *so far* cannot be proven. Things like Wikipedia: [http://www.wikipedia.org/wiki/Goldbach’s Conjecture](http://www.wikipedia.org/wiki/Goldbach's_Conjecture) have no known exceptions out to a very large (and growing) number of empirically tested cases, but are at the very least *very difficult* to prove (or *disprove*) using axiomatic reasoning and obviously *cannot* be proven (if true) by empirical testing of an infinite set. Gödel’s theorem thus far appears to have *actual cases* of

cannot *know* that it is. God, as a supposedly self-aware entity, is bound by *exactly* the same mathematical rules that we are, because God math carried out from a set of axioms isn't any different than human math carried out from the *same* set of axioms, God logic no different from human logic ditto. When God explores self-referential chains of contingent reason beginning from some set of axioms, those chains contain vast tracts of Terra Incognita, not just unknown but in some deep sense *unknowable*. If there exist any unknowable but true assertions about *anything*, then *true omniscience* is impossible and Standard Model God cannot exist.

I can just hear some of you thinking out there – “Well, fine, maybe God can't know an *unknowable* proposition, can't decide the undecidable *even if it is in fact true*, but I'm happy enough believing in a slightly *weakened*, *mostly* omniscient Standard Model of God with these exceptions.” Aside from the fact that this is your Cognitive Dissonance speaking, bear in mind that quite a few of the mathematical *problems* you are allowing into your system of reasoning that must embrace a complete and consistent knowledge of the Universe – like the Wikipedia: [http://www.wikipedia.org/wiki/Halting Problem](http://www.wikipedia.org/wiki/Halting_Problem), to name a specific example – are themselves rather specific assertions of the limits of reason that bleed down into rather mundane assertions of omniscience of a mind capable of *computation*.

This is all rather math-y (sorry! can't help that!). Here's a second statement of this disproof of an omniscient Standard Model God, one that is simpler and more intuitive that doesn't invoke the actual theorems and mathematics of Gödelian knots, stuff that one can all too easily dismiss as a kind of irrelevant sophistry if one really wants to believe in a Standard Model God and is looking for any way out that would allow them to do so. Its fundamental basis can be reduced to one sentence in ordinary English⁵. Here it is:

No sentient being can ever be certain that its knowledge of the Universe is complete and correct.

To put it another way, no matter what a sentient being – one that can “know” something at all in a nontrivial sense – knows, that being cannot be certain that there are not things that exist in the Universe (all that exists) that the sentient being does not know, because if there are, *it doesn't know them!* Further, it may

non-trivial propositions that may well be *true* but that may well also be *unprovable*.

⁵...and yes, it is an English statement that simply encapsulates the first two statements in the more formal proof above, but in a way that ties it to some simple examples from the everyday world and mere common sense, to the Standard God property of *sentience* and to a certain *logical fallacy* that represents the only counterargument.

not be possible, *even in principle*, for that sentient being to *learn* them – they could be knowledge of an existential set disjoint to the set about which it *does* have knowledge, one that the being can’t *see* (or to be more general, has no perceptual link to or direct knowledge of)⁶!

Let’s examine this in a bit more detail. Suppose that something does exist in the Universe of things that objectively exist that some given sentient being doesn’t know about. It’s trivial to find strong examples where *nobody living at the time* knew of something that, nevertheless, existed in reality, waiting to be known: before the invention of the microscope, *nobody* knew that bacteria and viruses existed (but they do); before 1988-ish *nobody* knew that extrasolar planets existed (however much they were imagined without actual evidence by people from Giordano Bruno on, but they do, too). Even today, *nobody* knows whether or not a magnetic monopole exists in reality outside of our imagination and theoretical models – and it *might*, or *might not*. For about 2000 years, it was thought that Euclidean geometry was *objectively true*, at least as an idea, because one could prove it from “self-evident” (if insufficient at the time) axioms, but then along came curved space non-Euclidean geometries (plural intended). Did curved space geometries exist before somebody imagined them and derived them? Which of the many spatial geometries out there, some of which we might not have imagined *yet*, is *true* as in correctly and perfectly describes the real geometry of the real Cosmos in which we appear to live (if any)? Or is “true as in exists as a consistent set of objects and rules in our imaginations”, which is not at all the same thing?

Clearly, our imagination – the sentient expression of belief (in the mind) about *something else* (that may or may not be in the mind) alone is not sufficient for some notion to be considered, or rejected, as probable knowledge, and even our wildest imaginings might not come close to spanning the set of everything that really exists. Let’s consider this further, as this idea applies even to fantasy worlds, alternative Cosmi, and other related things that certainly do exist in our imagination. My favorite example is that no sentient being living “in” a strict subset of the Universe that includes our own Cosmos can ever be *certain* that the Lord of the Rings Cosmos does not actually exist in some *completely disjoint* strict subset of the Universe – a subset that does not interact with the set where our own Cosmos lies in any way, and is hence “invisible” to us by

⁶Note that this is actually true *independent* of Gödel’s theorems, so that this is more than “just” a restatement of the same argument. It is actually more general. Gödel’s theorems only apply to theories that are complicated enough to include arithmetic, but they actually don’t apply to e.g. simple geometry. However, this result applies even to two disjoint real sub-Universes with their own, possibly different, *geometries*.

any and all means. Even if you *know as a fact* that J. R. R. Tolkien wrote the LOTR as complete, unadulterated, made up fantasy containing all sorts of things that almost certainly violate the laws of nature we've deduced for *this* Cosmos, there is no logical contradiction inherent in supposing that it exists in a completely distinct Cosmos that might well have different God(s) and different laws of nature, and the mere lack of *evidence that this is so* cannot *prove* that it isn't. Finally, we should *never* forget the lesson learned from Black Swans – if we have no knowledge of something, some of what we think we *do* know (such as “there are no black swans anywhere on the Earth”, based on a non-exhaustive *sampling* containing only what what we've looked at *so far*) is *incorrect*.

In other words, this is an *important* epistemological and logical axiom. To deny its truth is essentially the assertion of a well-known logical fallacy, that lack of knowledge is knowledge of lack! This is all literally ancient news – it dates back to at least Plato's Parable of the Cave, discussed in a previous chapter. Any sentient being's *innate* knowledge – to the extent that any such thing exists – is what it is, and could be complete or incomplete, in a precisely accurate correspondence with (or a perfect map to) the objects of that knowledge – or not. Its *acquired* knowledge is necessarily limited by the range of its perceptions, which might be large enough to include everything that exists – or not. That being can never be logically or empirically certain that its perceptions and innate knowledge include all that there is to perceive or know, or if there are hidden worlds, hidden dimensions, that are *truly hidden* from its perception and of which it *as no* innate knowledge, ***but that are real nevertheless***.

Clearly there is nothing logically contradictory in this assertion – indeed, to claim otherwise is to legitimize a *named relevance fallacy*: the ***argument from ignorance*** – but this time on behalf of a hypothetical Standard Model Deity. *Lack of knowledge is not knowledge of lack*. All thinking, knowing beings are necessarily blind to their own blindness, ignorant of their own ignorance, and permanently *in error* as to their own state of knowledge if the two simultaneously occur (so they don't “just know it” and can't “see” it to learn it). No matter how much knowledge one *thinks* one has, no matter what the source of that knowledge, not even if one makes up a laughably inconsistent special exception and name it something like “transcendent knowledge” that is true even though it isn't provable and makes assertions that *by definition* aren't empirically verifiable (as I said, I can hear you thinking out there...) one cannot transform even a vast, possibly *infinite* body of knowledge into certainty that there isn't any leftover real “stuff” that one knows nothing about because not even “transcendent” knowledge can know that it is transcendent over *everything*. How could it

be? You can be as unprovably “transcendentally certain” as you like that you know *everything or anything* and still be *wrong!*

This is so obvious (and should have been obvious even before Gödel’s time) that it is surprising that as far as I know, it has never been used as an argument against omniscience in the past, but with it in hand, it is surprisingly simple to do so now and hopefully you can already see that it is correct and true. But let’s examine it in more detail and lay it out explicitly.

To build the argument, we need to add in one more assumption from the Standard Model: that ***God is necessarily a sentient being***. If God doesn’t *think* and have *perception* and *know things* – if God is not *self-aware* as well as *aware of others* – then it is not a Standard Model (dualistic) God. Indeed, sentience is a critical property of a God or Gods even in religions that are *not* of the Standard Model, from simple spiritual animistic faiths up through the complexity of the polytheistic myths and beliefs of the ancient Norse, Greek and Roman religions and Hinduism.⁷ Let’s transform these two simple statements just a tiny bit and arrange them in bullet points with a few others and see what we get:

- A Standard Model God *must* be omniscient, and such a God would know with *complete certainty* that – among all other things that it knows with equal certainty – its knowledge of the Universe is complete and correct.
- A Standard Model God *must* be a sentient being.
- No sentient being can *ever* be certain that its knowledge of the Universe is complete and hence correct.
- A Standard Model God therefore *cannot* be certain that its knowledge of the Universe is complete and hence correct. Indeed, even

⁷It is precisely this which differentiates the Universe itself as a nonthinking entity that “just is” and is even “omniscient” in that it is its own tautological self-representation (absent a mind) and a “thinking” self-aware Universe that is also God, a Pandeity. We are absolutely certain in our ongoing empirical experiencing of “something” that exists that the Universe – defined to be the set of *everything* that exists – exists, and consists *at least* of that part we can directly perceive and make inferences about within our own Cosmos. But we do not usually worship the Universe per se as God because we don’t think of rocks and empty space and stars and moons as being sentient (specifically, we utterly lack any model for a sentient rock or evidence that rocks and empty space and stars and moons *are* sentient). Pandeism adds the hypothesis that the Universe *is* nontrivially sentient or that a sentient God died to become the nonsentient Universe that it planned out while sentient but these don’t suffice to eliminate the problem.

a God with no more knowledge than I have has to *know with complete certainty* that it can never be certain that its knowledge is complete and correct.

- Therefore, any proposed model for God cannot possess the traits of *both* omniscience *and* sentience; in particular no Standard Model God possessing both of these traits can exist, Q.E.D.

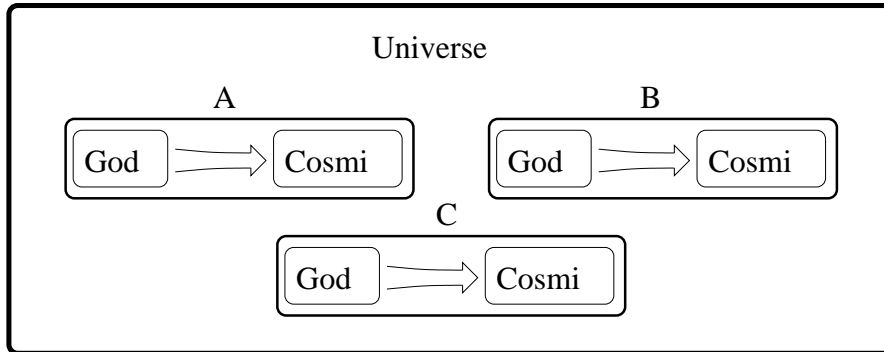


Figure 15.1: A Venn diagram showing a possible Universe (which could be an open or closed set of any cardinality you like) that contains three non-intersecting sub-Universes: A, B and C.

Let’s visualize this. In figure 15.1 a schematic Venn diagram is presented of a hypothetical Universe – the Universal existential set of everything that exists. This Universe has three sub-Universes (strict subset of the Universal set) labelled A, B, and C. In each of these sub-Universes there exists a creator God that possesses all – or well, most, to the extent that they can be made consistent – of the properties of a Standard Model God *in its sub-Universe* along with the one or more Cosmi these Creator Gods have Created. However, each of the three Gods in this diagram is completely unaware of the existence of the other two, because their sub-Universes are *completely disjoint* and do not interact in any way and are hence imperceivable one from the others.

Clearly God_A , God_B , and God_C are, as far as they *themselves* know or *could* know, Standard Model Gods, creators of all of the Cosmi in their individual sub-Universes, but from our “elevated” point of view we can see that they would each be mistaken were they to do so. The sub-Universes could easily be different in many ways, possessing “Gods” that significantly differ in their ethical behavior. Their Cosmi could operate under very different rules. “Life”, created or not, could be enormously different across the sub-Universes or the Cosmi within the

sub-Universes or, for that matter, on different planets at different ages within *one* Cosmos in *one* sub-Universe. The point is that with absolutely no interaction and communication in between A, B, and C, *not even the Creator God_A* within universe A could be certain that its own knowledge *was* complete and exhaustive and its omnipotence “perfect” because they could *never* rule out the possibility of a larger Universe in which their entire experience and knowledge of Universe_A is but a disjoint subset

Let’s anticipate an objection and quash it before it gets off of the ground. Suppose that one rejects the idea that any of these supposed Gods are *the one, true, God of the Universe*, so that my figure above is simply missing a God inside of the big box. All of these other small-box Gods aren’t God, they are gods (lower case), devils, angels, or simply deluded, mistaken *space aliens* from the A, B, and C dimension sets. Inside of – or better, *outside* of the big box there should be a *single* God with a capital ‘G’, one that made the box and all of its contents (right down to make gods with a lower-case ‘g’ that mistakenly *think* that there is no higher-order God, and hence fail to worship It, and will one day be consigned to god-hell for failing to understand that they were created by God a notch up.

Leaving aside the issue that when we draw the box labelled Universe, *there is no outside* so that if God exists at all, God must be inside of this Venn boundary (and might be all or part of the set itself) and could not possibly have created the set itself as a consequence, let us note that introducing a recursion of this sort does not fix the problem, not even when one hypothesizes that it can run off to infinity and it is *that limit*, the *infinite limit* God that is the *real* God, and all of the lower limit gods are just plain old lower case ‘g’ at best. Why not?

Because this limit does not exist. It’s as silly as asserting that there is definitely a largest real number, an actual number such that all numbers are less than this number. No matter how large a number you postulate in the recursion, not only are there larger numbers but there are (always) an *infinite number* of larger numbers because the word infinite represents an idea of unboundedness, and the symbol ∞ does not actually represent a number, not even when it is axiomatized and given its own special rules in arithmetic.

This actually explicitly refutes Anselm’s Ontological argument for God. For those who haven’t played the game, here is Anselm’s argument in a very condensed form:

- It is a conceptual truth that God is a being than which none greater can be imagined (that is, the greatest possible being that can be imagined –

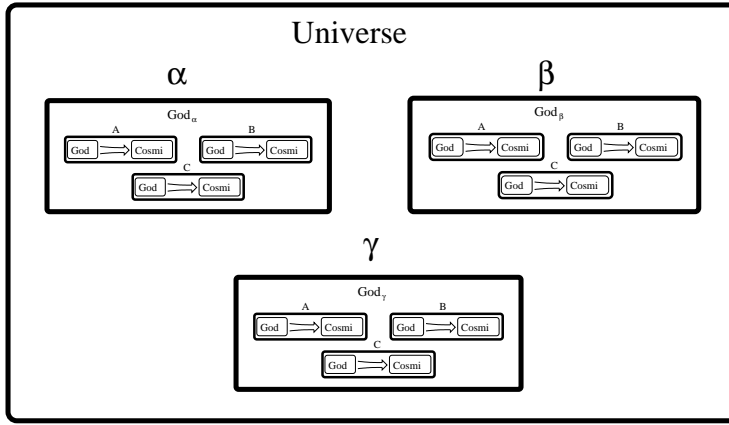


Figure 15.2: A Venn diagram showing a possible *recursive* Universe (which again could be an open or closed set of any cardinality you like) that contains three non-intersecting sub-Universes: α , β , and γ , each with their *own* Gods, who in turn have created and are responsible for three sub-sub-Universes αA , αB , αC , βA ,... each with its own God and its own various Creations (each of which could have its own God and sub-Creation). It is hopefully obvious that the Universe could be larger still so that this box isn't the Universe but only a part of it, embedded in a still larger Universe.

hence the Standard Model with all of its infinities, to the extent that we can imagine infinity).

- Standard Model God exists as an idea in the mind. Fair enough. I even wrote an explicit definition of such a God above, something St. Anselm never did, or considered. That was a near-certain way to end up being burned to death by your own religion, back in the day.
- A being that exists as an idea in the mind and in reality is, other things being equal, “greater⁸” than a being that exists only as an idea in the mind.
- Thus, if God exists *only* as an idea in the mind, then we can imagine something that is – ahem – greater than the God we are imagining, something with all of the mental properties we invented and ascribed to a model of God that *does* exist.
- But we cannot imagine something that is *greater* than God (for St. Anselm, at least, thinks that it is a contradiction to suppose that we can imagine

⁸For a meaning of greater that doesn't, actually, mean greater than in any way related to its usage in logic or set theory...

a being greater than the greatest possible being that can be imagined, a thing that would have made Cantor and generations of mathematicians afterwards quite sad).

- Therefore, God exists.

I won't bore you with all of the many ways that this (in my opinion) ridiculous argument has been justly mocked and attacked over the thousand-odd years since this was written down, the simplest one being that ideas in our mind may or may not correspond to reality in any way whatsoever because the map (in our mind) is not the territory that the map claims to represent and we can easily invent maps corresponding to no real territory and there can easily exist real territories with no existing map. I will even grant the existence of an idea of "greater than", although such a simple statement is an *axiom* requiring very careful specification, not at all trivial *even in arithmetic*. I will simply rewrite the argument with one small change:

- It is a conceptual truth that infinity is a number such that no greater number can be imagined (that is, the greatest possible number that can be imagined).
- Infinity exists as an idea in the mind.
- Infinity that exists as an idea in the mind and in reality is, all things being equal, greater than infinity that exists only as an idea in the mind.
- Thus, if infinity exists only as an idea in the mind, then we can imagine something that is greater than infinity (that is, a greatest possible number that does exist).
- But we cannot imagine a number that is greater than the greatest possible number (for it is a contradiction to suppose that we can imagine a number greater than the greatest possible number that can be imagined.)
- Therefore, infinity exists.

Somebody should let all of those set theoreticians know that they *no longer need an axiom of infinity* in Zermelo-Fraenkel set theory because Anselm *proved* that infinity exists "in reality" just because we have an idea of infinity in our minds. Which is another way of saying that this argument is obviously absurd, *even when applied to something comparatively simple, like numbers!* Look at its

statements. The first and foremost error is in the very first statement. Infinity is not a number at all, let alone a number so large that no *greater* number can be imagined. It is the idea that ***no such thing as the greatest number that can be imagined exists!***⁹ If that isn't blindingly obvious and sufficient, we might also note that ***no number actually exists "in reality"*** (as opposed to as an idea in the mind, a.k.a. an axiom!) and hence asserting not only the existence of infinity but its existence as an element of an explicitly *ordinal* set of real things *outside* of the mind is sheer nonsense. And so it is with God.

No God can ever be certain that they are God, because for *any* unitary being that imagines/believes itself to be God, it can *always* be the case that it is merely embedded in a disjoint sub-Universe, a subset of the *real* totality of all that exists, and hence is mistaken. Presuming that any being with enough hubris to believe that they *might be* God is smart enough to recognize this fact, if God knows anything at all, God knows that God is not, and cannot be, an omniscient, sentient God because it cannot be *certain* that its knowledge is complete.

Anselm's entire proof is a prime example of a named informal fallacy, the "Mind Projection Fallacy"¹⁰. With numbers, one can be forgiven for *imagining* an unbounded sequence of numbers and naming the *idea* of its unboundedness "infinity", because numbers exist only in the realm of the imagination and mind in the first place – there is nowhere in the Universe of things that have real objective existence where one can point to "the number 1"¹¹. The mental constructs of arithmetic turn out to be *useful* in *describing* (building a mental map of) our sensory experience and the Universe it presumably reflects, so useful that we can easily confuse our counting of real-world pennies (see below) with evidence that "numbers really exist", but in the end asserting that "10" really exists is like asserting that "big" really exists or "one meter" really exists.

⁹Not even if one "makes it so" with an axiom. Infinity, I repeat, is not an actual number, it is an *idea* representing the unboundedness of *some* of the various sets of numbers that we have *invented*, and requires us to invent equally case specific rules for its manipulations – e.g. $\infty + n = \infty$ for any finite or infinite number n , $n * \infty = \infty$ ditto, *except* for $(n = 0) * \infty = ???$ (no kidding, the value depends on how one takes *limits*, key to the invention and utility of *calculus*), etc.

¹⁰Wikipedia: http://www.wikipedia.org/wiki/Mind_projection_fallacy. This occurs when someone thinks that the way they see the world reflects the way the world really is, assuming the existence *in reality* of objects that one is *imagining* within the mind. You can visualize, deduce, infer, or otherwise *imagine* a God or a pink unicorn or Santa Claus or black swans all you like, but that doesn't affect the probability that your imaginings are, or aren't, objectively *true*. The best we can manage is reasonable congruence of our imagination as a map with our overall sensory experience of a *presumed* real, external, objective reality.

¹¹Making the number 1 into *the loneliest number that you'll ever do!* See: <https://www.youtube.com/watch?v=d5ab8BOu4LE>. Damn! Did't see that coming, did you!

Now consider *God!* Even if one grants that God *does* exist as an idea in the mind – something that is by no means obvious since just because a word exists and is used in certain ways doesn’t mean that one has any real understanding of what it means¹² – where is it written that things in the mind have *any necessary connection at all* with things in reality? Nowhere! What is “written” – learned by extensive experience – is exactly the *opposite*, much of what we believe is *wrong*, and our beliefs are *vastly incomplete* as our minds and experience have *extremely finite limits*. Maybe *some* of the ideas in our minds are true, maybe they aren’t, ultimately this entire book is about doing our actual best to sort out which is which, but never forget that *the maps in any ‘mind’ are not the territory being mapped, even if the territory being mapped is the mind itself!*

Where is it written that the term “greater than” used as a comparison operator, as in “ $A > B$ ” is either true or false when comparing two things in *completely distinct domains*, such as the imagination and reality? Which is greater, the axiomatic theory of arithmetic *in my mind* or the lack of any *reality of arithmetic* in the real world? Is the idea of seven meters *in my mind* greater than, less than, or equal to seven meters *as a measured distance between two observed objects in the real world*? Is a generic watermelon I’m imagining *in my mind* greater or less than a tiny grape *picked from an actual grapevine* but that I only know of from sensory impressions *in my mind, right alongside the watermelon*? Whoa! Even my knowledge of generic watermelons is derived from prior sensory impressions and experiences that happened (I believe – in my *mind*) – at previous times (that I *seem* to remember – in my *mind*) and that I’m simply *hoping* are an accurate mental map of real world territory corresponding to contemporary “watermelons” just as I’m *hoping* that I’m not hallucinating the grape because of the LSD somebody might or might not have slipped into my coffee this morning or the result of a computer-generated image being presented to my naked visual cortex, no actual eyes involved, while I’m really just a power unit in the Matrix...

Mind projection is evil stuff because in some sense, all of our experience and beliefs about the world *are* mind projection – a map hypothesized to correspond to real territory – and it is *only by practicing the most rigorous of empirical and logical and statistical discipline* that we can at least *optimize* our state of ignorance in a defensibly consistent way and avoid being swept out to drown in the sea of Notions.

Before continuing, it is worth pointing out one more amusing consequence of the possible sequencing of disjoint realities illustrated above in figure 15.2.

¹²Infinity in general being an excellent example, as we’ve just seen, but there are *lots of others!* For example, consider the humble *Jabberwock!*. Just how many toes does it have, again?

Note well that $\text{God}_{\alpha A}$ was *itself* created by God_{α} , and let's imagine that God_{α} is just as elusive to $\text{God}_{\alpha A}$ as $\text{God}_{\alpha A}$ is to created beings in Cosmos 1 in sub-Universe αA (which might as well be us, since the labels are arbitrary). That is, the God/creator of *our* Cosmos can't be certain that it itself wasn't created by some other higher order God, say God_{α} , whether or not there is any evidence pertaining to the question either way – lack of evidence isn't, as carefully noted, evidence of lack. Does this God then necessarily spend lots of time *worshipping* God_{α} as its (possible) Creator, even when it might not exist? Does it worry about being thrown into Hell_{α} at some point (perhaps because it did some *pretty horrific things* in Cosmos 1, sub-Universe αA like screw this Cosmos up to the extent that it (for example) had to *drown most of the people on Earth like rats* at some point because they supposedly weren't ethically up to the standards expected by God_{α})? Does it know about $\text{God}_{\alpha B}$ and its sheaf of Created Cosmi, but not about $\text{God}_{\alpha C}$? Does lower-case $\text{god}_{\alpha Aa}$ (the game programmer(s) who built e.g. World of Warcraft with all of its non-player characters, as a plausible model of a contemporary sub-Cosmos $_{\alpha Aa}$) morally judge the good and evil non-player characters, or for that matter the human game players, and condemn them to a virtual hell or elevate them to a virtual heaven if they fail to virtually worship The Programmers of the Game?

Hopefully this makes it pretty clear that an Omniscient, Sentient God is actually impossible and really, a pretty absurd idea. In fact humans do *not* have a good mental “idea” of an omniscient God, because omniscience itself is an impossible, self-contradictory property. If any being is *certain* that it is omniscient (or if any being alleges the existence of another being that is certainly omniscient), it is without any doubt mistaken because it *cannot* know for certain that it is omniscient, and neither can any *other* specific being. If it knows this and hence knows that it *might* not be omniscient, well then, it knows that it is *not*, in fact omniscient because this (whether or not it is *otherwise* omniscient) is a possible near-infinity of true things that it doesn't know. Once again, if the frog claims to always tell the truth, all that you really know is that it *almost certainly* at least sometimes lies.

Next, let's offer a very simple formal proof that a Standard Model Creator God is impossible, using set theory in a *different* way from the way we used it above.

Let us assert that the empty set \emptyset is a reasonable set-theoretic definition of “nothing”. It's not clear that this is quite true – the “initial state” assumed by the assertion of a Creator God appears to be $\emptyset \equiv U$, that the Universe is this empty set, that nothing exists, but we have *already* defined U to be the Existential

Universal set – everything that really exists in a “time-independent” way where past and future existence are just as real as the present, so this statement would require that nothing existed, exists now, or will ever exist independent of all time-like dimensionality, the “nothingness” of a complete lack of existence of anything, anywhere, anytime, *including God*, which throws out a rather large baby with the bathwater. But this baby was never in the bathwater in the first place!

The question is whether or not it is *possible* to consistently assert the real existence of a dynamical agent G such that¹³:

$$G : \emptyset \implies U$$

in an ordered (causal) relationship, or (in English) that a God transformed *nothing* into the *Universe*. This is precisely the belief of the Abrahamic cluster of religions. Indeed, it is their core belief that a Universe *cannot exist* on its own, that it *requires* a Standard Model God to create a Universe *ex nihilo*, from nothing.

The problem, of course, is that¹⁴:

$$G \subseteq U$$

by definition, at least if God *exists!* Furthermore, one is assuming that God is an *active dynamical agent* in an *ordinal process* – before, no Universe, after, a Universe. But a dynamical ordinal process – “cause and effect” – requires a *real ordinal dimension!* But real ordinal dimensions – space, time – are again already “something” or the concept of precedence and cause have no referent to measure/observe and hence establish order. $G \subset U$ ¹⁵, as is the ordinal space/time implicit in dynamical cause/effect relationships. which is sufficient to demonstrate that¹⁶ :

$$\nexists G \subseteq U | G : \emptyset \implies U$$

Q.E.D.

¹³Sigh. Let’s translate this into English. “There exists a (God/dynamical agent) that transforms nothing into the Universal set” in mathematese.

¹⁴“God is contained in, or is all of, the Universal set”. God is a *subset*, or possible all, of the Universe.

¹⁵A Standard Model, Creator God is a *strict* subset of the Universe, as time has to exist outside of God in order for God to “do” something in time. Like initiate Universes out of nothing, *not even space or time!*

¹⁶“There cannot exist a God contained in or equivalent to the entire Universe such that this God created this *same* entire Universe in a time-ordered sequence out of a prior nothing/lack of any Universe at all.” by the way. It’s just a slightly more compact notation.

This is a rather simple proof that - and here is where English words are slippery things - it is not the case that there ever existed any real thing (Standard Model God) that created the Universe out of nothing (the empty set) because in order for this to happen, the Universe, consisting *at least* of the God and the time-like axis of the ordinal dynamic process used, had to *already* exist (“before” the creation act along that ordinal time-like axis) as a part of a *non*-empty Universe. This proof can be made to sound pretty one-liner-slick in English if one states this as “Nothing exists that made the Universe appear from Nothing¹⁷”. To the extent that this is a sensible arrangement in *logic* it merely equates

$$G \equiv \emptyset$$

or in English, the hypothetical God we assumed turns out to be *nothing*, drawn from the “set of things that don’t actually exist” (which is the empty set, don’t be fooled by the language, we’re talking *existential* set theory here, not *imaginary* set theory, we need real pink unicorns, not pink unicorns in my imagination).

Now, let’s be fair. What the creation mythology of the Abrahamic really asserts is *not* that God created The Universe from nothing. Indeed, if you read Genesis and take it at face value, it is clear that they believed that there were many gods, that there already existed a “deep” and motion, a literal description of an entity that moved above the waters of an already existing, flat, dark, primordial sea. The real problems are latter-day additions as it has become empirically *as certain as it is possible to be about anything* that Genesis doesn’t describe the actual early events associated with the inflation of the *real* Cosmos we live in even as a halfway decent metaphor. Rather than simply accepting that Genesis, as a plausible creation hypothesis, is utterly contradicted by literally all available evidence, the world religions with Genesis as the basis have turned to *hermeneutics* and *exegesis* – basically weaseling the words so that they *might* be construed as perfectly true *even though* they are obviously perfectly false by turning them into metaphor or “interpreting” them so that they magically describe what we actually observe and then, presto-change-oh, somehow become evidence that Genesis is actually *perfectly true*¹⁸!

¹⁷...because the Universe is defined to be everything anywhere that actually existed, exists, or will exist, so the intersection of a Universe and Nothing – capital ‘N’, meaning that *nothing existed, exists, or will exist, with no ‘where’ to exist in* – is a simple contradiction. That makes the sound bite, however attractive, slightly incorrect, as it seems to imply that the empty set, as a strict member of the Universe that somehow ‘exists’, is itself responsible for “making” the actual existing Universe appear out of Itself. The Universe as we have defined it *cannot* appear or disappear, as it is *existential* and *independent* of spatiotemporal dimensions.

¹⁸My favorite is the assertion that “God time” and “human time” are different, so that what

In order to preserve the model of a creator God *and* the Big Bang, they assert that it is *logically necessary* that the Cosmos, arising from nothing (*ex nihilo*), has to have a *cause*, because *everything that exists* (but God, the special exception) had to have come *from something* – nothing (but God) can come from nothing.

This last statement, quite obviously, is the fundamental inconsistency. It is, quite simply, not the case that *anything* in the existential Universe could have caused the existential Universe itself to exist, so there is no need to assert a cause for our particular Cosmos on any *logical* grounds. If God can “just exist” as all or part of the Universe without the need of being created from nothing, then the Cosmos could just as easily “just exist” as all or part of the Universe without the need of being created from nothing.

Let’s also be fair *in the other direction!* Of the two things being discussed, God and the Cosmos, we directly observe the Cosmos and are pretty sure it exists. We do not directly observe God and have no evidence that God exists, because – in spite of the fact that this is really what the Abrahamic religions are striving to have you accept – *the Cosmos itself is not evidence!* The logical argument “Only God can make something exist. Something exists. Therefore God exists.” is not a valid *proof* as it *begs the question* in the first (axiomatic) assertion. Why should we believe that only God can make something exist, that the stuff we experience is created? It isn’t even consistent, as God couldn’t have made *God* exist without already existing, uncreated, so clearly things *can* exist without being created. Finally, we can look back in time (as we look ever farther away) and *observe the direct consequences* of the Cosmos bursting into an expanded existence without any evidence of a “creator” or plausible model for creation in the Big Bang¹⁹.

This formal demonstration then has two agreeable results. First, it shows that no Standard Model God could exist that created the ***Universe*** out of nothing, because for a suitably defined Universe the statement itself is horribly inconsistent and hence utterly meaningless. Second, it kicks the legs out from

took God six ‘days’ took 13.7 *billion years* in *our* time. Next step: Inventing an explanation for just how God made pretty much all of the plants *before* he made the Sun and the Moon, something that requires reordering of time-ordered events even on this distorted, ridiculous timescale!

¹⁹Note well that I am not asserting that the “stuff” that makes up the visible Cosmos actually *came into existence* during the Big Bang. We do not know the initial state except by extrapolation of various lines of evidence, and may *never* know that state as it is hidden behind, well, a Cosmos-spanning explosion that has expanded cooled, and condensed for almost fourteen billion years.

underneath any attempt to claim that any particular part of the Universe *requires* an external cause that *created* it out of *nothing*. Let me state this as clearly as possible: ***It is not the case that the mere existence of the Cosmos (as opposed to nothing) requires an external cause*** because ***nothing in the Universe can be caused by something that is not in the Universe*** (as a result of our cleverness in defining the Universe correctly as everything that independently exists in a time-independent way). All of our knowledge of causality is obtained by observations *within* the ordinal space-time of the Cosmos, and we never actually observe something coming from nothing. We have no reason to believe that nothing can ever be transformed into something. The only model we have for such a process – a magician pulling a rabbit from a hat after tapping it with a magic wand – is *magic*, direct violation of every single one of the physical principles we observe to hold in our Cosmos.

There is, perhaps, no direct harm in us believing that such a process is possible. It is an enormous part of our wish-fulfilling collective cultural mythos, the ultimate in undeserved rewards, Aladdin's Djinn making a palace appear from nothing on a hilltop in a twinkling of an eye. But it is a *child's* belief. As human civilization proceeds towards adulthood (a process I devoutly hope is occurring fast enough to keep us from destroying ourselves before we get there, little children playing with nuclear fire) we need to put away the childhood beliefs of our species, our myths and fantasies, and face the fact that Standard Model God is *magic*, no more likely than a real magician pulling a real rabbit out of the nothingness inside an empty hat – something you wouldn't believe if you saw it happening before your eyes if you are older than seven and not an idiot. At the very least, you would demand an enormous amount of evidence that the magician in question didn't really just have a rabbit up his sleeve, in a false bottom of the hat, under his cloak, inside the table, hidden by smoke and mirrors, or any of the many ways of crafting the *illusion* of rabbit-creation *ex nihilo* inside an ordinary hat before *ever* believing that the magician actually worked real magic.

Now, let's do another proof of the inconsistency of the omni properties in the Standard Model by examining them two or three at a time. Let's think about free will. Here's a nifty argument:

- God is omniscient so it knows exactly what has happened, is happening, and will happen, not just in our Cosmos but in the Universe as we have formally defined it.
- God *cannot* change its mind about what has happened, is happening, or will happen in the Universe, or its prior knowledge

would turn out to have been false and the God in question would not be omniscient!

- In fact, God cannot actually change its mind about *anything*. If omniscient, God does not have a volitional mind that functions *in time*, capable of reactive time-dependent *change* in response to events in the time-ordered Universe! Standard Model God is *inconsistent*. Q.E.D.

Furthermore, in the latter case, *no other entity in the time-ordered Universe has free will* as their actions are entirely predetermined by Standard Model God, built into the Universe as a whole according to Its sole design. The inhabitants literally cannot choose to do anything other than what they were programmed to do without falsifying God's prior predetermined perfect knowledge!

This is also an argument best given with an example. Standard Model God *knows* that It will not manifest Itself as (say) a burning bush in my living room in *this* Cosmos in the next few minutes (perhaps providing me with some actual evidence that I'm mistaken in my conclusions) while I type this line about it not manifesting itself (It didn't). It cannot *now* make the burning bush have manifested itself in the past after all, because if it did it would have been *mistaken* about its prior knowledge of the events of the (now) past few seconds when the bush failed to appear.

Omniscience and omnipotence, taken together, are *inconsistent* with each other and the axiomatic property of volition. An omniscient and omnipotent God quite literally cannot ever *change its mind* about anything at all, and in the process ceases to be omnipotent in any useful sense as well. An omnipotent omniscient God cannot *choose what it will become or what it will do* because at no time did it not *know* all of that. It can only *be what it is*²⁰.

At any instant of "God-time" (a hypothetical but *mandatory*²¹ time axis along which Standard Model God *with* free will and volition can experience dynamics and make changes and build Cosmi with their own independent time axes), it has to know all of its choices in all pasts of all Cosmi (including its own God-space if any and God-time), all presents (including its own God-space-time)

²⁰That is, it has no more free will or self-knowledge than the Universe itself does. In fact, God becomes *indistinguishable* from the Universe which, after all, is "omniscient" by virtue of *being* its own state and omnipotent in precisely the sense that it *is* the proximate cause of all events in its braid of intertwined causal physical law...

²¹"To change" means explicitly "To change with *respect to something*" – for example, time. Lest Newton's invention of calculus turn out to have been in vain...

and all futures (including its own God-space-time). It cannot *change* any of its actions as a *function* of God-time as they aren't *choices* to God, those actions in toto are the immutable Universe itself about which it *always* has perfect knowledge. Free will – including Its own – utterly disappears. The answer to all why questions becomes – because ***that's the way the Universe is in a time-independent way*** and humans literally don't have a *prayer* of influencing it in any way whatsoever. In this case the uncaring, fully automatic Universe and God become essentially indistinguishable, and in any case our own free will becomes an illusion permitted only by *entropy*, our own fortunate *lack* of perfect knowledge of the future that permits us to choose, and choose again, and choose again as agents simultaneously discovering and navigating an imperfectly and mostly *unknown* terrain.

Let's examine this same issue again a different way, and see *how* Universal omniscience is inconsistent to get a *fourth* formal disproof of Standard Model God. This disproof examines the *information theoretic* implications of omniscience. This is a somewhat “math-y” disproof, but it is *absolutely irrefutable* precisely *because* of that.

To start, if God is omniscient, then God's mind has no missing information about either itself or anything else. In the language of physics, we would say that it has *zero entropy* because one interpretation of physical entropy is that it is the *log of the missing information* required to perfectly specify some physical specific system's microstate within some incompletely defined macroscopic state. Note well that this definition is independent of physics per se – it also arises in *information* theory and in discussing omniscience we are speaking of *information entropy*, the log of the information required to decode some *specific* message that *is* encoded out of the vast number of messages that *might have been encoded* within the capacity of some particular set of “information storage”. In fact, the reasoning we are about to use applies to *any possible* physical system, or information processing system, or system *period* that has state information – “something to know” – that is a particular combination of possibilities drawn from the set of *possible* states of the system. Zero entropy is a *very special condition in either physical theory or information theory* where *there is no missing information and the state of the system is precisely known*.

We must confront a small problem, of course. This is supposed to be a *simple* book that is *easy to understand* even if you've *never heard of* information theory or Shannon's theorem or maximum entropy and so on and so forth. So in order to communicate the proof, I'm going to have to teach you a bit about how information theory works in a very simple system indeed, one that you can

actually play with.

Here, in very simple terms, is how information theory “works” to describe the *encoding of information in some structured representational space/system*. Let’s consider a toy “representation space” consisting of binary numbers with a certain number of binary digits, or bits. For example, a 1 bit space can represent only two states as it has only two distinct possibilities, 0 and 1. A 2 bit space can represent four states as it has four possible states to assign in the representation: 00, 01, 10, and 11.

Note that these bits are themselves *not knowledge*. In the abstract sense, knowledge is one thing *standing for something else, a map which is not the territory*. To make a model of knowledge, then, we need *both* the bits *and* something else they can stand for, such as four integers *represented* in binary as: 0 (00), 1 (01), 2 (10) and 3 (11); or four fruits *labelled* with a binary pattern unique to the fruit, say: apples (00), pears (01), oranges (10) and bananas (11).

Extrapolating this a bit, there are eight distinct, ordered, three bit states in a three bit “memory” and again we can make the bit combinations *represent* any eight distinct things, a four bit state space can represent 16 distinct things, and so on.

Tedious as it is, let’s establish eight things to be represented in a three bit space – that’s plenty to get the key point across, but we do have to work this out patiently to get to the punch line:

$$\begin{array}{cccc} 000 = a & 001 = b & 010 = c & 011 = d \\ 100 = e & 101 = f & 110 = g & 111 = h \end{array}$$

We are going to pretend that these letters “exist in reality” as irreducible real objects in the real Universe rather than as ideas or peculiar shapes projected onto your retinas by a chain of irreducible real causes and events governed by the Laws of Nature that haven’t a hint of “a-ness” about them at all, although not much is lost if we permit them to be what they are – the (distinct!) *ideas* of the letters a, b, c...h.

Now we are going to try to “think” about the “real” letter a using the memory of a very special “brain” – one that has only three bits, but since the letter a is real, external, and perhaps is carved out of wood and sitting on your mantel, our 3 bit brain will only be able to *think* about it in terms of its symbolic representation, 000. Ready? Set? *GO!*

000

You see what we did there? We brought not *the actual letter a* into our very limited “minds”, we could only bring its *symbolic encoding* in. But no worries. After all, 000 stands for a, so we thought of a. Didn’t we?

Only for a meaning of the word think that does not, in fact, mean think – so far – but which is absolutely certainly, beyond any doubt, a critical *component* of anything resembling thought. For example, the computer you may or may not be using to read this book is hardly a thinking genius, but to store and retrieve all of these *English* words I’m writing (which may well have been *recoded* into other languages by the time you read them) it (probably) uses a somewhat fancier binary encoding of *all* the letters in the English language, one that used to use seven bits – 128 distinct patterns of 0 and 1 – with room for all the letters both lower and upper case, all the digits, all of the usual typewriter/punctuation symbols used in ordinary English writing, and with enough leftovers to handle computer and formatting things like spaces, tabs, backspaces, and where to break lines to make paragraphs and pages.

In this seven-bit system, known as ASCII²², the letter ‘a’ is represented not by “000” but by “1100001” (the base 10 integer 141, in another way of interpreting the ordered 7-bit string in base 2 binary). The actual *storage* of the letter ‘a’ in a place from which it is retrieved and eventually written as dots on the screen in the familiar pattern you are reading involves *using electrical energy to pump a particular pattern of charges into a highly structured chunk of actual physical “stuff” inside the computer!* None of which looks at *all* like an ‘a’ until at the very, very end, and the computer *itself* has no concept of ‘a’-ness as a symbol used to encode actual *language*!

We pause to marvel at the self-referentiality of our problem. What does that even *mean*, to ‘store a *representation* of some kind of *information* about *something in the real world* as “000”’? 0 is *itself* a symbol that stands for stuff, not a real object in the real world with the real property of real temporal persistence in obedience to real physical laws. We cannot store symbols, symbols are abstractions that must be stored! Using the Laws of Nature (physics, chemistry and so on) we can only generate arrangements of objects, stuff in the real world, arrangements that *last for a while* (that’s the storage part) and/or *evolve in*

²²Wikipedia: <http://www.wikipedia.org/wiki/ASCII>. Actually nowadays it is more likely in Unicode, an *extension* of ASCII, where it is still – mostly – 1100001 but with more stuff tacked on.

time in predictable/controllable ways (so we can *see* the arrangement to get the information back later and *write it into the stuff or switch it around later* as required). This is just as true for the human brain – our only example, so far, of sentience capable of significant symbolic reasoning – as it is for the computers we use to augment our very limited natural capacity for information storage and processing in those brains.

What real world objects actually encode *this specific* letter $\Rightarrow \mathbf{a} \Leftarrow$ (presuming you are viewing it on some sort of computational device screen, as opposed to some ink stuck to some paper somewhere on a page)? Somewhere inside your computer there is a real chunk of stuff (most likely) composed of a mixture of silicon alloys and oxides. When real electrical signals of a certain kind made up of real electrons hit it, the voltage across two points in the chunk really changes by a couple or so volts. When other real signals hit it, it sends different signals running down a line that leads to still other real chunks of real conducting and semiconducting metal. Note that nowhere in all of this is a **zero** or **one** to be found, let alone *the letter a*!

The “0” in an actual computer memory refers to a *reference voltage* in this chunk of stuff (which can in principle and to some extent in practice be any voltage you like, since voltage is defined in physics *relative* to a choice for ground) that can either be *written* to it in such a way that it persists in that state, stably, for a *time* (basically storing the information for that time) or *read* from it at any time within that window²³ by – still other signals that are basically nothing but voltage changes, but all carried by *real stuff* changing in *real time*, not “symbols” at all. Symbols are what we invent when we want to think about all of this real stuff in a *mental simulation* of it, in a *symbolic map* that exists, encoded in various *biological* real stuff, in our brains. The ongoing operation of those brains is what we call our “mind”.

That’s all well and good, but we want to be still *more* concrete, because you, dear reader, may not be a computer geek and all of this talk about silicon, bits, memory, voltage and information processing devices may well have made you

²³Which can be very long or very short – the “fast” memory in computing devices typically stores it for a *very* short time by human standards but constantly reads it and rewrites it within that window, “refreshing” the memory. If the refresh process is stopped, the state goes away in much less than a second, irretrievably. Other kinds of memory write once and the state persists for days, weeks, perhaps even years without additional maintenance – but nothing lasts forever and *centuries* from now whatever information is encoded on e.g. a solid state drive will almost certainly be completely gone. This degradation of non-refreshed information is Universal (and is a.k.a. the Second Law of Thermodynamics) – you can see it in missing chunks of truly ancient tablets of cunieform and in the aging of our physical bodies.

very uncomfortable, to the point where you're going to throw up your hands and go do something easy, like drive your car to the store to get dinner (something that is actually vastly more complex if only you think about it). Yet this is a really important idea to grasp, so let's build a slightly more accessible physical model, one that doesn't require electricity and semiconductor magic to operate or read, and one that you're quite likely to have readily at hand.

So dig into purse or pocket and pull out *three nice, shiny, new pennies*²⁴, and lay them out in a row on a table next to you. We'll now let tails stand for 0, heads for 1, and (using the same encoding defined above) the letter a is now quite *physically* represented in the figure nearby containing images of three pennies.



Note well: These three pennies are most definitely *not* the (abstract) letter a, let alone a real, material, hand carved piece of wood shaped like the letter a on your mantelpiece! But even so, you could use an array of nine pennies to encode c-a-b in our eight bit code given above. If you are so wealthy and fortunate as to be in possession of nine pennies in your stray change jar, why don't you do this, as an exercise (it won't be wasted, you'll need the nine pennies to do some more work below).

Ready to continue? Time for something deep. Fine, we've established our three bit "code", physically encoded in a semi-permanent arrangement of actual stuff that you could leave out on a table to send messages to friends as long as nobody who likes to steal or arbitrarily scramble the pennies comes along, where each unique arrangement of the three pennies (in a certain order, we'll come back to that later) stands for eight distinct actual objects (the letters a-h) according to the table we set up above. However, your friend, in order to decode your messages, has to have the state of the nine pennies (that's the encoded message – remember you were going to encode c-a-b?) *and the mapping between penny arrangements and letters he will need to decode it*²⁵! After all, how does *he* know that you made an a out of three tails? It could have just as easily been three heads, or two heads and a tail!

²⁴Or old, dirty, ugly ones instead. Doesn't really matter.

²⁵Just as it will also help a lot if you *speak and write the same language* – after all, if we used the same pennies to encode symbols in *mandarin Chinese* you might be able to determine the pictograms from the mapping, but have *no idea what they mean!*

Whoa! That’s a serious problem. Serious enough that it is in some sense *the* key problem in encryption theory and in information transmission – you have to both have the message itself, however it is encoded, and an unambiguous, mutually agreed on, method of decoding it. After all, how do you *know* that the three pennies showing tails above encode the letter ‘a’, instead of (say) ‘the front left leg of your eight legged pet spider, looking down on it from its dorsal side’? How do you even know *tails* (or ‘T’, in a written table) stands for 0 instead of *heads* (or ‘H’)?

It brings up yet another problem. Since pennies can stand for fruit, or letters of the alphabet, or spider legs, or even all three at once, are the pennies in your pocket somehow *thinking deep thoughts*²⁶ as they mix around, forming all kinds of combinations? Is the solution to human poverty and obtaining world peace in every pocket full of change, if only we could see it? Is it really *true* that the entire Universe could be perfectly reflected in a single grain of sand (if only we knew the encoding)²⁷?

And herein lies the rub, as they say. For a set of actual persistent “stuff” made of anything – *anything at all* – to stand for *something else* we need not only the stuff itself but:

1. The stuff has to have a *state space* – all of the unique ways the stuff can both be arranged (to write information encoded on it) and be observed to be so arranged (to read the encoded information written on it) – that is *at least as large as the irreducible number of things to be represented*²⁸! If we ignore the orientation of these three pennies and look only at heads and tails as being the two possible states for each penny, we can represent *up to* eight distinct objects. But there is literally *no way in heaven or hell* for the pennies lined up in exactly this way to represent *ten* objects that are all equally (un)likely to be “the message”. Try it! Can’t be done!
2. You have to have a *dictionary* (the encoding/decoding table). The dictionary establishes the *mapping* between the unique real states of the real stuff that is going to record the information and the unique real things being represented. Or for that matter, the distinct *imaginary* things being rep-

²⁶About apples beginning with ‘a’ held by a spider’s front left leg, say...

²⁷According to information theory and the argument below, absolutely, unambiguously *not*. How could it? It uses its entire *capacity* for encoding information to encode *its own state* by *being in* that state!

²⁸I’ll ignore for now the possibility of compression and treat only cases where the information is incompressible/irreducible. If these words don’t mean anything to you, don’t worry – what they mean is “don’t worry about it, in the end it won’t matter”.

resented, as in fact we are perfectly capable of representing very abstract things, such as pink unicorns, invisible fairies, or representations of other symbols, as well as real things like the real books on our real bookshelf or eight out of ten of our ten little piggies.

Note well the problem of permutations. In our “threepenny” state space there are 8 possible states. They can represent up to 8 distinct objects. But there are

$$8! = 1 \cdot 2 \cdot 3 \cdot 4 \cdot 5 \cdot 6 \cdot 7 \cdot 8 = 40320$$

permutations of ways to assign 8 *actual* objects to the 8 states of our “threepenny memory”. Here is a table to give you just a hint of the permutations that are possible:

Side Bits	TTT 000	TTH 001	THT 010	THH 011	HTT 100	HTH 101	HHT 110	HHH 111
1	a	b	c	d	e	f	g	h
2	a	b	c	d	e	f	h	g
3	a	b	c	d	e	h	f	g
⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮	⋮
40319	h	g	f	e	d	c	a	b
40320	h	g	f	e	d	c	b	a

and we *cannot decode a message* without selecting *which row* of this very large table is the one that represents the particular assignment of our eight objects to our 3-bit, 8 state space, represented in pennies or silicon or on your fingers or in dots and dashes on a piece of paper! And the eight letters a-h *themselves* can be used as the basis for a code based on an *even larger* space, with *many more states and many many more permutations of the mapping between states and objects!* But we’ll start needing a lot of pennies to represent them.

Wowsers! The space spanned by the dictionary is always larger – quite possibly much larger – than the *actual* information space being represented and the representation itself (compare 2^3 to $2^3!$), because it has to resolve the *permutations in the order of assignment to the state space of the set of things being represented*.

The encoding of “anything” has other difficulties, as well. The actual English dictionary²⁹, encoded in ordinary letters, contains a lot more letters (total) than it does words (total), and uses *way way* more words in its definitions that it

²⁹We’ll assume that it is one devoid of pictures, *another* way of encoding and transmitting information.

defines. It is also highly – some would say entirely – self-referential, meaning that it is impossible to read unless, well, you can already read, which means you *already have* enough of the map it contains to sort of bootstrap the rest of it. Worse, in most places the definitions form (sometimes very complex) *reference loops* – if one defines a “fnarp” as a “frumal bleshnik”, and the definition of bleshnik is “a kind of fnarp” and “frumal” is “a common characteristic of bleshniks”, *this isn’t a lot of help!* Now imagine just how difficult it is if the entire dictionary is written in Martian, and you don’t know how to separate Martian symbols into *words!*

Unless you have independent access to and knowledge of actual bleshniks with and without the trait of frumality, a dictionary defining each term in terms of the other terms isn’t going to be a tremendous amount of use in learning the *actual* meaning of fnarp! And if it is written in Martian, you’re probably going to need a Martian “Rosetta Stone”³⁰ in order to be able to read it at all and know that some particular permutation of eighteen strange symbols is the Martian spelling of “fnarp”³¹.

By extension, if we wish to “know everything” about the Universe, as we’ve defined it, we’ve got a serious problem. First and foremost, there is *no other stuff to use to encode, or represent, the state of, all of the stuff in the Universe; there is only all of the stuff in the Universe itself!* Second, even if we have some non-stuff stuff (i.e. ‘Standard Model God’) and manage to pretend that the non-stuff stuff isn’t part of the Universe (but is still exists and is real, note the contradiction) but that stuff stuff over there *is* the Universe and is also real³², we still need enough *more* non-stuff stuff to define a dictionary for the non-stuff stuff encoding, because 000 could just as well have stood for d as for a, and heads could just as easily have stood for 0 as tails, and I sort of implicitly labelled *the pennies themselves* as penny 1, penny 2, penny 3 from left to right and *that* can be permuted as well if we play the pea game with the pennies without flipping them, shuffling 3 into 1’s place and 1 into 2’s place and 2 into 3’s place (for example).

A second substantial problem in dictionaries is that they in general only represent a *compression* of the actual inherent information in almost any real world object. The definition of the word “tree” stands for not just one specific object

³⁰Wikipedia: http://www.wikipedia.org/wiki/Rosetta_Stone.

³¹...and you still won’t know how to pronounce it. It probably isn’t pronounced fnarp at all. And it might be spelled and pronounced *differently* after the word “fnarb”, in a contraction that avoids confusion when pronouncing “fnarb fnarp”.

³²A mental feat that is child’s play for most theistic creationist idealist dualists...

that happens to exist in the real Universe in your back yard, but rather for a general *class* of objects that can in some cases easily be mistaken for shrubberies and in still others exist only in your imagination, not in reality. But the alternative – specifying precisely *every single particle that makes up an entire actual object we so casually call ‘a tree’* is if anything even worse. At that level of detail, we know everything but at the same time, in another sense, we know *nothing* about the tree.

Ouch. If we want to be said to “know everything” about just *one lousy tree*, we have to be able to encode and represent *every single smidgen of actual stuff that makes up that particular tree* (plus, arguably, what it does, how it works, what it looks like, and ever so much more – even how it makes us *feel*, its relationship to *everything else in the Universe*) so our knowing system has to have some “stuff” with a state space at least as large as the information required to precisely specify all of the stuff that makes up the tree plus a dictionary capable of resolving the *encoding itself* from all of the possible *permutations* of ways that information could have been encoded, and *even then* that would not be complete as the tree is embedded in the Universe and interacts with it so its state technically depends on the state of “everything else” in an irreducible way! And we haven’t even gotten to where we can *think* omnisciently about *everything* that precisely defines that *one tree* yet – this is just what is required to actually have the information on hand to *think omnisciently about* that tree once one figures out just what *thinking of* or *being aware of* something really is.

The usual way of viewing “thinking about something” is that it is retrieving all, or part, of this encoded map representing the “something” into our “thinker” and bouncing it around a bit. How is this different from jostling a pocket full of pennies? How subtle and difficult to encode is that bouncing process *itself*, and what is *it* encoded on and what dynamics govern *it*, as bouncing is, after all, changing in time, the province of dynamics even if they are *random-ish* dynamics like grabbing a handful of pennies, shaking them a bit, and slamming them down on a table?

By extension, in order to postulate the existence of a thinking being that “knows everything” about the Universe, we’ve got some serious, serious problems, only *one* of which is coming up with a concrete model that answers all of these questions. But we’re in logical difficulties already that will transcend all possible answers.

First and foremost, as I hope you caught all by yourself from my snide parenthetical comments in the text above, there *is no* other stuff to use to encode,

or represent the state of, all of the stuff in the Universe! We carefully defined the Universe to be everything that really exists. Second – and this is the subtle point I’ve been leading up to and may *not* have been telegraphed enough for you to catch it – no finite set of stuff can encode *its own abstract state and the dictionary required to be able to think about it!* For a three-penny memory, we still need enough *more* stuff/pennies to be able to define *and represent* a *dictionary*, because 000 could just as well have stood for d as for a, and heads could just as easily have stood for 0 as tails – there are 40,000 odd ways we could have encoded *just eight symbolic mappings* in our *eight state set of pennies* and a nasty infinity of things we might want to map with those symbols!

Information theory per se doesn’t concern itself with the dictionary part of this except via inequalities – we always need *strictly more* informational head room in the set of states of the encoding set than we have in the set being encoded, because we *must* have the encoded information *and* the dictionary³³. To put it in general semantic terms, not only is the map not the territory, the *omnisciently faithful* map is *always larger than the territory* because it has to have the map itself and some sort of legend, and if the map is *our knowledge of actual territory*, that legend is vastly more complex than the map itself is³⁴. Our encoding is analogous to the *memory* of a computer, but actually *thinking about* or *knowing* is more than just storing information with a decoding rule, it involves *processing* and *changes in time!*

There is one exception to this rule, and that is something we might call ***existential self-encoding***. A real tree (or anything else) in the real Universe isn’t intrinsically represented by something *else*, it is something that represents *itself*. It encodes itself by *being* itself, with no dictionary and no real entropy. An actual territory is an absolutely perfect map of *itself*. A real tree doesn’t exist in *any* state of “imagination” that we might call “knowing”, that is, possessing an abstract map (however complex and precise), a dictionary to decode the map, and a complete layering of further encoding of the conceptual functional structure of the tree plus (to be complete) a similarly deep knowledge of its connections to all of the Universe that is *not* the tree, usually with *almost all of the information*

³³And, in the real world, we generally need a bit of headroom to fight *information entropy*, using a few extra states to add in *parity* or *checksums* in case the state system dynamics permits *errors* to creep in, which (of course) it always does... Good old Second Law!

³⁴Again, technically this is only true if the information in both is incompressible, and we do have a concept known as Wikipedia: http://www.wikipedia.org/wiki/Kolmogorov_Complexity to handle cases where short/simple algorithms can generate “rich” structures (like Mandelbrot sets) but this will not matter in the arguments we are developing because those structures, however complex, are abstract and only “stand” for themselves.

required to specify the real tree exactly as it is thrown away. A real tree is what works the exact opposite way – it *is* the real-world referent with all of that information, perfectly self-encoding, that we struggle to imagine in some pale, highly fuzzed and compressed echo of the magnificent complexity of the tree itself, and call that blurred, compressed, confused dynamic encoding in neural tissue that results “knowledge” of a tree.

This problem isn’t one that exists only in our imaginations. Physicists struggle with it whenever they try to solve problems in quantum mechanics involving a many particle system. Representing the exact state of a single, isolated Uranium atom *precisely*³⁵ at the accessible precision in any of our existing binary representation computers requires more storage than we have in all of the computers on the planet put together, and leaves us with a problem in partial differential calculus that *we cannot solve* even if we had a computer capable of holding the state and doing computations at that scale. This is what makes e.g. quantum chemistry and quantum field theory “interesting”³⁶. It’s all about coming up with a scheme that *works well enough* to predict things in *approximate* agreement with observation while inevitably falling far, far short of precise “omniscient” knowledge and hence predictability, and that is when we *think we actually know what is going on* and can formulate the problem on *paper* pretty darned well!

We now are ready to prove that an omniscient, thinking, sentient God cannot exist. Consider the definition we have already given for the Universe: “everything that exists” in the most general sense of the terms “everything” and “exists” – all things at all places, all times, in all real dimensions, that have the objectively real existential property. If something exists, it is a subset of the Universe (where a set is always a subset of itself, so it *could* be the whole thing). If God exists, God is therefore a subset, possibly a *proper* subset (a set that is *smaller* than the original set) of the Universe.

In passing we note that a thing cannot act as a creator without existing, and if it exists then it is *already* a part of the Universe. God did not and could not, ever create (in a temporally ordered sense or otherwise) the Universe because if it existed as an uncaused cause to do so, the Universe *already existed* as an

³⁵For a meaning of precisely that isn’t, actually precise. Leaving aside whether or not that state “is” represented in nature in real numbers or numbers discretized at the level of the Planck length/time, the largest binary representation of real numbers used in ordinary computation are things like Wikipedia: http://www.wikipedia.org/wiki/Quadruple-precision_floating-point_format with only 30-odd digits out of the *infinite* number required to specify an actual real number or the enormously large number required to specify a rational number at the Planck scale.

³⁶In the sense of the Chinese curse, “May you live in interesting times.”...

uncaused cause containing *at least God* as well. Hence any arguments for the “necessity” of a prior cause for the Universe and the Standard Model features of uncaused cause and creator of the Universe are therefore disproven, Q.E.D. Sometimes a simple definition makes things much easier.

Now let’s make up a model of an absolutely necessary part that the mind of God – *even God!* – must have in order to “know”, anything at all: a memory. Forget omniscience, forget actual thought – let’s start small – what does it take to “remember” just one tiny thing *about something else?* It requires a representation!

Following the general ideas above, let’s imagine a very simple, very stupid God, one with some kind of “God-stuff” within its mind that can take on two states in whatever God-space and God-time you want to invent so that God can actually act to create space *and time* in the Cosmos we appear to inhabit. Again, if God exists (where existence is reality in *all* real spaces and times, not just existence in our Cosmos if something more than just that exists), surely God’s mind must have enough complexity to store just two distinguishable things, so we can think of this as homing in on one tiny part of God’s mind that is necessarily *different* in a distinguishable way when God is thinking about or remembering those two distinguishable things that are *not* the two states doing the storing *in* God’s mind in that God-Cosmos where God exists presumably independently of our created Cosmos that contains the two objects being remembered or thought about³⁷.

Let’s represent those two distinguishable states or objects that are encoded in *something real* in God’s mind (because God and God’s mind and God’s memory must be real, or we’re done here – I will freely concede that an imaginary God exists as an imperfectly defined and inconsistent concept) as ‘a’ and ‘b’³⁸. God can use those two states to encode any two “things” drawn from the set consisting

³⁷As in the discussion above about a tree, we have to eliminate the trivial case of existential self-encoding as somehow being “knowledge” as in “the Universe knows itself” just by *being* the Universe. A rock *is* itself in microscopic detail, but does it “know” itself in microscopic detail? I’d say no. In fact, I wouldn’t say that it *knows* anything at all. What about you?

Let’s call this simple, stupid kind of self-knowledge “rock knowledge” – the Universe knowing itself by simply *being* itself. Dumb as a rock, that is.

³⁸Note that I’m not even attempting to guess *how* this information is stored, or whether it is maximally efficiently stored or stored in two different places/Godmind objects or one Godbit with two states or – like all of the actual memories in our experience – is stored in a *lot more than two things* cooperating to facilitate robust storage in a dynamic environment – because the argument works for the most efficient encoding of those two things you can imagine or that can theoretically exist, and just works *better* for inefficient codings or dynamical systems with actual entropy.

of *everything else* that is not part of this “stored memory” unit in God’s mind, but for the moment let’s assume that there are two objects in the non-God Universe being so stored and call them ‘an apple’ and ‘a berry’. Perhaps God will make ‘a’ stand for ‘apple’, ‘b’ for ‘berry’, maybe it will be the other way around.

No problem! But note that for this tiny chunk of God’s mind to remember/think about *just one of* ‘apple’ or ‘berry’ using *only this one two-state chunk of it’s mind*, God has to know/store/remember *two more things* with *only* this 2-state memory! God has to *know* state ‘a’ and ‘b’ – they are part of everything, so somewhere, somehow, God has to “know” at a high level that it’s own mind is in the ‘a’ state *when* it is thinking about ‘apple’ *and at the same time be thinking of apple*. In other words, to use ‘a’ to think of ‘apple’, it cannot also use ‘a’ to think of ‘a’. It needs to store two more pieces of information – necessarily using another two state chunk, perhaps ‘c’ and ‘d’ – so it can recognize when it is thinking about ‘a’ meaning ‘a’ itself (‘c’), and when it is thinking about ‘a’ but means ‘apple’ (‘d’) and we’re up to needing *four* states to think about *both* the two objects in the real world *and* the memory used to store a representation of those two objects maximally efficiently encoded. It’s actually worse than this, of course, because somewhere, we needed a whole lot of states in God’s mind to to store and encode just what ‘apple’ really stands for in our dictionary, a whole lot more just to find and identify the *particular* two states used to store the apple/berry symbol in God’s mind, as well as the *second* pair of states required to tell us whether ‘a’ means ‘a’ itself or ‘a’ means ‘the apple’.

Oops! We are in deep, deep trouble. Really fundamental trouble. To remember two things – any two distinct things – as something other than existential self-encoding *rock* memory, which from now on we won’t even call “memory” as it demeans the term as used in the context of thought and sentience – one requires strictly more than two state “units” capable of storing information. That is because there are always *two sides* to a mapping – the map, which has to be real, as we’re talking about reality here, not mathematical mappings or imaginary mappings – and the *distinct* stuff being mapped, plus that pesky *legend*, the *dictionary* that specifies how stuff in the map corresponds to the territory and resolves permutation degeneracies in the mapping. This causes an explosion – in order to *just remember* two things *and be able to remember or think about the memory you are using to store them* you need strictly more – and usually a *lot* more – than two distinct “bits”!

In a computer, or a human brain, this isn’t a problem. There are *way, way more than two things* involved in storing the *very simplest* memory of two

distinct things “known” by either one. A unit of computer memory capable of storing a single bit of information – a single, switchable, readable 1 or 0 that can eventually be mapped into part of a letter a in a string with “meaning” – consists of at least millions of atoms, each atom consisting of order of a hundred or more “elementary” massive particles. A penny is much worse – now the number of particles is order of 10^{25} and they have to be shaped *just so* within a *certain range of temperatures and other conditions* to be able to “represent” the state of a single penny. A neuron is even more complex, involves nearly the same orders of magnitude of particles as the penny, but cooperatively storing fragments of *many* possible messages with a dynamical encoding that we have a hard time even simulating because it is so much more complex than our penny/binary memories.

To put it bluntly: It takes *many atoms in a computer memory ‘bit’, many pennies, or many, many neurons*, to store a *single useful piece of information about the outside world* because that information is so heavily freighted with stuff establishing *robust* mappings (ones that do not decay into the disorganized “noise” generated by interacting with an external Universe that are the inevitable fate of all memories in the real world) and the dynamic process that we call “simple” computing using the stored information, let alone the vastly more complex process of thought *about* or knowledge *of* the real-world ‘stuff’ represented by that stored information and the dynamical system interacting with the memory allowing the information to be stored and retrieved at all!

The amazing thing about these electronic or material biological brains is that they *can* build deep hierarchies of “knowledge” – specific memory, reliably stored in a distinguishable state space, that maps into “stuff” being remembered, plus a dynamical system that can act on the memories stored to transform it in useful ways (often generating new things to “remember”), through many *layers* of encoding and dictionaries and dynamical rules for “grammar” or “time-evolution” along the way.

The electrons in my brain are helping me remember the words in the English language at the same time they are helping me generate “new” strings of letters representing those words that have not only meaning, but rather subtle meaning at that, as are the quarks in the protons and neutrons in the nuclei, as parts of the atoms that make up the molecules that make up the neurons, and the many neurons that make up my brain, that is doing all of this stuff *transiently* so that the computer I’m working on becomes an essential extension of the same process, as my own brain could never record every word I’m thinking up while I’m thinking it up in such a way that it could ever be precisely retrieved a day

from now when I return to work on (say) this book³⁹!

We are forced to conclude that there is one thing that my brain can never, ever do! That is to represent *the exact state of all of the stuff that makes up my brain*, as a high-level memory *accessible to my mind*, because the latter requires just as many “bits” of information to store as there are bits of information in my brain *as well as a lot more* information required to define how it is encoded, plus still *more* information required to define how the encoding definition is encoded, etc. It is a vicious circle, one that never closes, but simply gets larger and larger. A system cannot simultaneously represent its own representation and *any* high level encoding that tells you how to *decode* that representation, and *both* are required for *high level* sentience or thought, as opposed to thinking like a rock⁴⁰.

We have proven that no sentient being can *ever perfectly “know” its own mind* – forget about the outside world – using only the storage capabilities of its own mind. It isn’t just very difficult. It is formally, mathematically impossible. The only sense in which it is possible is the trivial one, the tautological one, in which yeah, my brain *knows its own state by being in that state*, which is the “knowledge” only in the sense that a rock made up of a gazillion moving parts “knows” its own state *just by being the rock in that state*, a false rock-memory of *being* something independent of *knowing* or any ability to think, not the real memory or knowledge *of* the exact state of the rock by a thinking being. To coin a bit of a phrase, ***the territory is not the map***, or in philosophy-speak, ***ontology is not epistemology!***

Note again that we’re right back to the order of precedence – experience precedes knowledge because knowledge *compresses* experience. One cannot *experience* or *know* one’s own complete state (right down to the precise state and time-history of leventy-zillionth electron in the fifteen thousand three hundred and seventh choline molecule in the tenth neuron to the left of the middle of your frontal cortex) one can only *be* in that state while thinking about or “knowing” some probabilistic, fuzzy compression of its experience of self that can *never* have sufficient resolution to resolve *itself, perfectly*. Buddha got this one dead right.

This is a problem. It is a *very serious* problem. Indeed, it is an *insuperable problem in information theory*. God cannot simultaneously know It’s own mind

³⁹Now *that’s* one hell of a paragraph....er...sentence...

⁴⁰Computer scientists and information theoreticians have been kicking these things around and proving stuff like this for most of my life at this point – they appear as things like the Wikipedia: http://www.wikipedia.org/wiki/Turing_Machine, the Wikipedia: http://www.wikipedia.org/wiki/Halting_Problem and the Decidability Problem (sorry, no easy link).

right down to the microstate of everything that makes up *its own* brain – material or immaterial, makes no difference, we’re talking about information here, not the specific means of information storage – in anything but the sense of rock-knowledge! Specifically, it cannot know its own mind right down to the microstate of every single irreducible chunk of “stuff” that it uses to remember things in any way but the *irreducible* rock-sense described above, let alone use that stuff *a second time and in a different way entirely* to represent the state of *something else* (anything else!) and establish the *highly degenerate mapping* between its internal memory state, its non-rock knowledge of its internal state, and that other stuff!

At this point, you are doubtless a bit confused as this is a tricky and subtle idea to grasp, which is why it has been missed (I think) by philosophers (but probably not by information theorists) to this point. Let’s reduce it to pennies, or neurons, or bits – but again let’s choose pennies.

Grab your nine pennies. Shake them and drop them onto the floor or a handy table (in such a way that they don’t go rolling off under the furniture). Look down. Now tell me what they *mean*! Hopefully you are sensible enough to correctly answer “absolutely nothing” (other than their existential state – they “mean” something like “hey, look, we’re nine pennies lying on your floor in some pretty much arbitrary pattern”)⁴¹.

OK, so let’s go one better. Let’s invent “time” and “space” (or at least an ordinal ranking system of some arbitrary sort – and don’t forget to add the one used to your dictionary) so we can sort out the pennies in a spatial way that encodes their temporal ordinal ranking. And don’t forget these inventions – remember that *reality* was that existential flop of the pennies when you shook and dropped them, with *nothing* to even identify which penny is which after you drop them!. Here’s a good (but ‘special’) arrangement: flip the pennies one at a time and arrange them in a line from left to right in the order you

⁴¹We could digress into a long and learned discourse on the futility of shaking out the marked sticks of the I Ching, court wizards reading entrails, vikings rolling small piles of bones or stones or toy boats, witches and gypsies from many cultures reading tea leaves, astrologers and priests building a horoscope on the basis of the positions of the stars and planets, or teenage kids using a Ouija board to spell out meaningful messages of wistful affection, but I think it would probably be better to just let this footnote stand in for the whole pointless digression. If you actually believe that any of these things have useful predictive power of anything but, e.g. – the most likely configurational patterns of tea leaves in the bottom of a cup, the particular configurational pattern of pennies resulting from the particular way you shook and dropped them *this* time, etc. – well, there is little point in your reading this book at all, right, as you have forgotten to *doubt* all of this *highly dubious belief*!

flipped them. Or label them 1-9 with a marker and flip them however you like but then arrange them from left to right in the order of the numbers. Just be aware that this *particular* order is just one of the $9! \approx 360,000$ -odd ways they can be arranged and that you'll eventually need to double this to account for the symmetry between heads and tails, and that we are *completely* ignoring the *spatial* arrangement of the flop – in principle a penny that rolled off of the table might mean something completely different from one that did not, and if it rolled under the *refrigerator* – well, if that happened, I see death in your future! And I'm never wrong.

If you actually do this – and if you don't actually do the exercises I suggest, well, don't blame me if you don't get the point entirely – you'll get some pattern – maybe something like the following (provided for the lazy):



OK, *now* what does this mean? Again, the answer is basically *nothing* (but itself). Oh, we can *make* it stand for something. For example, if we let tails equal 0, heads = 1, and use our previous code, this is $110 = 6 = g$, $001 = 1 = b$, $, 100 = 4 = e$, so it means *gbe!* Wow! A hidden message! Or should we have let tails be 1 and heads 0? Now it is h-g-d. *gbe?* *hgd?* Huh? Or maybe it stands for 110001100, a nine bit number standing for $256 + 128 + 8 + 4 = 396$.

396? Well, it's not 42^{42} , but it is – something? But wait, maybe the message is scrambled! After all, the order we laid out the pennies is pretty arbitrary. Of course there are a lot of ways we could reorder the pennies (360,000 of them, in fact), each with *many* possible hidden messages – depending on how large you want to make that dictionary. Or maybe... wow!

There are a *lot* of things this can mean! Who knows, maybe it encodes a message that tells us how to achieve World Peace and Universal Happiness⁴³. So many, that as noted, it means nothing, at least not without a fair bit of help, help that is ultimately and always *more intrinsically complex* than any message you might try to encode.

⁴²If you are alive but don't know the meaning of 42, well, ***Sigh***, but it is time for you to read, or watch The Hitchhiker's Guide to the Universe, by Douglas Adams. Or visit its wikipedia page. Or Google '42'. Participate in world culture!

⁴³**Probably** not, though. That's – literally – what I'm trying to communicate here, the probably bit.

To discover this for yourself, now try to find a way of representing this *particular* state of the pennies *using pennies themselves!* No, you don't get to count the obvious one (and only one that works) as a self-encoding row of pennies in this precise order and orientation to represent themselves. You have to use pennies to store the information required to differentiate the not-quite-identical pennies, *and* indicate the geometry and order of how they are laid out when they are encoding a message, *and* how you encode information onto any one of the pennies (whether or a tail stands for 0 or 1 etc. Even if you cheat and encode their state into – their own state, rock memory – then you will discover that you can't use those pennies to represent *anything else* at the same time.

And you can't do that, not with only nine pennies. Nobody can. It can't be done. There simply aren't enough pennies. You can observe that the pennies in that order *stand for themselves*, but you cannot be given even the simplest imaginable representation of the *information* about *something else* in the actual state – the binary number 110001100, say – and reconstruct the state of the pennies even if you *ignore* the order permutations because you don't know if a head or a tail represents a '1' and it takes *at least one more penny to tell you!* And since the head could equally well have stood for abstractions like "true" or "false" or actual objects like 'the apple sitting on my table in the kitchen or the apple I ate yesterday', really, more. A *lot* more.

Hopefully it is obvious that this result didn't depend in any particular way on the number of pennies, or in the number of sides per penny. Pennies, bits, neurons, numbers, bones, dice, ancient tablets covered with Martian glyphs. *You can never catch up.*

This doesn't get any better when we add in the fact that we're treating whole pennies as "bits", while they are not. They aren't even pennies. What they *are* (as best as we can actually tell using that ideal mix of observation and sound reasoning) is a series of fleeting configurations of little teensy bits of energy and other stuff in space-time. All of the time you are looking at these "pennies", this stuff is whirling this way and that, vibrating, interacting with every other piece of matter in the Universe in wierd quantum ways, in such a way that their future state cannot even *in principle* be predicted or be considered "known" from knowing the state of every single bit of stuff that we call "a penny" at some specific instant of time! You'd have to know the state of *everything else within at least 14 billion light years* of the penny – if not even more stuff than that – as well!

Also, the information – if any – stored in your penny code is *fragile* and won't

last very long. Any minute now you will sweep them into your pocket in disgust and – poof – the message, if any, is *destroyed!* Congratulations! You have just participated in the increase in the information entropy of the Universe – of possible penny states. The energy you expended flipping and arranging the pennies, and then expend again if you reach out and flip, say, the sixth penny so it was heads and is now tails is you, singlehandedly⁴⁴ validating Landauer’s⁴⁵ theorem, and increasing the *actual* entropy of the *real* Universe by way more than you decreased its entropy generating the arrangement of pennies per se. And don’t worry – if (having read this) you stubbornly decide to leave the pennies there *forever* encoding their non-message, and glue them down and varnish them onto the table and serve dinner on them for the rest of your life – do you really expect that a million years from now the table and pennies will still be recognizable and the arrangement encoded now will persist? The second law of thermodynamics is *brutal* – or rather, utterly indifferent to human desires – and it will erase their state over time even if you encoded the penny message in *mountains*⁴⁶ instead of pennies.

Even this pessimistic analysis, incidentally, requires that you actually *did as I asked* and dug up nine *actual* pennies and flipped them and arranged them. If you are relying on the *image* of pennies I arranged for you (shame on you, you lazy human you), the “pennies” you are relying on to get the point aren’t *even* pennies, and never were pennies, and you simply don’t want to know how much stuff and how many layers of information, dictionaries, rules, and just plain *machinery* was required so that I could have an idea, transform it into simple ideas that communicate the point (which has nothing to do with pennies per se) and arrange a presentation so that you *could be fooled* into interpreting what is, after all, just a set of neural impulses *in your brain* into the *meaning* – whatever that might be – obtained via the light from points on your screen that most certainly are not pennies or numbers or bits or letters – until, of course, they reach your brain and in some abstract way, they are!

Now try storing *that* in your nine penny memory!

Hopefully this is obvious to any thinking being that knows almost anything at all about how real brains function, or how real computers operate – and *now* is just as obvious to you, even if originally it wasn’t. Experience leads to knowledge, right? Go Buddha! Go Richard Cox! Go E. T. Jaynes!

⁴⁴Literally! At least if you only used one hand...

⁴⁵Wikipedia: http://www.wikipedia.org/wiki/Landauer's_Theorem.

⁴⁶Hmmm, *artificial* mountains, like – pyramids? Maybe we have discovered the subtle purpose of building “timeless” monuments...

In summary: Bits in a computer are made up of *lots* of stuff. Neurons are made up of even *more* stuff. To precisely specify the state of all of that stuff in a memory that holds (say) a billion bits or a billion neurons takes *way, way more than a billion bits*, or neurons or atoms, molecules, elementary particles or anything else we might even *conceive* of to represent the information. The actual stuff *itself* has some definite state, to be sure, but that state isn't what we ordinarily call "knowledge" of the state. Three pennies cannot encode every feature on Lincoln's head as portrayed on even one penny.

No computer – or mind – can *perfectly symbolically encode* all of the information needed to *perfectly symbolically encode its own state symbolically encoding its own state* any way other than as the irrelevant existential rock-knowledge tautological sense of *being* in its own state. We can never "know ourselves" precisely, and *neither can a hypothetical Standard Model God!* It requires a dictionary (and functionally, a lot more) to even vaguely be considered "knowledge" and the dictionary has to select a single choice from a domain that is strictly larger than the state space of the system doing the encoding. This inequality persists as one takes limits, and if anything it just gets worse as the system gets larger and more complex, and we haven't even *added* knowing its own state while it is knowing *anything else* at the same time!

Just because there are bound to be mathematical purists out there who mentally discretize the entire physical Cosmos at some scale and then say "ah, but in a single real number there are an *infinite* number of digits, and hence we could in principle *store the knowledge of the entire Universe in a single number!*" or something equally silly – if this is you, please meditate on the *inequality* involved – you cannot encode the real number and a rule for decoding the real number into the same real number, so while the real number can stand for anything you like, and in principle can encode the very, very large rational number that you want to transform the state of the Universe into as well as a rule for mapping that number into back into that state – maybe – you can't do that *and* know the number itself as anything but a representation of itself that is rock-knowledge, not knowledge. This isn't solvable by the continuum hypothesis, in other words, because you can *never catch up* to the need to store the encoded information *and* the meta-information required to *decode* the information *in* the encoded information being stored – if you want to be omniscient in any sense more meaningful than the 'omniscience' of a rock 'knowing' its own state by *being in* that state!

Real brains get out of this dilemma quite simply by *not knowing everything*. I don't know the actual microscopic state of *anything* inside my own head as I'm typing this. I cannot be said to "know" the state of one single neuron in my

brain in any useful sense. But *using* all of my neurons⁴⁷, I can generate, think about, type, and reason with all of the symbols used in this book. Think about what I would have to know if I had to know the specific state of every neuron and synapse and biomolecule and atom and electron and quark and photon and gluon and so-on (joke) in my brain in order to be able to think about my own brain at the level we would call *knowing everything* about my own brain. I can't do it. It is impossible. It is impossible for me and it is impossible for God. Not because it is very, very difficult, so if I were smarter I could do it and God is possibly a lot smarter. Because it is provably impossible to represent the microscopic state of *any* information storage and processing system *within* that system in any other way than the microscopic state itself as a self-representation. Try to encode it as *usable knowledge*, and you have an information explosion.

Q. bloody E. D.

There are several other properties of God in the standard model that are equally easy to formally disprove (as long as one does not permit the slippery arguments that require the redefinition of evil as being good, or pain as being equivalent to pleasure), but many of these require a mix of ***reason and observation*** taken ***together*** – that is, the application of the Cox axioms and the *global* optimization of a worldview seen as a set of *posterior* probabilities that are most consistent with the actual evidence of our senses and rigorous experiments and observations made of the real world. equally easy to disprove or fail to support by either reason or observation.

For example, the “human” property of omnibenevolence *and* omnipotence in a Creator God is contradicted by experience – all of the evil of the world becomes the direct, preordained consequence of the deliberate act of creation of the omnipotent, omniscient deity. This deity bears the responsibility for its acts, and indeed *because* it is omnipotent and *everything* that happens was planned and is caused *only* by it, nobody and nothing else does. This contradicts any assertion of an all-*good* God as effectively today as it has over the thousands of years since it was first proposed and written down⁴⁸.

⁴⁷Well, some of them. Those that survived decades of abuse and continue to function in some way I can't understand or define in any detail, even as they do the work on their own just fine.

⁴⁸Wikipedia: <http://www.wikipedia.org/wiki/Epicurus>. E.g. by Epicurus, see “Epicuran Paradox”. Although it is almost certainly prehistoric and was surely around long *before* it was written down. My *five year old son* discovered it for himself without being taught or told, asking me in the car one day “Daddy, if God is good why do people suffer?” Smart kid!

If a God worthy of the name exists, I didn't have an answer for him then, and don't have an answer for him now. Nobody does. On the other hand, if reality is what it is without any intelligent causal agency one can identify as a Standard Model God, one can easily understand

A second problem with the standard model of God is that the “action” properties of God are *never* verified empirically in careful experiments. For example, a number of double blind experiments have been conducted that attempt to demonstrate a positive benefit to prayer. All have failed, some of them getting (as one would expect in a data dredge of a null result) a *negative* result (the very sick people being prayed for recovering at *less* than the rate of the control group, although not significantly so)⁴⁹.

The most powerful argument against a God who is relevant to the real world, however, can be more or less directly and algebraically disproven in terms of Bayes’ theorem, the central precept of what (I argue above) is – combined with the accumulation of evidence and the ongoing recomputation of posterior probabilities for the prior assumptions to maximize agreement with the data – *the* best rigorous basis for knowledge of the real world (compared to the alternatives). This argument is sufficiently important (and simple!) that it is worth a chapter section all its own.

why things happen in nature in such a way as to be as almost completely indifferent to any associated suffering in sentient biological entities as we observe them to be. We can even understand ‘suffering’ as nature’s evolved way of motivating animals that suffer to avoid danger, live longer, and procreate in the ongoing process of evolution.

⁴⁹Wikipedia: http://www.wikipedia.org/wiki/Studies_on_intercessory_prayer. As you can imagine, it is remarkably difficult to set up a double blind, placebo controlled study of the efficacy of prayer. However, my favorite study is the one where they studied whether prayer *now* could affect outcomes *in the past!* Hey, if everybody just prays *hard enough, right now* maybe we can make World War II *not have happened*. Madness.

15.2 Bayesian Estimation of the Implausibility of God

The law that entropy always increases holds, I think, the supreme position among the laws of Nature. If someone points out to you that your pet theory of the universe is in disagreement with Maxwell's equations then so much the worse for Maxwell's equations. If it is found to be contradicted by observation – well, these experimentalists do bungle things sometimes. But if your theory is found to be against the second law of thermodynamics I can give you no hope; there is nothing for it but to collapse in deepest humiliation.

– Sir Arthur Stanley Eddington, *The Nature of the Physical World* (1915), chapter 4

Is it more probable that nature should go out of her course, or that a man should tell a lie? We have never seen, in our time, nature go out of her course; but we have good reason to believe that millions of lies have been told in the same time; it is, therefore, at least millions to one, that the reporter of a miracle tells a lie.

– Thomas Paine, in *The Age of Reason*

Note that this section is important enough to deserve its own little pre-section quotes. They both make an extremely important point. Most of what we know about the Second Law of Thermodynamics we know in a form that is ***independent of the particular microscopic physics underlying it***. It involves the computational of *probabilities* in regimes where most of what can happen is so improbable that it isn't that much of a stretch to say that it will never, ever happen, although in principle it "could". Those probabilities are evaluated using principles that are almost identical to those advocated in this book as the basis of reason – they are therefore so very, very *reasonable* that they effectively *define* common sense itself – they are the "common" part, that things that usually happen and are most likely to happen are unsurprisingly, one and the same.

What does this kind of probabilistic analysis say about not the formal, mathematical, possibility or impossibility of God, but the mere common-sense *probability* that the Standard Model of God is correct?

We have seen in the previous section that the *axiomatic definition* of a Standard Model God is not consistent. Because the *possibility* of completely disjoint subsets of reality exists, then no being can ever be certain that the reality of their personal experience is exhaustive of *all* of reality, no matter how great it

is, and no omniscient being can be *uncertain* and still be omniscient.

God, if God exists, **cannot** prove that Its knowledge of reality is complete and consistent any more than you or I can, and Gödel's theorem (formally) and the simpler but related argument I gave next both *prove and give a concrete example* of how this must be so.

Information theory also contradicts omniscience of a dualist Standard Model God, although it leaves open the possibility of a monist *non*-Standard Model Pandeity who *is* the Universe and hence is its own self-representation from the information-theoretic point of view, but who cannot meaningfully *know itself* at the microscopic level or be *sentient* any more than you can precisely represent the state of every electron and quark in your body in a symbolic encoding involving only the neurons in your brain that are *made up of* those electrons and quarks, let alone think about them thinking about themselves thinking about themselves thinking about themselves in an infinite explosion of impossibility.

However, *we* would like to at least *try* to be consistent in our reasoning process, and one thing that has been repeatedly asserted in this book is that one cannot really make logical arguments of this sort about the real world. It isn't that the real world is immune to logic; it is instead that there is a terrible infinity in the set of all possibly true notions about the real world and that pure T/F logic is a poor tool to use to attempt to establish the best thing to believe. As David Hume, George Boole, and others established, we can't *prove* anything about the real world without unprovable assumptions, axioms. Hume – and many others, of course – *missed* the explicit point that we can still invent a *process for fixing our axioms* until reason and proof founded on them lead to the *best possible correspondence* with what we observe.

Best belief, as we have seen, should be based on *evidence and common sense*, or in more mathematical language, on *probability theory and Bayes' theorem*, where we *refuse* to make definitely true or definitely false assertions even as (especially as!) priors, or axioms, of an argument, and *let evidence speak* by reconstructing posterior probabilities for our priors as evidence accumulates in such a way that they can, over time, be (almost) completely disproven or (almost) completely proven without ever reaching the level of being known to be perfectly true or perfectly false.

We still demand consistency, but now consistency is “softened”, as it is the case where proposition A is 99.99% likely to be true and hence (consistently) 0.01% likely to be false *given the data so far*, and yet A can turn out to be false! Beware the black swans, lack of evidence is not confirmatory evidence of lack,

and all that. Consistency merely requires that all of our prior and posterior probabilities in an exhaustive set must add up to 1, nothing more; it doesn't assert that something is *true*, only that we keep adding 9's to the probability that it is true based on the data – so far – and remember to *decrement* the probabilities of *all the alternatives* to that belief as we do so. The more I believe that the Knave ate the tarts, the less I believe that anybody else did.

What does Bayesian probability theory have to say about the *probability* that a Standard Model God exists? To find out, let's express beliefs about a Standard Model God in a probabilistic format:

$P(G) \in (0, 1)$ stands for the probability that G(od) exists. We express it in this way to make it clear that it is *not certain* that God exists, nor is it *certain* that It doesn't. No matter how strongly you believe, you must admit a chance that you are wrong. No matter how strongly you do *not* believe, again you could be mistaken. As described above, a critical aspect of Bayesian reasoning is that one cannot assign a prior probability of a statement as equal to 1 or 0 exactly and leave it “correctable” by evidence in a posterior probability computation. It then becomes truly an axiom as in ineluctable truth that will warp your entire concept of reality in a way that no evidence can overcome.

$P(L) \in (0, 1)$ stands for the probability that the L(aws of Nature) are, in fact, *laws* that cannot be broken. Note that this is not the assertion, per se, that the Laws of Nature that we teach in physics classes and do experimental and theoretical research on in University departments and laboratories and use as the foundation of our everyday engineering, chemical, and biological enterprises and research are precisely correct in all details – it is not about whether or not we have the precisely correct Unified Field Theory or Theory of Everything – it is about whether or not the *major components* of those laws are (probably) correct or incorrect, or better yet, that there *exists* a set of Laws of Nature that are never broken whether or not we have yet got them all right.

To be a bit more specific, I'll limit this assertion to the claims that (in particular) the ***First and Second Laws of Thermodynamics*** are correct – essentially the conservation of mass-energy (First Law) and directed time evolution of sufficiently complicated isolated systems from less likely (lower entropy) macrostates to more likely (higher entropy) macrostates, that the entropy of the Universe itself increases or remains the same with the passing of time – and in general terms that the theories of gravitation

and of electromagnetism, in particular, are at least excellent empirical approximations to unbreakable law when they are suitably expressed but that might have a more general and correct form, eventually.

$P(G, L) = 0$ stands for: “There is *no chance* that a Natural Law-violating God exists **and** that the Laws of Nature are never violated.” This at first glance appears to be an exception to the *common sense rule* that we not make egregious claims of perfect knowledge of almost *anything* about or in the real world, but it follows from the Standard Model of God! The word omnipotent *means* that God can violate the Laws of Nature, and most religions are based on reported *miracles*, events where God *did* violate the Laws of Nature. That is, we can never expect to observe a Cosmos in which the Laws of Nature are inviolable *and* evidence of an all powerful miracle working Supernatural Deity that violates those laws. The two ideas are mutually contradictory, and hence mutually exclusive, not by observation but by definition! It’s as impossible as asserting that Black Swans exist (so it is not true that All Swans are White) at the same time you assert that All Swans are White!

$P(L|G)$ and $P(G|L)$ are the *conditional* probability of the inviolability of the Laws of Nature being true given the certain existence of a Law of Nature Violating God (first form) and the probability that a Nature Violating God exists, given that it is true that the Laws of Nature are Inviolable.

We are now set up to write down Bayes’ Theorem:

$$P(L, G) = 0 = P(G|L)P(L) = P(L|G)P(G)$$

From which we can write down two “syllogisms” in *probability theory* as opposed to formal logic. In a moment you will see why the problem is formulated in this way.

We need one more thing – a way to make these assertions connect to *reproducible evidence*, the only kind we can, or should, accept. Hearsay evidence isn’t acceptable in a court of law, and is if anything *less* acceptable as evidence in matters of this sort, where many individuals and groups have vested interests, and where we truly want to believe the *best* thing to believe.

Let’s keep it simple. Pick your favorite physical law – perhaps gravity. If you are smart enough to be alive reading this, you’ve probably figured out that if you climb to the top of a tall building, and jump out to fall (say) 30 feet or more onto concrete, the results won’t be pretty, will certainly be painful, and might well be

fatal. You also know that the chances of your just drifting down to the ground gently, like a leaf, with no parachute and no hidden anti-gravity invention, just you and your tight-fitting clothes, hard ground far below, are basically zero.

Why do you believe this? After all, if you believe in a Natural Law violating Omnipotent Standard Model God, you basically believe that there is a *chance* that you will just float down like a leaf. The more certain you are that you will fall, the less certain you *must* be that you won't fall because after all, you are a nice enough person, and hitting the ground in this way will shatter your legs and maybe your back and the chance of dying aside, you will experience excruciating *pain*, and Standard Model God is both *omnipotent* and *omnibenevolent* and could partially suspend the law of gravitation long enough for you to drift down like a leaf, and thereby save you and your family all kinds of pain and suffering.

Yet you are all too aware of your memories of having fallen many, many times, and jumping down from trees and playhouses, and you have undoubtedly thrown many things up into the air, only to see each and *every single thing you throw up fall down again*⁵⁰. You have read books, seen movies, watched and learned from others, and found that – outside of some highly dubious stories of religious yogis claiming to be able to suspend gravity and fly at will⁵¹ and carefully engineered magic shows that present the *illusion* of floating in defiance of gravity, and of course ignoring cases of flying in *airplanes* and the like in *accord* with a larger set of physical laws that *includes* Universal gravitation – near the surface of the Earth, *things always fall down when released at rest without support over a long drop to the ground*. Or to be more clear, to the best of our knowledge and experience they always have *in the past*.

It is true that this absence of evidence of natural law violating Standard Model God overriding the Law of Gravitation is not positive proof that Standard Model God doesn't exist and couldn't override it if It wanted to. Maybe it just never, ever, seems to want to. But it is a complete absence of evidence *for* a Standard Model God who performs *anti-gravity miracles!* Worse, if we perform *careful* experiments and make *careful* observations of near Earth and long range gravity, it appears to behave *extremely consistently* in agreement with a law that pretty much says that yeah, as long as this law is true, or even approximately true in the sense that the real law is so close to the law we've figured out that they can both explain the same evidence, if you jump or fall out of a high place onto hard

⁵⁰No, helium balloons don't count. *They* fall down again, and choke sea turtles and so on when they do. You just don't necessarily see it happen.

⁵¹https://rationalwiki.org/wiki/Yogic_flying: Seriously. I sometimes despair of my own species.

ground without a parachute, you will *not float down* and *you will be sorry when you reach the ground!*

You arrived at this conclusion using pure Bayesian reasoning – simple common sense. Suppose initially you thought “Hey, maybe it is a coin flip, if I jump out of this tree, maybe I’ll fall to the ground like my friends seem to, or maybe I’ll fly like Peter Pan up to the roof and wave at them from way up there! Two possibilities, each equally likely!” You jump, and you fall down. You jump again, and you fall down again. You jump a third time (after all, jumping out of not-too-high treehouses with friends is a good time when you’re a kid) and yup! Down it is.

Over the next days, weeks, months, you accumulated literally hundreds of cases where you fell down. Every step you took, your feet came down. Every time you tripped, you fell down. When your glass of milk (perfectly reasonably) slipped through your fingers, your Dad had to clean up the mess and broken glass on the *floor*, not the *ceiling*. Get the picture? Every single experience was *data*.

As a Junior Bayesian, you may have had no idea, initially, what the chances were of flying like Peter Pan, but as you tried, over and over and over, to put this to the test and *always failed to fly, or float down, or do anything but fall, pretty directly and moderately violently **down***, you quite naturally adjusted your *beliefs* so that they were in better agreement with your *experience*. Really, it is the only sane thing to do.

You also learned that Fire Burns (much the same way, but it probably took fewer trials for you to accept it as a conclusion due to the high personal cost of each trial plus the substantial reinforcement from your parents). You learned that water is wet. You learned pretty much *everything* about the world you live in by having experiences and systematizing your observations so that your beliefs about “what’s really going on” were maximally predictive of that body of experience.

As you went through school, you learned to be more systematic, to trust at least to some extent (one hopes) the purveyors of empirically validated, reproducible, rules as you took science classes that included a “see for yourself” laboratory as part of the experience. If you were better than average in math, and had aspirations in science, you may even eventually have learned at least some of the body of physical laws that we have tediously worked out to be in best agreement with observation, and have had ample chance to observe that – like the law of gravitation – you personally have never directly observed an exception

to those laws, and you *have* observed many many places where your observations are in good to excellent agreement with those laws. Bayesian reasoning rocks!

At the end of this learning process, you *should* have arrived at the point where you've concluded that $P(L)$ is very, very, close to one. Sure, you can lie to yourself and say, "Well, the next time I fall from a tree *I'm sure* that God will save me as I float to the ground like a feather..." but you know, deep down inside, based on all of that experience as a child, that this is not true, and that if you climb out on your roof and jump headfirst down onto concrete, you're just committing suicide. Yes, you've no doubt read that Jesus turned water into wine without the intermediate steps of grape juice, yeast, and fermentation (violating a whole pile of physical laws in the process), but *you've never done this*. You've never seen anyone do this. You've never known anyone to pray for this and have the prayer granted. You may believe that God sometimes heals people with a common cold, but you also know that people get over colds without God's help. What God doesn't ever do is heal amputees, no matter how hard one prays for it⁵².

In the end, all of the reasons for believing in miracles boil down to two things: either *other people report it* (pure hearsay) and you accept it as true without reliably observing it yourself under controlled circumstances or *you mistake the mere occurrence of something that is neither impossible nor particularly unlikely* – like a rain when you pray for rain, or getting over a cold, or even the remission of cancer, when you pray to get over either one, or don't – for a natural law violating miracle. Remember, everybody gets over a cold eventually, and just as many Hindus, Buddhists, Atheists, Muslims, and Undecideds survive cancer with or without prayers to any of a number of possible Gods or none at all as do Christians. And just as many of the truly devout with cancer who pray desperately for a miracle so that they can live to see their own children grow up, or worse, pray desperately for their own *children* to survive cancer or recover from a closed head injury suffered jumping out of a treehouse, *fail* to have their wishes or prayers answered independent of religion or prayer or justice or mercy.

In the end, there simply *is no reliable, reproducible, non-hearsay evidence* that the Laws of Nature are violated by some sort of divine intervention contingent

⁵²There is an entire website, <https://whywontgodhealamputees.com/> devoted to this point, but in the context of theodicy, not Bayesian reasoning per se. Note well that a human amputee regrowing a limb wouldn't even be an *egregious* violation of natural law the way water into wine or deific levitation would be. Starfish do it all the time, and I've got a private bet with myself that human science will manage it *non-miraculously* before I die. I don't quite know how I'll pay myself off if I lose, though...

upon prayer, belief, will, or even just randomly for no reason at all. Quite the opposite. That's why we call them Laws – because there are basically no reproducible exceptions observed to the behavior they describe in contexts where the Law(s) should reasonably apply.

Based on the best evidence, and really, *all* the truly reliable evidence we've managed to accumulate over several hundred years of systematic scientific observations, $P(L) \approx 1$. Not $P(L) \Rightarrow = \Leftarrow 1$ to be sure – we can never be *certain*. But surely there is enough evidence to raise a good, solid Bayesian estimate to many, many nines if we confined our attention to the particular Laws I mention above, and even where those Laws may prove to be not quite right, we haven't any reproducible evidence of *capricious* violations on the part of a sentient miracle-working entity, with or without some associated activity such as belief, faith, or prayer. Let's plug this into our Bayesian observation above:

$$P(L, G) = 0 = P(G|L)P(L) \approx P(G|L) \implies P(G|L) \approx 0$$

In human words, to the extent that we fail to observe violations of Natural Law and come thereby to $P(L) \approx 1$ as by far the posterior probability in best agreement with the evidence, we must agree that the chances of a miracle-working God existing *given* the Laws of Nature being true diminish.

What are we left with then? A possible God that *could* break physical law but *never actually does*? A God who breaks physical law all the time, but so subtly that we can't detect it? A God that actively *hides* any reliable, trustworthy, direct evidence of Its existence from us? A God that you can worship or not as you please, but it won't ever earn you the slightest reprieve from a Cosmos that is obviously indifferent to your suffering and will cheerfully⁵³ allow you to be dashed to pieces on the pavement if you leap from a window fifty feet above?

Here is what the Bayesian argument above boils down to. The more likely you think – *based on actual reproducible evidence, evidence that everybody has access to and can verify on their own, no particular degree of "faith" necessary* – that the Laws of Nature are in fact correct and are never reliably known to be violated, the less likely you can *consistently, also* think that a Standard Model God exists based on miracles that violate those Laws. It's really that simple.

⁵³Not really. Utterly mindlessly, indifferently is more like it. An utterly indifferent Cosmos is, amazingly enough, in some unexpected way *perfectly just* as it refuses to bend its ways to your desires in any way other than by *you*, learning and exploiting its unbreakable laws to your advantage. Otherwise known as using science and engineering and medicine and all of that *non-miraculous* stuff.

This is *before* we ring in any of the *other* properties of Standard Model God. It is sometimes asserted that God has to hide its existence from humans in order to permit the existence of Free Will. However, there is *no plausible reason* that a Universal standard model God would hide its existence from mankind *now* but have made itself known, (reportedly, with tremendous regularity and across multiple completely different religions) back in the Bronze Age and well into the Iron age⁵⁴.

Were all of these humans scattered over the ages not equally entitled to their Free Will? Is it fair to turn some humans, like Saul/Paul, or doubting Thomas, into saints by providing them with evidence to directly support what is, quite honestly, a dubious proposition, while damning others to an eternity of torment for not believing the same things *without* being provided with the same evidence? The free will argument doesn't hold water, but we'll delay a fuller discussion of the *ethical* arguments against Standard Model God until later still.

One can also assert that God *could* break the Laws of Nature at will, but chooses not to. Ever. At least where people can see. Not because of Free Will – that argument doesn't fly. Because It is *God*, and doesn't have to explain Itself to you, or to me, or to make sense. It's God and we're not, and that's that. This leaves us, of course, with a Universe where we can never detect God, where no physical outcome is ever going to be measurably different if you believe in God or if you don't (nobody can deny the effect on people's lives due to *belief* in God, as we live in a world with nearly unceasing religious wars, with many laws based on religious beliefs that may or may not make any actual sense – like the idea that God hates homosexuals, that exposing a woman's naked breast to the world is somehow evil, that buying beer anytime before 1 p.m. Sunday afternoon is a deep affront to God, that God prefers to be named Allah as opposed to Yahweh, Jehovah, “just God”, Brahma, or The Great Spirit and if anybody does any of these prohibited things it is all right to punish them in a variety of ways right here on Earth because *obviously, we can't rely on an All Powerful Standard Model God to take care of it Itself when it never actually intervenes in the natural time evolution of the Universe!*

⁵⁴For example, Saul/Paul asserted that Jesus had not only appeared to *him* posthumously on the road to Damascus, but to “hundreds of others, some awake and some who have fallen asleep” – that is, dead. Why only then, and only them? Why not everybody, and why not all the time? It would be much easier to believe in something unlikely *with* the contemporary, scientifically validated evidence to support it...

15.3 Conclusion

We started this chapter by carefully defining a Standard Model God – one that possesses the “usual” agglomeration of “infinite” properties: omniscience, omnipotence, omnibenevolence – who is besides the Creator of the Universe. We then systematically deconstructed this model on both logical grounds and empirical grounds. Let us conclude the chapter by lining up the results of our analysis in a simple list.

- A dualistic, Standard Model God who *created the Universe* is impossible, because existence must precede creation (if the latter is a dynamical act) and we have carefully *and correctly* defined the Universe to be *everything* that has the fundamental existential property that we have *inferred* from the amazing consistency of our non-null experiencing of “something”.
- *No* sentient being can “know” itself perfectly. Whatever the mechanism used to store information, it cannot simultaneously store information *about the microscopic, detailed state of that mechanism* and *anything else* at the same time, especially when one allows for the need to store, somehow, the *meaning* of its entire storage system, what it *stands for*, how it must be *interpreted*. An omniscient *sentient* God is therefore impossible – contracted by the not-so-simple *counting* of information theory.
- *No* sentient being can be certain that its own perceptions and knowledge stretch to *everything that exists*. Again, comparatively simple mathematics always leaves open the possibility of *completely disjoint patches of the Universe* defined as usual as everything that objectively, really, truly, exists, whether or not *we* know about it. If a sentient being isn’t certain that its *own* knowledge is exhaustive, it cannot be said to be omniscient in any useful sense.
- The properties of omniscience and a capability of action are incompatible. Action occurs *in time*, but time is meaningless to an omniscient being as all events and knowledge are essentially *frozen*, with no meaningful past, present, or future, or (thereby) *choice*. The entire *concept* of free will – for anyone – disappears, since all choices are hardwired into the Universe itself. The *illusion* of free choice exists only for sentient beings with *imperfect* knowledge of the future and outcomes who can act interactively with a dynamically changing, mostly unknown environment.

- Finally, in a separate but related question, it is a simple fact that the best Bayesian estimate of the *probability* that a sentient/interactive God exists yields a result asymptotically approaching zero in the absence of reliable, reproducible, systematic evidence support that belief. To put it bluntly, the more evidence we accumulate that science works and our evidence-backed scientific beliefs are *probably true*, the less we should believe in *all* disjoint alternative hypotheses, especially God, for whom *extraordinary* claims are made – all safely untestable – while in the realm of the mundane evidence is entirely lacking.

Chapter 16

Pandeism: A Sort-Of Consistent Model for God

Reality is all-encompassing: the absolute nature is one. Although we may feel separate from the original uncreated reality - whether we call it 'God,' 'peak experience,' or 'enlightened mind' - through awareness we can contact this essential part of ourselves.

Tarhang Tulku

In the previous two chapters, we observed that the Standard Model of God, Creator of the Universe, embraced by at least *most* of the sects and variations of Christianity, Judaism, Islam, Mormonism, is *inconsistent* and hence *provably impossible*. A God could not even create a *Cosmos* without already existing, and existence itself is not logically or empirically contingent on the pre-existence of God. No matter what, the Universe *is what it is*, uncreated.

We have observed as well that an *omniscient, omnipotent, omnibenevolent* God is quite impossible. Omniscience literally violates some of the simplest and most fundamental principles of computer science and encoding, information theory, and geometry – *nothing* can be omniscient *and* sentient because it is literally impossible for any being to fully know its own mind, no matter *how* it is constructed (magically/mystically, or otherwise). Nor can any being ever be *certain* that its own knowledge is complete, let alone consistent, so any really *smart* being would *know* that they were not omniscient and would thereby never claim the Standard Model God property of omniscience in any sort of religious revelation unless they were also a *liar* and not even *close* to being an actual God, or god, or really powerful (but ethical) space alien. Omnipotence obviously

exits along with omnipotence – no Standard Model God has power that extends beyond their own possibly bounded knowledge, no Standard Model God can *choose* to know themselves perfectly or pretend to have or be able to confer “free will”. Omnibenevolence has *always* been an absurd proposition as we empirically live in a Cosmos that *doesn’t give a shit* if we suffer, justly or unjustly.

Indeed, all of our experience teaches us that the only beings we can rely on to make the world a better place is ourselves; modern science has managed in a little more than a century or two to perform pretty much *all of the miracles* attributed to Jesus, and a whole lot besides. If Jesus *were* omnibenevolent and omniscient, he would have accomplished far, far more by simply teaching his followers glassblowing and the art of making microscopes and telescopes – the rest of the development of science and medicine would have taken care of itself¹.

Instead there isn’t even a *hint* that Jesus knew that the flood myth was a *myth*, not the truth, that Genesis was filled with *myths*, not actual knowledge. Jesus may, or may not, have been a particularly good human being – something to debate another day – but it is practically certain is that *he was not God* in any form whatsoever and that *he did not come back to life three days after actually dying dead!* To the extent that you believe the general correctness of the *entire scientific worldview* that *works* to support the universal “miracles” of modern life including your ability to read these words, you must believe that coming back to life from not just dead, but dead *and rotten* is pure fantasy.

Yet, humans feel a powerful pull to believe in *something greater than themselves*, something capable of *giving meaning to their existence beyond doing what it takes to exist yet another day* while en route to a death that common sense and experience tells us is *inevitable and permanent*. If I didn’t exist for (literally) half an eternity, and won’t exist for (literally) the *second* half of eternity except for a tiny little window in the present, *why should I bother to care about, or do, anything at all?* What reason is there to choose Good over Evil. What even *defines* Good and Evil? Without the *comfortable myths* of a benevolent perfectly just Deity who will make it all work out in the end, *no matter how miserable things are in this one brief life that you have*, you may well be one of the *many* people who suddenly feel like they are once again dangling over the Existential Pit of Dispair!

¹Jesus might have thrown in the printing press along *with* glass and optical instruments if he had wanted you to read anything he *actually wrote* instead of copies of copies of scraps of manuscript copies of hearsay about what he *might* have once *said*, written down the better part of a century after his presumable death. The bible lacks even an assertion of evidence that Jesus was *literate*, let alone *omniscient*.

It therefore behooves us to take a look at our model of Deity and see if we can – perhaps, just maybe – *tweak it a bit*. We’ll have to get rid of some of the properties of Standard Model God, but perhaps we can preserve a few as well, softened or altered to avoid the impossibilities attendant on the *way* we assert the “infinite/Omni” properties. Infinity is a troubling concept even to mathematicians and physicists who somewhat understand it. Maybe a lot of our trouble is that our ancestors insisted on an *anthropomorphic* God, one that we created in *our* own image because we did not know enough to just let Nature speak for itself without human’s appointing themselves as tribal interpreters without check or balance or any possibility of empirical correction.

There are excellent reasons to give this exercise a try. For one, it leads to a model of God that is *marginally compatible* with at least *some* world religions – even some sects of the *Abrahamic* faiths embrace it at least in part. For another, it might, just might, give us a way of making the Pit of Existential Despair vanish from our lives forever, and at the same time point out a way to move towards a *rational* system of ethics instead of one derived from pronouncements made by patriarchal genocidal tribal leaders thousands of years ago, ones whose *primary* purpose was quite obviously to cement themselves into a position of power in their culture.

To get a starting direction, we can do no worse than to return to good old Saint Anselm. What is *literally* the “greatest” thing that you can imagine?

How about ***everything that has the fundamental existential property of actual existence in the real world – the Universe itself?***

Note that now I *can’t* imagine anything greater. I’m imagining – in the sense of assigning an understandable word to a general concept – everything that was, is, will be, in this set of spacetime dimensions or any possible *larger* set of connected or disconnected dimensions. I’m even throwing in my imagination itself – pink unicorns, invisible fairies, deities in general, the Lord of the Rings cosmos – they all exist *at least* in my imagination, but (as a good student of E. T. Jaynes – I hope) I know better than to assert a mind-projection fallacy, that existence in my imagination has any effect *one way or the other* on the objective reality that I imperfect observe and reason about. If pink unicorns really exist, they do so quite independent of my *beliefs* about them², and my

²Which is, if you have read the preceding chapters, that there is *no good reason* to believe that they exist, making it safe enough to believe that they *probably do not*, at least not on the Earth, where we’ve looked pretty hard for pink unicorns! Maybe they all hang around deep sea volcanic vents, or live deep within the earth’s crust – someplace we just haven’t looked yet – or maybe they are just *very, very good at hiding*, but... nope, can’t convince myself. Show me, is

reasoning process is open minded enough to be corrected at any point by reliable empirical data in the meantime.

Note that – as I’ve already argued – if God exists, then God must be *part* (a subset of) this Universe. But nothing I’ve argued requires that God be a *strict* subset of the Universe. We must allow, therefore, the possibility that God *is* the entire Universe, and hence is *literally* the greatest “thing” one could imagine existing, consisting by definition of *all that actually exists*.

Note well that I am *not asserting that this is probably true, or the best thing to believe given the evidence!* I am simply pointing out that the assertion “God and the Universe are identical” is *consistent* – so far – and conforms to the general idea of Anselm’s original argument. Here we have a huge advantage over Anselm, though, as *we are quite certain that something exists* so that “the Universe” is not the empty set.

The remaining thing to do is to see how close we can *reasonably* interpret the various properties of Standard Model God within the bounds of this general – still quite unproven – assertion. Let’s go through the properties one at a time.

16.1 Omniscience

We spent a great deal of time on omniscience in the previous chapter, as it was the one that could most easily be shown to be quite impossible, thanks to the development of information and encoding theory. This time was well spent, though as it also makes it possible for us to *skip* almost all of it here.

It should be apparent that the Universe knows its own state *like a rock knows its own state*. That is, it *is* what it is. The information content is self-encoded in the “stuff” that makes up the Universe. Note well that I make no effort whatsoever to place the slightest restriction on what the sum total of that “stuff” might be, only recognizing that *so far* it appears to consist of *at least* four-dimensional spacetime, a bunch of structured mass-energy interacting according to some empirically decipherable rules that generate coherent but transient patterns in spacetime, that we *are* just such a transient pattern, living on the surface of another, and that there is some reason to believe that there are *at least* another six or seven dimensions and that the spacetime we live in extends *at least* a few hundred billion light years out from where we happen to be. Not bad for the cooperative efforts of all those little chunks of ordered “stuff” working together

all I can say.

to figure all of this out using a mix of empirical and logical reasoning!

Now, does the Universe “know” everything in any sense *more* complex than rock knowledge, self-representation? In general, the answer is almost certainly *no!* Make no mistake about that! You can get all mystical and assert that a rock is wise, knowing, experiencing, participating in a greater sentience, but ultimately the best we can say *using the actual probable knowledge worked out by science* is that the rock has nothing *like* “a brain”, has no internal processes that we have discovered *so far* that *could* conceivably function like a brain, no sensory apparatus, no evolved structure, no metabolism – the list of reasons to think that rocks are, well, *as dumb as rocks* is a long one!

And if you look out at the Universe through a telescope great or small, look at the planets in our solar system, look at the stars beyond (and imagine looking at the planets we can just *barely* “see” with our most powerful looking apparatus that surround them) what you will conclude is that *most of the Universe we know of* consists of:

- Empty-ish space. This is 99.999...offhand know how many nines (somebody probably has estimated it) but it's a lot. I say -ish because even interstellar or intergalactic space has *some* matter in it as well as some massless things like photons passing through it – on the order of an atom per cubic meter, IIRC. But – ignoring the fact that the *atom itself* is mostly empty space and treating it as a chunk of matter an angstrom in radius – that would mean that the number of 9's would be around *thirty*.
- Stars. Lots and lots of stars. A few hundred billion galaxies of them that we can *see* (and a lot more almost certainly – subject to a few reasonable assumptions – out past the limits of what we can see), with each galaxy having order of a few hundred billion stars. Again, there isn't the *slightest reason* to think that stars can think as in symbolically reason, or perceive their environment, or talk to their fellow stars.
- Planets. Planets are mostly made of, well, rock. Ex-star stuff that has cooled enough to condense to a liquid (e.g. magma, molten rock) or solid (rock). And *please* don't hold up a pet rock or mystic crystal and assert that you can talk to the former or commune with the latter, or I'll make up a simple experiment that proves to any reasonable person that you are *almost certainly* mistaken... and quite possibly in need of help.
- Waaaay down here in the list, we can acknowledge that at least *one* of those planets is covered with a scruffy bunch of self-replicating “stuff” that

has evolved enough structure to be able to exploit the flow of free energy in its environment to maintain and increase the complexity of its structure. The most complex chunks of this scruffy, soft, transient material are *us!* And yeah, *we think!*

- Finally, there is a bunch of stuff you *can't* see in telescopes and that physicists infer only from long and complex complex observations intertwined with speculative reasoning. That's where things like "dark matter", "dark energy", "hidden dimensions" and so on live. Most of this has advanced to the point where it is *probably* real enough, but – and I say this as a physicist who watches the pros in the field with great interest – so far, we have no completely coherent *empirically supported theory* that has risen to the point of probable truth, although the facts the *speculative* theories being played are supposed to explain are clear enough. We'll ignore this entirely at the moment beyond noting that our knowledge of the Universe is, beyond all doubt, *incomplete*³.

So, can we reasonably assert that the Universe is God, God is the Universe, and is omniscient in a *useful* sense? Allowing for the fact that it knows everything by *being* everything, can it know itself at any *higher* level?

The best *empirically supported* answer is yes – and no.

I bet that caught you by surprise, didn't it. I said *yes* (before note well, saying no as well, no fool am I). Our best understanding of computation and sentient processes in actual brains is that they involve *considerable amounts* – *multiple layers of* information encoding, information compression, dynamical associative processes in a *loop* of consciousness of self at the interacting heart of an ongoing sensory stream from a presumed Universe outside of our selves, both physical body and perceptual center. All of these processes involve *enormous amounts of energy and entropy*. The human brain burns *30%* of your calorie input every day⁴. The brain is just as subject to Landauer's principle as any other computer, and your brain generates *heat* as the metabolic byproduct of all of those entropy generating processes that drive your thought processes.

³...but that's no excuse for sloppy thinking, mind-projection, etc. Something has to be supported by strong consistency with *actual evidence* in order to be promoted over the sea of competing notions that all *could* be true, given that *almost all of them are not!*

⁴See? Reading this book is, like, a *workout*. Even if you skipped actual exercise so that you could read it, here you are, burning through calories like a house on fire. And, like a workout, thinking a lot makes you *tired*, you deplete your neurotransmitters used in thought, and, eventually, your thinking apparatus gets *stronger* from use just like your abs used to back when you were 18...

Your brain thrives on information entropy as well. You *can* think about trees because your brain *compresses* a vast, fuzzy set of tree-associated concepts to define a categorical set and associates it with the single token “tree”. You can walk through the woods with a friend and you can *both agree* that the majestic oak you are walking next to is a *tree*, agree that the squirrel collecting acorns at its feet is not, and engage in a spirited debate about whether acorns are trees *in posse* if not *in esse*, or whether a scruffy holly at its feet is a tree or merely a shrubbery. You don’t *need* to know the location of every damn subatomic particle that makes up this *particular* tree to reason about the tree – indeed, that kind of knowledge would be an impediment to actual thinking, to *conceptual* knowledge.

Well, your brain – yes, I’m talking about *you*, sitting (or not) as you read, not anyone else – almost certainly contains, by virtue of your ability to be *able* to read this book, a *map of the Universe*. Mind you, chances are pretty good that your map is probably a pretty terrible one – the moral equivalent of how a pirate map scratched out by a nine-year old kid who has hidden a “treasure” of some sort under a rock in your back yard⁵ compares to a satellite enhanced map of your neighborhood, let alone a really *good* map of the Universe (something we as a species still are not *close* to possessing). But still, *a map*.

You are certainly *part* of the Universe, aren’t you? I mean *I* as I sit here writing this cannot be absolutely certain that you really exist, but *you* are participating in the instantaneous celebration of your own unambiguous existence by *being*, *perceiving*, *thinking*, *doubting*. Something can’t be *doing* anything at all without *existing*. And here you are, *thinking about the Universe*, bringing into your mind in symbolic/conceptual form a map of sorts *of* (at least a part of) the Universe! **You are, in fact, a very small part of the Universe thinking about, knowing, perhaps even appreciating, *itself*!**

Your *sentient* appreciation of and knowledge of the Universe is far, far, from “omniscient”. In order to be able to think *at all* you must have had a constantly shifting stream of information from your perceptual apparatus feeding your brain from its earliest points of organization up to the present. Your perceptual apparatus, while adequate for the evolutionary needs of a hunter-gatherer species on steroids, is actually extremely limited in terms of range and scale – you can’t see more than a handful of light years away (and most of that is pretty fuzzy and hard to interpret) and the smallest objects you can see are really a *lot* bigger than the entire microscopic world that defines who we are and how we actually function. Even our instrument-augmented senses have much larger, but still mas-

⁵I still come across small plastic figures digging around in my garden. Three sons. No wonder that my beard is white...

sively finite, ranges. In *order* to think about *just trees* in your *local* Universe, you had to learn a language that compressed all that tree-ness and discrimination of tree from non-tree into a single *word*, and you will *never* actually see or study more than a tiny, tiny fraction of all of the trees that exist on our planet over the entire course of your – and their – lifetime.

Indeed, as far as we are able to tell based on observations and applying our reason, thought would be *meaningless* if it *were* “omniscient. Consider a movie, encoded and engraved on a DVD disk⁶. We will imagine that it contains and absolutely faithful (within its given resolution) image of a dynamic movie. It is, in fact, *omniscient* about that movie, in the rock sense of the term. Even if you put that DVD into a player and played the movie on a screen of some sort so that the images danced *precisely the way they were supposed to* and all of the sound waves came out of the speakers *perfectly recreating* the sound track of the movie, we would never say that the DVD player combined with the screen and speakers are *sentient*. They, too, are omniscient – they are generating a *perfect reproduction* of the information content in the DVD *in time*, but that omniscience is useless.

Only when the information makes it into *your mind* (for example) does it start to convey meaning, and your mind *gets* that meaning by *utterly ignoring* the precise coding that perfectly represented all of that information and focusing in on the *highly compressed* information conveyed by generalized *patterns of light and darkness* as *interpreted* by your brain, understands the sound track not by knowing what the oscilloscope trace of the currents fed to the speakers looks like but by *interpreting them as words*, or as music, or as environmental sounds that are *like* ones from your experience.

Needless to say, there is an *enormous* amount of information entropy being bounced around, symbolic encoding on top of symbolic encoding, with *meaning* so heavily encoded and dereferenced through so many layers that omniscience *at this level* becomes impossible, meaningless. In order to *experience* life as a sentient being, one *cannot simultaneously* be omniscient in anything but the rock sense of the term.

Before, we used this to conclude that Standard Model God could not exist, because the assertion there is that God knows *everything*, not as rock knowledge but as time-transcendent perfect knowledge of precise state and we showed that

⁶By the time you read this, DVD disks may no longer exist. Hell, by the time I’m *writing* this, they *already* barely exist. Basically substitute for “DVD” in your mind whatever mechanism that is currently in vogue for storing encoded information.

this was literally impossible. But knowledge *itself* is not impossible, *sentience* is not impossible, as long as one removes this limitation. And you *are* a small part of the Universe, *knowing itself* in the only way it can, imperfectly, in the stream of evolving time, with a whole, lot of entropy in the form of *unknown* knowledge available to be *discovered and experienced* by your sentient mind.

Is this enough to make the assertion God is the Universe is God plausible, in a highly *Non-standard* Model of God?

Most people would say no, I suspect. They want a God that really “knows” everything, the way *they* imagine knowing everything, although if you asked them to build an actual *model* for a being who is simultaneously totally aware of *both* the microscopic state of everything *and* could keep track of all of the thoughts and experiences of every sentient being running *in parallel*, they couldn’t do it. After all, God would have to not just “know” their thoughts – to truly *understand* them God would have to be *living your life*, actually *experiencing* your thoughts as they emerge in the dance between memory, perception, and reasoning at the heart of the sentient loop. God can’t just know “she’s having her period”, or “he’s addicted to alcohol” the way *we* might assert these things as an attempt at empathic compassion to explain some bad behavior, God would have to actually *experience* the mental and biological distortions associated with each, and *recall perfectly* all of the events over the course of a lifetime that led the people in question to the cusp of the decision, whether it be to snap at a loved one in a poor temper caused by pain and discomfort “beyond one’s control” or reach for one more drink before driving home.

Hey, wait a minute! This is *exactly* the kind of knowledge that God as the Universe *does* have – as you then *are* (perhaps, from a certain point of view) God, knowing perfectly and experiencing perfectly all of these things in the only way possible – by *being them*, not watching them from the outside. This doesn’t really help answer the basic question about omniscience, of course – it isn’t what the Abrahamic family of religions asserts as perfect knowledge, for sure – and it certainly doesn’t give *me* as part of God a perfect knowledge of *you* as part of God any more than it gives me a perfect knowledge of the dark side of the moon or what one specific Tyrannosaurus Rex was doing on April 17th at 3:05 pm sixty two million years ago... but not even *God* could have that sort of knowledge except, as we have noted, as rock knowledge, by at one point *being* that T. Rex, by *being* all of those rocks on the moon that I will never see and that don’t think at all.

Before I go on to the next things – which will be a lot shorter, I promise –

I will point out that the question is far from concluded in the analysis above. Our knowledge of physics is far from complete or perfect. For all we *know*, all of those hidden dimensions could contain entire Universes worth of computational structure, thinking apparatus, and a transluminal communication network operating on a Cosmos spanning basis with its own independent time axis. Or, we could all be *utterly mistaken* about our beliefs because we are all power units in The Matrix or some other comparatively absurd assertion of reality isn't at all what we experience it to be. Again, all I can do is point out that while evidence that these assertions are *true* is by construction impossible at this point in our epistemological and scientific development and (sigh) yeah, lack of evidence is not evidence of lack, neither is it *positive* evidence of *existence*. In my personal opinion, it is actually *immoral*, a scandalous breach of your responsibility as a sentient being, to believe things that are not the best things to believe *given* the evidence, let alone propose that we lift sets of beliefs that are openly *absurd* given the evidence to anything *like* probable truth.

These are ideas from the infinite sea of notions that need to just stay there, having tea with Pink Unicorns and March Hares, until there is *positive* evidence that they are true, not just the assertion that we can't prove them false either.

So yeah, it *could* be the case that the Universe is hard wired *way down deep inside* so that could be considered "sentient", just as it could be the case that it could *physically* and *actually* wired up in a big expensive computer in the *real* Universe where all of our perceptions of an *apparent* one are false. Or it could be the invisible fairies. Pesky things.

Believing that this *is* the case, that the Universe *is* co-experiencing Itself with (at least) the entropic resolution of your own perceptions, is a comparatively harmless one. There is no doubt at all that the Universe is the Universe and you are part of the Universe, and if you need to believe as well that the Universe is God and you are therefore part of God, well, a rose by any other name smells so sweet. The main thing is to not *anthropomorphize* that concept of God and start believing that because the Universe *may* also be God, that you will receive some special favors or status as a result. For that, we have if anything, mountains of *negative* evidence, which leads us to our next sub-topic.

16.2 Omnipotence

This one is easy. If the Universe is God is the Universe, then yeah, God is "omnipotent" in *precisely* the sense that the *Universe* is the all-powerful first

and only cause for Itself. Can it *choose* in any meaningful way? Probably not – see the previous section. But every time I drop a rock and it falls, it is without any doubt the physical laws structuring the Universe itself that causes it to dynamically act in the way I sentiently appreciate as “falling”, so if God *is* the Universe, then it is equally true to say that God *made* the rock fall.

Could God have chosen to do otherwise? Could God have made the rock, say, fly into the air *in direct violation of all physical law*? To the best of our knowledge, no. At least, we have no evidence that It has ever done so, that any physical law violating events have ever occurred. That’s why we call them physical *laws*...

To conclude *this* section, then, a Pandeistic God, God that is Everything is consistent with the assertion of omnipotence per se, with the question of Universal sentience required for *useful* omnipotence, the ability to *choose*, extremely dubious or openly contradictory depending on how you frame the assertions.

16.3 Omnibenevolence

This is a tough one. If God is the Universe, and the Universe evolves precisely according to immutable physical law (as it appears to so do) *and* of the Universe possesses *enough* sentience to be able to make choices, then it is difficult to assert that God is omnibenevolent. The Problem of Theodicy is a *serious moral problem* with any deity that is anything *like* Standard Model of God. If an Omnipotent God is also Omnibenevolent and Omniscient, then it “knows” of evil, “hates” evil, and “could end” evil, and (presuming it is also *sentient*) could *chose* to prevent all evil. Yet evil exists⁷.

In precisely this sense, the fact that evil *does* exist is an argument against the Universe – if it is indeed God – being an *omnibenevolent* God. To the absolute limits of our ability to observe, the Universe is *utterly indifferent to suffering*. It *never* goes out of its course, as Paine might have put it, to alleviate suffering and in due course, it is the *Universal* (literally) cause of all suffering. Yes, suffering is an evolutionary trait – it motivates life and reproduction enhancing activity, like avoiding getting eaten by predators or falling off of high rocks and breaking

⁷Again, I’m not going to nitpick over this with people who want to assert that human suffering isn’t really *evil* – it sure as hell is the very *definition* of evil to the sufferer, especially if somebody is sitting there going “There there, sure it hurts, and yeah, all I have to do is snap my metaphorical fingers and you’d be good as new, right as rain, feeling as good as you’ve ever felt in your entire life and then some, but *I’m not going to do it* because it is *good* that you are suffering...”

bones because it *hurts*. Animals suffer to a greater or lesser extent all the way down to simple tropisms as a simple way of encapsulating (to quote a well known song) “Nature’s way of telling you something’s wrong”. Evil in human affairs is more complex, as humans are more complex, and it is easy for humans to suffer in ways that the lower animals do *not*. But still, it is fairly clearly repurposed or distorted life-seeking instincts and emotional responses that are involved even when one suffers because one’s basketball team loses a game and no actual lives are at stake or actual pain is caused by the event.

This provides us with a couple of very important lessons that absolutely *must* accompany any assertion that the Universe is God is the Universe is God... (etc) – to the best of our *empirical* knowledge, the Universe, God or not, is indifferent. On the good side, that means that the Universe is *perfectly just* by being *perfectly impersonal*. It doesn’t single out humans for special rewards, it doesn’t alter natural law on a whim to accommodate our desires or needs, but neither does it single humans out for special *punishments* or *deliberately and maliciously* cause suffering. Suffering, good, evil, whatever, all just *are*. They are an inevitable aspect of the Universe we live in, an outcome of its time evolution under physical laws.

Is this some sort of “omnibenevolence” *in disguise*, as religious apologists would generally have you (and they themselves) accept just so they don’t have to experience the *enormous* dose of ***cognitive dissonance*** associated with the realization that no, God does not, and will not, cut them the *slightest bit of slack*, no matter *how hard they comply with the arcane magical rules that are the requirements of their favorite religion?*

Absolutely not!

Let’s not play word games here, and redefine evil as good, pain as pleasure, or assert that magic happens but only undetectably, just as if it did *not* exist. Suffering exists. Suffering sucks and any merely *ordinarily* benevolent *person* would rather that all of those around them did not suffer, and most to some greater or lesser extent act at least occasionally to reduce both their own suffering and that of their neighbors, friends, co-inhabitants of the planet. Therefore, no omnibenevolent Deity capable of ending that suffering exists. As moral/ethical syllogisms go, this one is pretty powerful.

16.4 Conclusion

So here it is. *If* you feel the need for a religion – and many people do, and it is undeniable that religions have done a lot of *good* things along with many absolutely horrific things (both understandable as they are the imaginary creations of mere humans capable of both good and horrific things) – then the *only* religion(s) that are not instantly rejectable on the grounds of reason mixed with observation are variations of Pandeism, the assertion that everything is God, God is everything, that the Universe and God are One.

Most world religions that make this assertion – and certain sects of the ones that do not – don’t do a very good job of specifying the Deity in question, corrupting their own favorite model with impossible, inconsistent, self-contradictory chunks from the Standard Model, or making up whole chunks of creation or other mythologies to accompany it, or anthropomorphizing it into a distorted image of a human tyrant king (compassionate or not). Some of the mythology attempts to *address* the flaws pointed out above in the model – Brahma creating the Universe by essentially destroying Itself as a self-aware entity in the process, Krishna revealing his Visvarupa to Arjuna on the high fields of Kurukshetra (basically asserting that Krishna is mere Krishna, the human person of the moment, and is simultaneously *every other person on the battlefield, every other person who will ever or has ever lived, and all of the world that they did, are, or will live in* at the same time). These are all tales of how the Universe *could* be sentient and all knowing, all powerful etc, but in the monist pandeist school of thought, not the dualism inherent in the Abrahamic faiths.

As myths and legends, we may find these *useful* to the extent that they motivate “good” behavior and avoidance of “bad” behavior, once those religions *also* incorporate a posthumous perfect *mechanism for rewards and punishments* that is entirely imaginary, unsupported by anything like valid evidence.

But without it, one is left with the standard problem. The Universe may well be God, but if so, it is a God that utterly doesn’t care about being worshipped. It is utterly indifferent to the suffering and pain experienced by living sentient beings. There is no reason to believe in any sort of afterlife. But it *is*, for all of that, a *pretty awesome and amazing place to live in, to be a part of!*

Understanding that all we can *really* be certain of in the arena of human suffering and experience and sentience is that we *are* parts of the Universe that experience the Universe, a tiny chunk of the Universe knowing itself. We *do* have the ability to choose – or rather, even if we really *don’t* as our behavior is the

inevitable outcome of physical law, to us it *does not matter* as we *cannot predict* the future but only *experience* it as it unfolds into the present, with the *strong and compelling illusion* of choice.

If you want to believe that the Universe is God then, and that therefore *you* are a tiny bit of God, and you *want* God to be, if not perfectly benevolent, at least *better* over time, you *as* God must sentiently and deliberately *choose the good!*

There is no heaven, there is no hell, save for what the world offers us and what we ourselves make of it. If you want perfect and compassionate justice for yourself, seek it for everyone. If you want health and a comfortable, safe, existence, seek it for everyone. Basically, while Buddha didn't actually invent a religion, he *did* invent a pretty good set of ethical rules for building a society that deliberately *minimizes suffering*.

If you long for heaven, work to build one here, because it is the only one you will ever know, *whether or not* the Universe is God and you are God's hands directing the course human and planetary affairs of one small sentient corner of a vast, mostly empty, and apparently indifferent Cosmos.

Part V

Ethics

Chapter 17

A Short Critique of Ethics

A scorpion wanted to cross a river, but scorpions do not swim. The scorpion therefore asked a nearby frog to carry it.

The frog hesitated, afraid that the scorpion might sting, but the scorpion promised not to, pointing out that it itself would *drown* if it killed the frog in the middle of the river.

The frog thought for a moment, nodded, and agreed to transport the scorpion. Halfway across the river, the scorpion stung the frog anyway, dooming them both.

With its last breath, the frog asked the scorpion why it stung in spite of knowing that it would die too, to which the scorpion replied: "I'm sorry, but I couldn't resist the urge. *It's my nature.*"

Ancient Fable

The good I wish to do, that I do not, while the evil I do not want to do – that I do...

Romans 7:19

I have promised to propose a *rational* basis for ethics, one that has a chance of *working* independent of religious beliefs or legal mandates. There is, however, one major problem to address, one that utterly corrupts most philosophical discussions of ethics. Those discussions almost invariably proceed as if humans have something approximating *free will*, and can choose between good and evil.

When I was young, and comparatively foolish, I thought so too. Now, I'm very doubtful. Our conscious, sentient, interior monologue driven, rational brains are

not, actually, in complete charge of our actions and choices. Indeed, sometimes they aren't in charge at all and the inner "I" that sees and thinks is almost a *passive observer* of our own behavior.

As an example, last night I polished off about a quart of moose tracks ice cream, in spite of the fact that I'm 66 years old, overweight, and probably pre-diabetic. I *know perfectly well* that eating ice cream is not good for me and that I should really lose weight¹ by restricting calories, exercising, and eating well when I do eat at all, but *some* part of me *wants to eat that ice cream*, to feel it melt sweetly against my tongue, to feel the serotonin rush the sugar load triggers, ... ah, but enough pornography, sorry.

The point is that I, too, do that which I would not do, while not doing that which I would do. Inside of me is a scorpion over which I have only intermittent control that is metaphorically stinging the frog (my body) as together we cross the river of life.

In my encounters with other humans, it is rare indeed that I find someone that does not have similar *moral failures* – things that they do that they know perfectly well are bad, not in the sense that they are likely to start World War III or injure kittens, but bad *for them!* My wife the physician, whoa, you do *not* want to get *her* started on the subject. Alcohol (ab)use, drug (ab)use, overeating, failure to take medicine or comply with a therapeutic regimen, failure to wear a seat belt, failure to get vaccinated against a deadly global pandemic when age and multiple systems failures make you a veritable *poster child* for the humans most likely to die if they contract the disease, she sees it *all*, and I hear about it from her while she nags *me* not to go around eating ice cream and to exercise right after asking me to bring her a couple of chocolates or a Klondike bar as she watches TV prone on the sofa at night.

Do we actually have "free" will? I think that the answer must be no. Yes, we are *responsible* as the *proximate agent* initiating our own actions – but that which we perceive of as our "self" is at the very least far, far deeper and more complex than *just* our rational conscious mind. A lot of what is down there motivating our decisions, in many cases *against* the wishes of our rational conscious mind, was either put there by third parties (parents, the church, school teachers, peers) or left in there by evolution, inherited from half a billion years of ancestors for whom getting enough to eat, getting laid, and finding a warm rock to lie on while keeping an eye out for predators was the shiznit. One of those ancient lizards

¹Indeed, I should probably be exercising instead of typing away at this book – I hope you all appreciate the sacrifice I'm making!

left me with a taste for ice cream, what can I say? It could have been worse².

This is an example of an incredibly serious failure in the one part of philosophy that one might expect to have *survived* Hume's devastation of axiom-based rational thought applied to the real Universe – ethics. After all, ethics were (really) *never* about something you can point to in the real world any more than the number one is – even less so that “the color green” – so surely we can reason about it without having to rely on the pesky *natural philosophy* – a.k.a. science – that is recognized as the *non-bullshit* philosophy of the day deducing probable *objective truths about a presumed external Universe*. Surely *here* we can define terms and bounce them around and achieve some sort of “formal” perfection a la Plato, the *moral equivalent* of his “ideals”?

Not.

Ethical discussions *almost*³ invariably fail to take into account *anything* that science has learned about the way our brains actually work when they are functioning “perfectly”, to the extent that we've learned anything at all about it and our conclusions are, in fact, correct (not quite the same thing, remember). Then, we do a very poor job of accommodating the fact that our brains *don't* work perfectly *nearly all of the time*, in some cases very imperfectly indeed, *all for reasons utterly beyond our control!* We do, actually, *try* to account for this to some degree in the actual enforcement of our laws – not guilty for reasons of mental incompetence is a legitimate defense – but ultimately it is enforced on the basis of an invisible line, a criterion that no one can even *state* clearly, let alone measure objectively. Who amongst us is *truly* mentally *competent*? It's all a matter of degree.

This makes reading accounts of so-called Eudaimonia⁴ (one of the common elements to many studies of virtue-based ethics) somewhat surreal. I have taught physics at one level or another for over four decades, and in the process have encountered many students who *wanted* to learn physics, and *needed* to learn physics, and *were certainly smart enough* to learn physics and who *worked hard* to learn physics but who *nevertheless, could not* – or did not – *learn physics* well

²Wikipedia: http://www.wikipedia.org/wiki/Filial_cannibalism. Say what? Is that even a thing? Oh yes it is! Sons of mine, look out!

³But not quite always. To quote a brilliant paper by G. E. M. Anscombe, “In present-day philosophy an explanation is required how an unjust man is a bad man, or an unjust action a bad one; to give such an explanation belongs to ethics; but it cannot even be begun until we are equipped with a sound philosophy of psychology.” Hear, hear! Except that I would replace the word “philosophy” with “well-founded empirical science” of psychology, something that we are working on but *still* largely lack.

⁴Wikipedia: <http://www.wikipedia.org/wiki/Eudaimonia>.

enough to avoid a grade of anywhere from a low C to actual failure, an F.

Early on, I attributed this failure to the student – after all, according to the implicit ethos system of our entire educational system, if a student fails it is (usually, at least) *their fault*, and students themselves will often⁵ agree with this assessment if they perceive of the course as being “well taught” and “fair” and *feel like “a failure”* after they fail.

In my “middle period” of teaching (let’s call it that, why not?) I began to attribute *some* of this failure to *myself*. Perhaps the students that had done poorly *could* have done well, if only I had taught them *better*. Perhaps teaching, and learning, were a lot more *nuanced* than I had believed (and that the accepted practices acknowledged) after going through the entire educational system to a Ph.D. myself, reasonably successfully. It worked for me so it *must* work for them if they try hard enough, right? Even now, to my experience this is a core *ethical belief* in academia top to bottom, making it surprisingly resistant to change.

I was aided in realizing that this might, just might, not be true by having three sons over eight years, two of whom were eventually diagnosed with ADD. My oldest son, in particular, taught me that no matter how hard I tried, *I wasn’t really teaching anything at all* in my physics class, or anywhere else! All I was doing was *providing my students with an opportunity and structured environment in which to learn*, where learning was an *active* process on their part, not a game where they were passive recipients of established wisdom, deep wells into which I could pour knowledge in a clear enough lecture. To mutilate a Yoda quote: “Learn or do not learn. There is no teach.”

As I actively explored this possibility and focused effort on conveying *specific* concepts that every generation of physics students struggled and tried to come up with ways I could *keep* students from giving up out of sheer frustration when they worked hard but didn’t succeed, it became increasingly clear that while “the system” teaches all students as if they are the same⁶, in fact many students learn *differently*. They often have *different cognitive styles* – some more visual, some more verbal, some need more examples, some thrive on derivations and logical rigor, and that if there was a common factor, the more time they spent *using* physics, *doing* problems in an environment that encouraged their active engagement and mentored participation, the better *on the whole* my class would do. This reduced, but did not eliminate, the exceptions.

⁵Of course, there is also a substantial fraction of them that will blame *you* for their failure even if they e.g. never did their homework and only rarely came to class.

⁶Follow the rules in class and you will learn unless you are too stupid or too lazy or (fill in the blank with a personal failure to avoid responsibility for their difficulties).

At about this *same* time, the academic world from kindergarten through graduate school started to *recognize* something learned from empirical and practical psychology. It isn't just clinically diagnosable attention deficit disorder and its hyperactive kin. It isn't even just named personality and psychiatric disorders: things like generalized depression, anxiety, being obsessive-compulsive, or the entire spectrum of autism. It turns out that there are *lots* of learning disabilities, some of them not even named yet, as well as wildly varying levels of actual intelligence⁷. I've learned from direct experience that students in the process of having their first bipolar break, or with low grade but burgeoning schizophrenia generally have a hard time learning, but that's low hanging fruit, fish in a barrel, and fortunately, comparatively rare.

More subtle – and common! – are students with *depression*. Depression is an insidious thing – biological psychology *barely* knows *some* of the things that cause it⁸. I can positively state from sad experience that students suffering from depression have a very, very hard time keeping up with the work and participating in the activities required to learn *anything*, let alone a challenging subject like physics. They often find it difficult to do simple things like *get out of bed*, and they not infrequently *self-medicate* with drugs or alcohol in ways that do not, actually, make it better or make themselves more functional.

Anxiety is another one. Fear and anxiety can take one of the *best students in the class* and render them incapable of remembering their own name in times of great stress – like taking final exams. I learned this from a student who literally handed her final exam in, in tears, and when I asked her what was the matter – she was a very good student and I expected her to get an A – she said that she spent the last forty minutes of the final staring at a 25 point problem, trembling, unable to think of anything but the fact that she couldn't think and time was passing and she was going to fail and this *increased* the stress and all she could think about was how disappointed her parents were going to be and she couldn't even read the problem and make sense of it, etc. Then she said something I have never forgotten since – “Now that I've handed it in, I can remember exactly how

⁷I already knew about that firsthand, as previously communicated, thanks to my two-year-older-than-me brother with Down's syndrome. I grew up with the contrast every day of my life until I left home for college.

⁸For example, *neurotransmitter imbalances* in serotonin, dopamine, norepinephrine are known and *somewhat* treatable, but some depression is linked to e.g. post-traumatic stress disorder – a traumatic life shock, some depends on *the weather or time of year*, some depends on one's *family and social environment and love life and gender identity and...* too many other things to list, many of them so complex we can't even identify them, let alone successfully treat them with any mix of drugs *and* therapy. Although the latter often *can* at least help!

to solve it. I just couldn't think during the exam because of all of the stress."

Once she had resigned herself to the failure and quit *wanting* to solve the problem so desperately, taking off the pressure, her *brain started to work once again!* I think it is safe to say that *all of us* who have lived more than a decade or two have experienced this general phenomenon over, and over again. To quote: "*Fear is the mind killer!*"⁹

Being as how the professor is "god" (lower case) in their own class, I casually asked her to step to the board and show me the solution she now could work out; she did so, and it was indeed perfectly correct, so I just counted *it* and gave her full credit for the problem but – if I *hadn't* asked her why she was in tears after noticing that she sat frozen for the last half hour, if she *hadn't* defused the stress and anxiety by telling me all about it, if I *hadn't* given her the opportunity to show me that she *had* learned how to solve it – she *would indeed* have gotten as much as a letter grade worse in the class. Perhaps, in her case, still not terrible, but certainly not a grade that reflected what she actually learned and her personal ability.

I began to ask myself – maybe it's not all them. Maybe it's not all *me*, either! Maybe – just maybe – doing poorly in the class was – more often than not – not a moral failure in *either of us!* Perhaps it was because of things *almost completely beyond our control* – ways that our own *personal* brains were dysfunctional (for at least this one purpose in this one context) that interfered with one or more steps in the learning process or (just as important, practically speaking, in a University) the *testing* process used to *assess* how successfully the student had learned! Epiphany!

Why have I told you this long, possibly tedious story? Because it has a *moral* (pun intended) to convey in the current discussion. After all, in one of the *first* serious discussions of philosophical ethics attributed to Socrates by his student, Plato, Socrates concludes (paraphrased) that "Knowledge is the (basis of) The Good". Here is a case study of students *in pursuit* of knowledge in a context that makes acquiring it in a specific, useful, limited domain *literally* the *agreed upon* "good" for the student in question, in a system *devoted to this good*. None of the students *want to fail!* They – or their parents or their scholarship or some combination of the above – are paying *well over a hundred dollars an hour* for the privilege and opportunity to *succeed* in learning! They have the

⁹At least, according to Frank Herbert his most famous work, *Dune*, where this aphorism appears as a basic creed of the Bene Gesserit. Although I would say "Fear is *a* mind killer". There are others.

intellectual wherewithal and time to spend learning and are – on paper – *capable* of succeeding. All of them¹⁰.

It's a perfect, simple, glimpse through a moral microscope. With the best of intentions and a carefully structured environment – basically all the stuff I set up in my “*late*” and *current* phase of teaching in part to address these issues, things like team-based learning (a mix of lecture immediately followed by in-class practice), well-staffed help rooms, multiple opportunities to succeed, and some focused therapy on things like test anxiety where and when I feel competent to deliver it – some intelligent and capable students *still fail to thrive* and do poorly for reasons that *nobody* can control, that are *nobody's fault*, and that (so far, at least) *nobody has a solution to!*

Certainly no fault in a moral or ethical sense – the “fault” at the individual level is *the entire life experience from conception to the present* of the student including what they had for dinner they had the night before, when they went to bed, and how well they slept. Some of it might be in their DNA. Some of what goes wrong might truly be rooted in their earliest life experiences and how they participated the neural proliferation and pruning of their brain as adolescents. Some of their failure to thrive might be due due to their own *particular* balance of hormones, neurotransmitters, endogenous steroids. Some of it could be attributed to chemicals they (have) consume(d) – microplastics, environmental lead and mercury, things in their food and water or the air that they breathe or sure, in some cases or at some times, alcohol and/or drugs. Some of it could possibly be blamed on life experiences – parents in the middle of a divorce, stress over scholarships or loans required to go to Duke (a very expensive school) in the first place, stress due to racial issues or gender issues or sexual relationships gone awry, overcommitment of time, undercommitment of effort. Trying to determine a *specific* cause is like trying to run down *just the right butterfly* whose flapping wings ten years ago caused the Category Five hurricane that just destroyed your house¹¹.

Sound familiar? It should. It sounds like *life itself* – the same burdens we *all* struggle with while trying to cope with *our* everyday challenges. That's why it

¹⁰This is *Duke*, after all – we accept only maybe 3% of those that apply in any given class year, and while they aren't necessarily selected by picking the ones with *the* best grades, boards, IQs, etc, they are all filtered out so that they are *broadly academically competent* – *very* competent – compared to the general population of college-bound students, who are *already* a filtered group.

¹¹Wikipedia: http://www.wikipedia.org/wiki/Butterfly_effect. In case you have never heard about it, the Butterfly Effect refers to the way tiny, tiny causes – the flapping of a particular butterfly's wings – can get *amplified* in a chaotic system until they have enormously disproportionate effects. See also Wikipedia: http://www.wikipedia.org/wiki/For_Want_of_a_Nail.

is a great lead for any discussion of ethics that is at *all* likely to *do any good* – however we ultimately, and probably more “fuzzily”, define the term. Real life is even *harder* to ethically manage than a simple thing like a physics class, and I haven’t even mentioned the *actual ethical* issues often associated with this sort of class – cheating, plagiarism, academic dishonesty – as an *alternative* pathway to *unearned* success in the class.

If it is difficult for all students to just “be good” – act “eudaimonically” – in a case like this, where they literally *try their best to be good* in a narrowly defined, extremely utilitarian task with an entire *team* helping out and providing *both substantive and moral support*, how can we reasonably expect to spell out some *complicated* set of specifications for “The Good”, label compliance with them leading to “happiness” or “self-actualization” or any of the other terms used to describe the eudaimionic goal, do an indifferent and inconsistent job of teaching its rules to students who may well be *literally incapable* of learning them they way they have to be learned in order to become a functional ethical system in many if not most cases, and expect the system to actually *work*? **If knowledge is the ultimate Good, does that make all of the humans incapable through no fault of their own of acquiring it – pretty much all of us, I’d say, with some a lot less capable than others – Evil?**

I certainly *hope* not. But happiness, as they say – a term that is sometimes used as a near-synonym of eudaimonia¹² – is often a matter of *decreased expectations*. Instead of trying to accomplish an impossible task – precisely spelling out **The Good** (capitalized *and* boldfaced, look out) – let’s instead try to *imprecisely* and *flexibly* spell out *the Good Enough!*

Here’s the punch line. Eventually – after getting a few things straight – I’m going to propose what one might call “pragmatic virtue ethics”. It will steal ideas from many of the “named camps” of philosophical ethics, advancing the idea that a system of ethics requires a careful analysis of the “idea of ought” as the basis of an implicit *duty* to behave ethically. At this point “deontologists” – who are all about duty and lists of ethical rules all neatly spelled out and often handed down by deities or provided and enforced by rulers of one sort or another, will (if they haven’t already) have a (metaphorical) cow. They will point out that if *duty* and *compliance with a list* is part of the system, pragmatic virtue ethics is just *reworked deontology* and suggest that we all move along here, folks, nothing to see, nothing to see.

¹²Which is, yes, sigh, a term that most people have never even *heard* of and that I’m henceforth abandoning as being uncommunicative bullshit jargon in favor of terms people *might* actually understand

However, I plan to establish below that there is *is no one to owe that duty to but yourself* and that, in *practical* fact, you are taught all such duties by some mix of life experiences with positive or negative outcomes and actual memetic/verbal lessons and conditioning *while* your brain is wiring for language, learning social norms from parents and peers, and pruning vast numbers of pathways to make some decisions relatively likely, and others relatively unlikely.

In this process, it is only *well after the fact* that deontological “lists” of ethical imperatives, whatever their supposed meta-ethical or teleological basis – are communicated in a language with an implicit logical structure, and it should come as no surprise that most of the language *used* to convey deontological ethical imperatives to developing youth or argue about it in learned journals is devoted to a pure, unadulterated, logical fallacy – often, argument by authority – because, after all, in Nature *there is no such written list of ethical imperatives!* Humans have simply *made up, invented* all lists of ethical principles and rules and laws and so on, generally for entirely practical reasons, not because any given ethical principle is in any objective, verifiable sense **true**! Philosophical ethics in general, deontology in particular, is a field devoted to clothing the metaphorical emperor in ever more glamorous and expensive imaginary clothes while ignoring the clothes that evolution has woven for him¹³.

Sadly, deontologists often have a very hard time acknowledging this and very badly want to attribute their *favorite* list to God, to some sort of secular authority, or to some *philosophical* authority or system of axioms that produces a list that is closely congruent to what *they themselves* think everybody should do, or be. In the bizarre bazaar of ideas, they are the ones with flashy neon signs that say “You **must** buy our product” right above some small print that usually says something like “or else we will put you in jail, publicly torture you, execute you, or otherwise make you wish that you had”. Indeed, a plausible reason for the invention of an angry, moralistic God *at all* is to provide an unassailable authority to support a particular deontological system, together with an *infinitely large* negative consequence to deviating from it in any way¹⁴.

This is *especially* the case with parents – who are “natural” deontologists, the sole provider of both the unwritten list and the ultimate authority – as they try to communicate a set of ethical principles their two or three year old little savage when he or she takes some other child’s dolly and smashes it or tries to

¹³Which are not, whatever the parable might wish to claim, *nothing at all*.

¹⁴Allowing me to argue that deontological systems of ethics can themselves be *evil* by *any reasonable use of the term*, including deontological specification itself, by at the very least being *inconsistent*.

run out into the street. The child doesn't even have a *vocabulary* yet capable of *discussing* rules and majestic ethical principles, but they do understand the idea of immediate negative consequence delivered by the local Authority, be it a gentle swat on the bottom¹⁵ or social isolation/time out¹⁶. The child learns just as much from the *positive* consequences – getting to play with other children when they *do* follow the rules, the warmth and love they *ideally* receive from their local parental authority when they *share* their own dolly with another child (who hopefully doesn't turn around and smash it), from the sense of well-being, safety, and contentment that they feel when they are not in conflict with their local family and tribe.

Note that the *parents themselves* are generally not paragons of the philosophical world, capable of advanced and sublime ethical discourse, attempting to communicate a modified version of Utilitarian Virtue Based Ethics to their offspring. With very few, extremely well-educated exceptions, they are operating with whatever ethical system *they* received from On High (that is, from *their own* parents, religion, schools, peers) back when *they* were too young to think critically about it.

Nor are they guaranteed to be particularly good instructors of ethics or anything else – all parents are *rank amateurs* at child rearing for at least their first child or two, and do not peruse Kant¹⁷ or Dewey¹⁸ as part of their preparation¹⁹. In all probability, they convey some mish-mosh of ethical concepts derived from (in no particular order) their own upbringing, the scriptural mandates of the religion they were taught by their own parents during that upbringing, the laws, customs, and mores of their local community and their country of residence at large, all filtered by and warped by their own ongoing socioeconomic status, their own participation in “unethical” or “illegal” actions, and their personal mix of intelligence and general mental health.

¹⁵Oooo, I can hear the objections already....

¹⁶...which is great – when it works.

¹⁷Wikipedia: http://www.wikipedia.org/wiki/Immanuel_Kant.

¹⁸Wikipedia: http://www.wikipedia.org/wiki/John_Dewey. Note that Dewey (like Sid-dhartha, the Buddha, in his day) was a *social psychologist* and hence was probably *far, far more competent to reason about ethics than any “philosopher” that preceded him!* Part Four of his book *Human Nature and Conduct: an Introduction to Social Psychology* is well worth reading, especially lines like “Because there is no final recipe (for discriminating ‘good’ from ‘bad’ – rgb) by which to decide this question *all moral judgment is experimental and subject to revision by its issue*” (emphasis my own).

Of course, this work is *one hundred years old this year* and maybe, just maybe, social psychology has made a few advances since then. Y'think?

¹⁹Which is likely a good thing in at least the case of Kant, after all...

This makes this entire part of the book somewhat silly because this is the *practical reality* of ethical systems. They are memetic transferences from the entire local culture that gave birth to each individual child as they come along, in a highly “information entropic” process that gives *each* of us a *personally unique* exposure to – or perhaps it is fairer to say “brainwashing in” – ethics, from which *each* of us ends up with a *personally unique personal ethos* moderated by *our own* biochemistry, life experiences, and plain old luck, good or bad. It is so complex that we all *actively resist* any impulse to examine it and change it, lest we *break it* since we don’t really know how it works – when and as it does!

Mind you, we are literally evolved to go through this process of transfer, and transfer of a *poor* ethical system (but somewhat capable of change) is better than the observed result of *no meaningful ethical system at all* in the case of feral humans. It is integrated into the way our brains develop – and a substantial fraction of what we describe as *non-ethical* behavior, *vicious* behavior, arises from this process going *wrong*, from *failing* to imprint a functioning ethical system on a child during the narrow window when such imprinting can occur, or the malfunctioning of the biological processes that enable the imprinting. *After* it has happened, rational arguments and life experiences *can* move the pointer of a “moral compass” – either way – but it is empirically both difficult and unlikely for this to occur²⁰ and it may be more likely for the moral compass to move in a *negative* direction according to the ruleset embraced by a society rather than in a *positive* one.

This is partly the second law of thermodynamics, generalized – there must be fifty nearly effortless ways to leave your lover, but there is *only one to stay* and that’s with a lot of work, hence a high divorce rate if people have the freedom to choose and no secondary penalties associated with the choice. Nearly all the ways you can drive your car lead to trees, other cars, people, pets, over cliffs, into lakes, while a relatively *narrow* window of ways that *explicitly follow well-known rules established for all drivers as a condition of being allowed to drive* allows us to get around with a *minimal* (but non-zero) chance of running into a tree²¹.

Why do we who *mostly* follow these rules generally get irked at those drivers who blatantly ignore the speed limit, who run stop lights, who weave in and out of the traffic, who zip past us on the road shoulder and then forcefully merge a quarter mile ahead while we wait in line to get through a bottleneck on the

²⁰See, for example, the recidivism rates published by law enforcement offices everywhere.

²¹Again, *all decisions are moral decisions* from deciding to get out of bed to deciding *not* to buy ice cream because you know you shouldn’t eat it and that if you buy it, sooner or later you will. Traffic rules, in particular, are deontologist heaven.

road? Because *this is a moral failure* caused entirely by the *probable lack of consequence*, much as we might fantasize about shooting out their tires as they pass us. We keep the road safe enough to drive on, mostly, by following the rules, and they take advantage of the safe road to avoid the *price we pay* to keep it safe while breaking the rules (and, in the process, making it marginally less safe for us). An entire Universe of ethical discourse in a single, simple example. No wonder road rage is as common as it is.

Deontologists get the idea of duty right but utterly fail to recognize where “one’s duty” really comes from and that it is a duty, ‘ought’, ‘obligation’ to *ourselves and ourselves alone*. They miss out on the way those duties are acquired via memetic transfer, as established by evolutionary anthropology, developmental psychology and social psychology (where they usually carefully refrain from making *moral judgements per se* about “good” versus “bad” and concentrate on *how and why we learn to make moral judgements at all*, thanks John Dewey, thanks G.E.M. Anscombe!), and still have to argue with utilitarians and consequentialists and virtue ethicists over why their favorite list conforms to some abstract definition of “the good” when the consequentialists stubbornly refuse to acknowledge the *authority* of whatever source they used to *build* that list and point out obvious cases where the consequences render “simple” deontological rules like “Thou shalt not kill” untenable – explaining why they have *always* been ignored in favor of expediency at some level of consequence – killing during a time of war, killing a killer to prevent more killing, killing because paying to keep a person completely locked up and alive costs a *lot* more than just killing them and putting them in the ground, killing because God *tells* us to kill witches or children that sass their parents²².

Consequentialists get the idea that ethics has to have *something* to do with

²²To cite another “famous” case, in 1929 Secretary of State Henry L. Stimson shut down the Black Chamber, a government organization that spied on foreign diplomats, justifying this decision years later in his memoirs with the infamous comment “Gentlemen do not read each other’s mail”. This deontological principle lasted until he became Secretary of War during Word War II, at which point he became a de facto consequentialist as the Allies eventually *won the war* – at the very least, as rapidly as they did and with as few casualties as they had relative to the Axis countries they fought – as the *direct result* of their ability to decrypt enemy communications of every sort.

The moral of the story – put any deontologist into the position where they face some negative consequence, even one not as sweeping as “being on the list to go into the gas chamber” or “losing the war and being enslaved”, and they will almost certainly start to look for *consequential loopholes* in their otherwise perfect ethical ruleset. The minute *your* completely unrestrained freedom to own a gun *without any form of regulation* as a deontological principle endangers *my* children as they are playing in my yard a lot more than it protects them, yeah, like that.

the greatest good for the greatest number, but they and their utilitarian friends usually fail to get just what it is *right* – among other things. They attempt to reduce ethical theory to a kind of *ranking mathematics*, a *calculus of right and wrong* by assigning some teleological²³ *value to the outcome* of any given act to enable us to decide *what we “ought” to do!* Honestly, this is absurd, or at least, it must appeal to authority to establish an external “ought”, because *there is no teleological basis in Nature for such an ought* beyond the perception of success or failure in the mind of the individual in question and, as a source of consequence, the natural world in which they live, the society to which they belong in the face of impersonal nature, and competition from other, often hostile, species, individuals and societies.

Consequentialism also fails for too many other reasons to list but here are a few: it fails countless edge cases where there *is no* objective way to quantify and rank outcomes; it often *requires* an ethical person to sacrifice self-interest in favor of the greatest good *at all times*, making it an ethical principle that will *inevitably fail* as it runs directly contrary to any number of evolutionary imperatives. Yes, we often revere people who lay down their lives for us or endure great pain to accomplish some greater benefit (for us) or simply avoid “being a dick” when they could have been one (to our own collective greater benefit, see previous discussion of traffic-weaving speeders on the road), but deciding *not* to “be a hero” and run into a burning building to rescue its inhabitants is a perfectly

²³Wikipedia: <http://www.wikipedia.org/wiki/Teleology>. I’m sorry, using big words, but *it’s not my fault*. Teleological rules are ones that argue that natural entites have purposes independent of human ideas or rules. So far, so good – color me teleological, as long as you don’t overextend the meaning of the word “purposes” to mean, um, *purposes*. OK, OK, lemme ’splain.

Certain bird species have beaks that allow them to crack seeds for food or efficiently eat insects. Some of those *same* species have discovered that beaks can *also* hold twigs that can be used to get insects out of holes into which their beaks cannot reach! Most of those species also breath through holes in their beaks, drink through their beaks, warble for mates with their beaks, preen their feathers with their beaks, fight one another or defend themselves with their beaks, and basically use their beaks in *any beak-y way they can think of* as required by their desire to survive, eat, procreate, and perhaps sit for a minute on a warm branch and enjoy the sunshine when they aren’t hungry or horny.

Just which of these are the teleological – that is to say *intrinsic* – purposes of “the beak”? The problem is that *one* meaning of purpose is “to do that which a thing is designed to do” as in “the purpose for which my kitchen knives was made is to cut up food while preparing it to eat”. In nature, *nothing is teleological* in this sense. The underlying non-teleological reality is that *undirected, purposeless evolution* is responsible for all apparently “purposeful” structure, so that while we can recite its *usefulness* or *evolutionary advantage* we cannot assign it a *cosmic purpose* in the second sense of the term. And that’s the *key* term for *both* deontology and consequentialism, because they use *second-sense purpose* in the sense of *establishing the “ought”* in ethical imperatives – and hence fail.

rational thing to do even if one of those inhabitants might have one day grown up to cure cancer, bring about world peace, and end global hunger.

Sure, we might get all haughty and self-righteous and tell ourselves that *we* would have done it even if it *did* mean horrible third degree burns, incredible pain, and losing our *own* life and *our own* chance to cure cancer etc, but until we face just such a building, burning, *we do not know* what we will actually do until we do it, or don't do it. What we usually do *not* do as we make the choice is rationally weigh out the alternatives! If at some point we swerve to avoid a little old lady who has wandered out into the street and crash into a tree and end up losing our legs as a consequence, we didn't do it by weighing alternatives – we “decided” in a non-verbal manner in a fraction of a second on the basis of things that can *never* be reduced to some quantitative analysis and ranking of comparative outcomes based on some consequentialist system of weighting.

In most cases, *we don't even know beforehand what the space of possible outcomes is* in more than approximate ways when we act. When I bounce my feet because they are cold and getting stiff, I usually do it *without thinking* (because I'm too busy typing and using my entire frontal cortex and a lot of my other brain systems to criticize lots of bullshit ethical systems while proposing yet another equally bullshit ethical system). I certainly am not evaluating the probability of blood clots if I fail to move, or assessing my degree of contentment if I keep my feet marginally warmer by burning a few extra calories in the muscles therein, and yet *this is a moral decision*. If you rescue the people in that burning building, one of them could turn out to be the next Hitler as easily as the next Gandhi. Judging virtue on the basis of *ultimate consequences* of any given act (consequences for the individual or for the society of which the individual is a member, or for the entire human species, or for the entire eco-bio-sphere of the planet Earth or *the Universe itself* – where do we even draw the *line*) is utterly absurd in a complex, *mathematically chaotic* Universe where actions as innocuous as the flapping of a butterfly's wings can cause the entire future history of the world to change in completely unrecognizable, unpredictable ways ten years later.

Finally, lacking an objective teleology, how can we even rank the outcomes we *do* have a reasonable chance of predicting, such as the fact that if we murder some one, (at least) that one person will end up dead. Beyond that, does this act increase the general weal of the world, because it is horribly overpopulated? Does the person truly “need killing” because, say, they are serial murder cannibals who

eat their victims, who are small children²⁴? What are the chances that the person we kill *actually* will cure cancer or do anything at all except be a burden, especially if they are old and senile, or young and mentally handicapped? What about secondary consequences associated with our (possible/probable) punishment for violating laws against murder, or the effect of that person is removed from the socioeconomic sphere in general?

There *is no way to rank* consequences in terms of pain, pleasure, satisfaction, as definitions of “the good” whether you apply them to the individual or to society itself, without *already* having a basis for good and evil and then pretending that it is both foreseeable and quantifiable, because actions committed with the very best of intentions can have horrific consequences and vice versa.

In the end, deontology and consequentialism and utilitarianism etc. *all* share *some* “good” ideas, but in their attempt to be “perfect” or “complete” theories, they are too damn strict. They self-justify with some bullshit premise and then pretend that it is an axiom of the *wrong* (according to this work, anyway) sort – “self-evident truth” – supported by the perfect clarity of their arguments (not!) and some sort of moral *authority* they invoke one way or another that begs, *as it must*, the question of just what the good *really is*. It must because nowhere in nature can one point to the good, any more than one can point to the number one – it is a *high level human idea* we invent to help *describe how societies function* as they must for human members to derive their manifold advantages compared to *asocial* life, *feral* life, in isolation from all forms of organized memetic transfer in nature.

Ethics, in other words, is not a Platonic, or Socratic, or Kantian, or John Stuart Millsian, or Buddhist, or Christian, or Confucian *ideal*. It is not a possible result of rigorous reasoning from self-evident principles. Ethics is fundamentally *pragmatic*²⁵. The key is to establish (as is done in science) a set of interwoven ethical hypothesis or rules and then *test how they perform*, having *at all times the freedom to change the rules* as needed to make them perform *better* on the basis of *critical thinking*²⁶

²⁴...and not, say, containers of ice cream.

²⁵Wikipedia: http://www.wikipedia.org/wiki/Pragmatic_Ethics. As I said, I’m perfectly happy to steal ideas, and this is an astoundingly good one – so good that it occurred to me completely independently of Dewey and his followers, whom I learned of while *writing* this book. Imagine that. Note, however, that I’ve pretty much explicitly rejected the idea that empirical ethics can approach something objective, like physics, because in the case of physics we are seeking the best possible description of an objective Universe, where in ethics, not so much.

²⁶Which sounds *exactly* like what I proposed, motivating your suggested autobeliefectomy, at

Aha! you might say. You used the word “better”. That implies having some sort of standard for good or bad *outside* of the set of rules themselves, and you are right back in teleological country, rubbing shoulders with deontology and consequentialism and preparing to throw out some *bullshit* as a set of concepts called *virtues* that in general beg the question of what is “the good” And you’d be right! The difference, however, is that *we both know, and acknowledge, that this is exactly what I’m doing!* Nor am I trying to convince you that this set is perfect, or that I’m right, because of my vast *authority* – I’m pretty sure that actual University-based ethical philosophers who publish well-researched and reasoned papers on the subject *have never heard of me*. I know perfectly well that I’m about to propose a *fuzzy* set of *pure myths* – high level ideas that exist in nature *only* in language based human thought (even if they do describe things that humans do automatically as part of their genetic and memetic inheritance) – and that some of them may not work out well, while others do, and that some of them may need to be added or taken away from the set as a consequence.

I *also* know that you will either accept or reject all or some of them as a *personal choice*, making them a part of your *duty to yourself*, a conscious knowledge of what you *ought* to do, how you *ought* to behave, in your general, often instantaneous, decision making leading to every action in your life, from wiggling your toes to keep your blood flowing while you work to deciding that buying a semi-automatic gun and wading into a hostile crowd with it locked and loaded just *might* be an ethically reprehensible act given its potential for all sorts of negative outcomes, easily avoided by just *staying home*. I’m certainly not forcing anything on you, only suggesting that you *consciously* start to *critically assess* the set of rules that *were* forced on you and built into you at the *neural* level back when you were too young to understand them or make an informed choice to accept them.

This is, as you will rapidly discover, damned hard work! ***Beware cognitive dissonance*** as you assess the arguments or suggestions – are you objecting because they are somehow *wrong* or because, right or not, the idea of changing your core beliefs makes you *feel bad*, feel uncomfortable, feel fearful?

To clean (the kitchen) or not to clean, that is the question. Note well that, however banal, this is a *moral choice* – one with both wife-imposed and teleologically natural *consequences*. So just what *ought* we to do, when faced with even this simplest of moral choices? What ought we to accept as our definition of the good?

the beginning of this book.

Chapter 18

What *Ought* Ethics to Be?

If someone does have a divine law conception of ethics, all the same, he has to agree that he has to have a judgment that he ought (morally ought) to obey the divine law; so his ethic is in exactly the same position as any other: he merely has a “practical major premise”: “Divine law ought to be obeyed” where someone else has, e.g., “The greatest happiness principle ought to be employed in all decisions.”

G.E.M. Anscombe, in *Modern Moral Philosophy* (as of 1958).

...no Knowledge of the face of the Earth; no account of Time; no Arts; no Letters; no Society; and which is worst of all, continuall feare, and danger of violent death; And the life of man, solitary, poore, nasty, brutish, and *short*.

— *Thomas Hobbes*

in Chapter 8 of **Leviathan**, Of the Naturall Condition of Mankind, as Concerning Their Felicity, and Misery (my emphasis)

I started off with a quote from Anscombe, because I think her paper on this subject is rather brilliant (if a bit difficult in places to read). She is, as I am, very fond of Hume without necessary elevating his sometimes rambling discourses into “perfect truth”, or even a “practical major premise”¹. She concentrates on seeking a place where the entire *notion* of the word “ought”, used in the sense that you *ought* to do something, has an actual, specifiable meaning. Literally, of course, the word ought is etymologically (and I quote Mirriam-Webster online here) “1st & 3rd singular past indicative & subjunctive of *owen*, to own, owe.”

¹...that is, *axiom*!

That is, we *owe it* to pursue “the Good” when we *ought* to pursue “the Good”. If you think about it, all of ethics is bound up in what we *ought* to do, but since it is very unlikely that any Standard Model supernatural all knowing, perfectly loving, perfectly *just* being exists to be owed, precisely *to whom do we owe it?* Aye, that’s the rub. All external answers proposed inevitably *invent* the answer as an *axiom*, as there is *literally no one else in the actual Universe* to whom we owe it as an actual, intrinsic, teleological or conceptual obligation to do as we ought, no matter *how* you define the latter!

Even if I say you owe it to *yourself*, it is mere sophistry (or an axiom, correct definition) – clearly you can’t impose any sort of debt upon yourself in exchange for goods received from yourself in any way consistent with the usual definition of “to owe”. We have no good evidence for a God, and even if we did, and even if that God had passed down some sort of deontological list of rules and told us that we “ought” to obey them, we still need a *meta*-rule that we *ought* to owe what God says that we owe God because, well, God allegedly said it². We’re back into lying frog, infinite iterated chain of “oughts” territory.

The only possible exceptions are things like owe a debt to *your parents*, or more broadly, owe it “to society”. Here we’re perhaps closer to the mark – at least society (including your parents) *does observable things of value* for you so it is *capable* of reasonably leaving you in a kind of debt – but still begs the question as to why you *ought* to experience the *feeling* of obligation to do as society says you ought to do *even if* society has given you things of value in exchange. Or, for that matter, why you *owe-it* – ought – to pay *any* debt.

That’s the reason I included the second quote above – good old Thomas Hobbes, author of the concept of the *social contract* as a basis for ethics that go *beyond* those implicit in ethos-free nature where life is nasty, brutish, and short, in part because *in Nature no debt – ought – is observed beyond the immediate whim of the entity*, at least in Hobbes’ mind. Therefore, at least one objective argument for an obligatory ethos might be that such an ethos *defines and structures* your society, and that without that society, you are far, far less likely to obtain the things that you actually need on the basis of *evolutionary imperatives*³ – food, clothing, shelter, security, sex, entertainment, education, intellectual engagement, protection of self and offspring, and of course *a warm*

²See: https://en.wikisource.org/wiki/What_the_Tortoise_Said_to_Achilles You *absolutely ought* (snicker) to consider reading this entire little essay by none other than Lewis Carroll, master logician. It illustrates the unprovability of proving that we should believe in the most *rigorously derived* conclusions of *pure logic* in a most amusing way.

³Imperatives in the sense of Pirate Rules. You know. More like – suggestions.

rock to lay on and watch for predators when not too busy otherwise.

You are in principle *free* to refuse the “ought” implicit in accepting these things as a member, but you should remember that all of the *other* members of that society are *equally free to enforce that debt* by, for example, removing your life, taking away your liberty, seizing your possessions, and removing all hope of your personal happiness⁴. Screw bullshit ethics – this is the *bottom line!* Don’t expect the protections of a society that are themselves based on a set of entirely practical rules when you yourself *violate* those rules *because* they aren’t laws of nature⁵, they aren’t inviolable principles deduced by “authoritative” philosophers like Kant or listed in your favorite religious text, they are *purely imaginary* constructs that ultimately form the *thin line between you and Hobbes’ perpetual state of “warre”!*

The point is that without a *voluntary acceptance of the concept of ought*, one *is de facto* living in a state of nature, in constant “warre” declared or undeclared with all other humans and nature itself. Furthermore, you need at least *most* of the others in your social group to accept those rules as well, and collectively you need to establish *some* way of dealing with those that refuse to⁶. A failure in *any*

⁴Just in case *you* dear reader, are something of a sophist and want to argue for some other definition of ought such as “because God says we owe it” or “because the law says that we owe it” (which is actually *almost* a particular instance of the same thing, but inverted) or “because it minimizes overall evil or maximizes overall good” (question begging so much that I won’t even start...) here is a simple test for you.

Watch Tom Hanks in the movie *Castaway*, and imagine yourself on his little island, alone, even naked and without Wilson or the contents of UPS packages to start with. You would – probably for the first time in your life – have to *really* help yourself, not in some Walden Pond fantasy, and experience an ugly, nasty, and brutish life for the short time you lived before something like a simple infection, trivial to cure with antibiotics, killed you. Or starvation. Or exposure. Or thirst. Or being killed by an ocean animal while swimming, fishing, gathering food. And all the time, utterly alone...

Neither God nor the Law will help you if you should find yourself in the *real* state of nature, devoid of all social networks.

⁵Well, *some* of them in some sense *are*, both for humans and other animals. We all have a set of ethical “oughts” preprogrammed into us, somewhat indifferently and imperfectly, by evolution – instincts, developmental psychological windows for learning language and culture, etc. Humans simply have a vast collection of *memetic* “oughts” transmitted *by* language *within* cultures that we thought up/memetically evolved at the social level all by ourselves, driven at most indirectly by our genetic imperatives.

⁶Nearly all possible variants have been tried. Early societies often just killed them, with or without preliminary tortures. This, as we shall see, is probably not optimal for many, many reasons, but is clear evidence that ethical systems are fundamentally *pragmatic*, like it or not, or they simply vanish in the mists of the past as a social group with an ethical system that is *more* pragmatic wipes them out.

of these requirements ensures that, at the very least, you will be far less likely to obtain the *advantages* acceptance of and adherence to the ***myths of ought*** gains for you and those around you. Language. Education. Companionship. Far, far better toys, tools, and objects contributing to a good life than you could ever manage on your own. Air conditioning. Really, pretty much *everything that you value*.

Why do I say ***myths***, and emphasize it as I do? Because Anscombe is *quite right!* Ought is simultaneously at the heart of *any and all systems of ethics* and at the same time *does not exist in the actual Universe in any way except as a high level, somewhat fuzzy concept!* Sure, we all know what it *means* – if I say I *ought* to quit typing and clean the kitchen before my wife gets home from work, you can (quite correctly) envision that we have a complex social contract in which she goes and practices medicine and I stay home (when I’m not teaching or otherwise working) and do things that improve our common weal, like cleaning kitchens or vacuuming carpets. You might *simultaneously* conclude that it is “just” that I do so – our mutual contributions to our shared life should at least on average somewhat “balance” – and conclude that there are likely to be *consequences* if I do not fulfill my obligation.

And that, dear friends, is as close to a fundamental basis to a system of ethics with an *empirical* basis as opposed to high-falutin’ philosophical premises as I think we are likely to get. There is nothing in nature, logic, or pure reason enforcing that ought – there is only practical, learned experience, plus a fundamental, largely evolutionary/biological, sense of *values*. Ethics is all about the one *other* at least partly empirical human study of (social and practical) value: ***Economics!*** Economics *literally* studies, and defines, what we “owe” and how, through anything from a simple system of barter through an enormously complex structured system that includes bizarre things like cryptocurrencies, we come to *owe it* as we perform the exchanges of *value* that *define* living in a society as opposed to nature where no such exchanges are possible (or such exchanges as occur are violent in nature).

To me it is almost unexplainable how, among the reams that have been written on ethical systems, this point has been missed, with only things like Utilitarianism skirting the edges of it. Most of this work seems to be intended to give an ethical basis to economics (among other things), not recognize that *this is exactly backwards*. Empirically, “ought” implies an *exchange in value*, and only the agent(s) participating in the exchange define “the good” of that transaction and accept – or not – the associated “ought” on the basis of their expectations of the consequences either way.

Even trivial actions involving no other agent than yourself – wiggling toes to maintain circulation – involve the expenditure of time and energy in exchange for *some* sort of expected value, unless they are entirely involuntary reflexes. You owe it to *yourself* to seek food and shelter and avoid pain and danger at such a low, evolutionarily preprogrammed level that you can usually override it only with a substantial act of high-level “will”.

Experience is not just the best teacher, in some sense it is the *only* teacher. This is one of the basic themes of this book – we *ought* best believe that which we can doubt the least, *based on experience and the network of experience-based well-founded beliefs!* Everything else, the entire web of social mores, customs, axioms, lists of commandments, moral imperatives, laws, norms, is *all bullshit* designed to structure and formalize a set of *practical, constantly evolving memes* that our *experience* leads us to believe is a set of oughts that lead us to a *more satisfactory* life than we would otherwise have if we *rejected* those oughts.

Oh, there is more than just that. As noted above, our evolutionary psychology is *engineered at the genetic level* so that we are *preprogrammed* to fit into a society (by among other things learning its language and its social rules and ethical/economical expectations) starting when we are born and proceeding throughout our entire lives. *Every* moral choice we make teaches us by virtue of the consequences/outcomes of our choice, and *over time* we develop our “moral sense” the exact same way we learn that sugar is sweet and touching a hot stove burns. Some of that moral sense doubtless *is* virtually instinctual – not really a “free choice”. We learn that we *ought not* touch hot stoves with our little hands not because mommy tells us it is bad, not because we learn some elevated Deontological moral principle first propounded by Kant, but because *it hurts*, and we (usually, but *not always*) come prewired to *learn how to act in order to avoid pain*⁷.

Most of our ethical sense is almost certainly learned through a massive system of social rewards and punishments. Many of them are subtle and some are highly unsubtle, as is evident from *feral human* studies⁸ and a great deal of practical

⁷Something the Buddha presumably figured out when inventing a sociopsychological ethos based on avoidance of suffering as “the good”. He never explained, though, why this didn’t make *painless suicide* nearly obligatory, since a significant portion of life *is* suffering and many of our greatest rewards and most satisfying experiences *require* much suffering to accomplish. Evolutionary imperatives, of course, make up the difference. Kudos to you, women who have borne children and men who have helped raise them!

⁸Wikipedia: http://www.wikipedia.org/wiki/Feral_Human. I’ve used the term before, but in case you have never heard it: Both social behavior and language appear to be learnable only from birth through an age of perhaps five or six; after that, humans literally raised by animals

experience of parents seeking to keep their children alive and safe amongst their peers. These are *empirically* supported assertions, not philosophical bullshit – the object of study of academic subjects like *economics*, *evolutionary anthropology* and *behavioral and social and biological psychology*.

I hate to say it, but *philosophers per se* have had almost *no* impact on this highly practical system of ethics, however much they enjoy debating and discussing it all with fellow philosophers. By the time a human is old enough to understand *philosophical principles*, their system of values is almost entirely already in place, being reinforced by *every single transaction with other humans or nature itself* as they grow, although it remains plastic enough that *some* brilliant, new, high level ethical principles can and do slowly diffuse through society and change it (usually taking decades, or even generations, to accomplish the transition against the *resistance* of the dominant ethos).

My purpose here, then, is to lay out not a set of axioms to be accepted as true and used as the basis for all ethical reasoning – it is hopefully obvious why *this will forever fail* as humans and human society continue to *co-evolve* both genetically and memetically, trying to *distance* themselves from the “state of nature” because *life there sucks*. We are *constantly* tweaking and optimizing its learned, changing, evolving ethical basis to *on average* improve the lives of all of its members – within reason (and with a whole lot of inevitable imperfection and error). I do not expect to help it change much – my words here may not change *anything* – but perhaps, in a few decades or generations, they might lead to a better world. Or not. I won’t be here to see it either way.

The “prime axiom”, or “practical major premise” of the system I’m going to propose is that of *ought*. An ethical system *is* simply a list of rules we ought to use to determine what we ought to do in the near infinity of choices major or minor we face every day, *in order to optimize our chances at ‘contentment’*⁹. That “ought” literally positions every step we take in at least minor ways, governs every reasoned action, governs a lot of *unreasoned* actions, and is by no means invariably rational or consistent. My stomach tells me I *ought* to eat, my frontal cortex tells me I *ought* not, and my little internal list of things to do looping around in there tells me I *really* ought to stop writing and clean the damn kitchen – any minute now – in order to finish and be doing other collectively constructive chores before my wife gets home.

practically never are able to learn a language or function in a human society once they are rescued.

⁹To avoid having to use overworked and ambiguous terms like ‘happiness’ or obscure ones like eudaimonia.

I literally cannot strike a key or write down a word without some sort of low-grade, instantaneous “ought” decision to spend my precious time doing *that particular thing* compared to *everything else I could be doing*, all of the other ways I might actualize my ongoing existence through action or inaction. Again this point seems to be at least partially missed – *all decisions are ethical decisions* as they all involve a judgement of ought that elevates one and lowers all others of the things we might do, instant to instant. We make those decisions so fast, and usually with so little involvement of our higher interior-monologue-driven rational minds, that “philosophy” has almost nothing to do with them.

So *let’s make it an axiom* of our moral system, a *prime* axiom. It is an empirical fact that you *have* an ethical system that you *are using* to sort out *everything you do* from the list of things you *might* do, and that which you *actually* do is the “ought” that wins. Sure, you are, as I am, way complicated, and sometimes the ought that actually surfaces is one that wins a kind of *vote* in a *competition* of all of the internal systems that are “us” so we can quite reasonably be sitting there with our rational selves wondering why the hell we are eating ice cream when technically the *rational* part of us thought that we *ought* not, but there it is. And don’t try to pretend that this, or something very like this, doesn’t happen to you¹⁰!

Once you accept this, and recognize that you *ought* to do what your whole being decides it ought to do¹¹ because the only alternative is to do *nothing* and even *that* is a kind of ethical choice, we can start to make progress. Ought exists. All you can do *now* is try to *rationally choose* what you ought to do, and accept it as a *duty* to at least ***try to discipline that internal mob*** that is you *in total* to follow your high-level choices, mostly, when there is time to consider them. This is a *lifelong* duty to be sure, and one you can and *ought* to pass on to your children in their early memetic education if you don’t want them to grow up to be sociopaths and have a high chance of *losing* the evolutionary game and passing your personal genes on or providing you the *contentment* of bouncing loving grandchildren on your proverbial knee.

¹⁰If it *never* happened to you, you are unlikely to still be old enough to read this and still alive. *Some* of those decisions, like the one where it is “right” to jerk your wheel violently to the right to get around a deer that just appeared in your headlights directly in front of your onrushing car, *can’t* be made after thoughtful consideration, because your “thoughtful considerator” is *way too damn slow*!

¹¹Even in some bizarre internal multibrained election where sometimes your so-called reptile brain, your gut-brain, or a well-trained *combination* of neural subsystems *wins out* over your high-level frontal lobe conceptual decision making system. And in any event, you *always are going to do what your complete self decides it ought to do* whatever your frontal lobe and “higher self” thinks of the choice.

To summarize, then, like it or not, *everything you do* is driven by a system of *ought*, things that *you personally* use to determine *every voluntary action* (and some involuntary ones) as part of your *debt to yourself*, in exchange for the *benefits* of, say, being alive as opposed to the ever-present, all-too-rapidly approaching alternative. You are born with a *duty to yourself to live!* This fundamental biological duty, one that for better or worse or strongly or weakly is at least in part *impressed upon your very genes and built into the earliest biological and experiential development of your brain*, is *there* and *is* your fundamental ethical system.

Forget all of the bullshit about *the Good* with a capital G. Philosophers haven't found it because it does not objectively exist. What objectively exists is *our biological selves* and the incredibly complex social and economic networks we have built up while inventing an *improved* set of "oughts", one that, on average, improves our lives almost *immeasurably* beyond what they would almost certainly be if we were truly left in Hobbesian independent isolation in a state of nature, making that state *so unstable* that it basically never occurs on Planet Earth *except* for rare feral children, or when the social order breaks down so completely that the horrorshow result is scarcely recognizable as "human", let alone "good".

Humans have, as an *evolved feature* of our high-level, sentient, rational brains, the capacity to *invent the rules* that they will use to define "the Good" along with the *rest* of their worldview, and one can see in even the *slightest* glance at the things learned from history, anthropology, psychology, economics and so on that we are *constantly* changing them, upgrading them, tweaking them, and sometimes even making game-changing paradigm-shifting *far* jumps that change *everything* in a (compared to the rate over most of human pre-history and history) *mere blink of an eye* – a few decades, or centuries.

For literally all of human history and prehistory, slavery was anything from ethically neutral to ethically *good*, *desirable* in at least some circumstances. It is explicitly permitted with only the weakest of regulation in both the Old Testament and the Quran. Jesus¹² said many good things and a few bad ones, but he *said not one word against slavery either way* in spite of the fact that it was a *ubiquitous* human evil by any standard of compassion at the time that he lived all over the world. Paul, in Ephesians 6:5, instructs Christian slaves *to obey*

¹²Reportedly, without going into the ongoing and probably unresolvable argument about whether there was a single historical Jesus/Yeshua, several apocalyptic street preachers combined into a syncretic Gospel Jesus/Yeshua, or if Jesus/Yeshua was a myth, possibly even a myth constructed deliberately by the Roman Empire for its own purposes that got out of hand, as proposed by e.g. Joseph Atwill in Wikipedia: http://www.wikipedia.org/wiki/Caesars_Messiah.

their masters as if their masters were Jesus himself. Of course if (Jesus and/or Paul) *had* openly opposed slavery, Constantine would *never* have adopted Christianity as the state religion of the Roman Empire with its vassal states and slave based economy.

Christianity was then, and continues to be today, the perfect religion for a slave-based or feudal culture¹³ recognizing the “divine right of kings” and promising infinite rewards in heaven for tolerating hell on earth as an underpaid employee, as a serf, as a slave. Of course, it isn’t alone in its amoral pragmatism in this regard. Hinduism wasn’t – and still isn’t, technically – far behind with its caste system and its connection to serial rebirth. Even Islam is far more liberal in its implicit and explicit critique of slavery while in the end remaining pragmatic and equally explicitly endorsing its continued practice (as it was still ubiquitous in the 7th century).

Then, accompanying to some extent the Enlightenment, *everything changed* and while it still hasn’t *finished* changing – memes like that don’t die all at once – even slavers and slave owners know that slavery is now officially “bad” (or at least, mostly illegal except for the continuing treatment of *women* in various cultures as *if* they were mere chattel, slaves, to be controlled by men), and promote and profit from it anyway, all over the world.

The real ethical rules of a society are not homogeneous, not ever written in stone, or supernaturally engraved on tablets, or written down in a system of laws (no matter how detailed). You don’t look up a rule in a rule book to tell you touching hot stoves is, or isn’t, bad, or that ice cream, under at least some circumstances, is pretty damn good. Some of the vast overarching principles are, sure, articulated and spelled out for practical reasons (to make them easy to teach and easier to apply and judge) but remember that they are never more than *axioms* in the true sense of the word that this entire work conveys: propositions, postulates, assumptions, inventions, *useful myths*, all intended to be *empirically tested* and accepted, or rejected, on the basis of how well they perform over time in the arena of human co-evolution with its various memetic/ethical systems and religious systems in competition.

This leads us, quite naturally, to the ethical system I propose. Much of it should be quite familiar to “ethicists”, for the simple and excellent reason that most of its basic principles are stolen, mashed together, and imperfectly sorted

¹³And make no mistake – the modern world with its enormous concentrations of wealth and the consequent disproportional influence of the oligarchic wealthy few on the political choices *available* to the other 99.9% of the population of the world, we *remain a de-facto feudal culture!*

out. This is as it should be, of course. In a society, I don't *have* to work in a vacuum, and just as I shamelessly stand on the shoulders of giants with regard to Bayesian reasoning as sound basis for imperfect knowledge of the real Universe, I will shamelessly steal from giants who have done a particularly good job at *expressing* an ethical rule in a way that is at least approximately "universal". After all, many of our ethical rules are common to all societies because they address the *common needs of every human* in order to *live and function as a member of society at all*.

Surely this is a good place for us to – not start, as this process is ongoing and has *always* happened all the way back to our hairy, tree-swinging, not-quite-human-yet ancestors, back to when *language* was invented and co-evolved with the brains that used it for substantial social evolutionary advantage – but perhaps *reconsider* ethics as what it always has been: an ***optimizing search process, just like science***.

This search process, and the analysis that leads us to it, has a pretty good chance of plugging the existential hole we must face when we finally acknowledge that the Universe is *not* just, benevolent, or itself sentient in any meaningful way and that there *is no* teleological plan or purpose to our existence ***except that which we invent for ourselves***. My only hope is to guide the process for that invention and make it far more deliberate than it is today, and thereby liberate the world from all of those that argue, often violently, that *capitalism is good* and *communism is evil*, or vice versa, or that *killing is always wrong* as if these are self-evident truths instead of pure human inventions that are *not true at all in any useful sense of the word true*, but are rather *propositions* that we can choose to accept, or reject, or modify, or refine as part of "the good" on the basis of *how well they work*.

Chapter 19

The Big Myths

I'm enormously fond of myths. Myths are – in my opinion, your local English teacher may differ – fundamentally stories with a moral, stories that capture our imagination with fantasy, with anthropomorphic gods that reflect our good and not so good selves, *teaching* stories that we *learn* from as we read them, hear them from our favorite storyteller, see them acted out in our favorite (now electronic) medium, or *invent* them for our *own* comfort and edification as well as for that of others. Some myths have a basis in legend, and legend (as I understand it) is myth that *might* have once had a historical basis, but the certainties of it have been blurred by information entropy over time and diluted by insertions from pure imagination of the generations of storytellers who have imperfectly repeated it, changing it as they did.

Some religions are based on myths. Well, honestly, *all* religions *are* a particular category of myth, one *claiming to be actually true in their historical and scientific claims and the sole authorized source of divinely inspired truth concerning ethical behavior*, but some religions don't have scriptures as much as they have – stories.

I grew up in India from when I was five years old until I was twelve, in a part of India that was overwhelmingly Hindu. I celebrated the Hindu celebrations (who wouldn't! they were fun!) and learned the two great Hindu sagas – the Ramayana and Mahabharata – that are the *foundation* of most of those celebrations in the same sense that the myths associated with the birth of Jesus are the basis for the modern mish-mosh that is Christmas, half of it drawn from Matthew who has Jesus born during the reign of King Herod the Great *beyond all doubt* with the magi and the flight to Egypt to avoid the slaughter of innocents, half of it drawn from Luke who has Jesus born during the reign of Herod Antipas *beyond*

all doubt as the Roman census and tax it describes simply did not exist when Herod the Great lived some ten to fifteen years earlier, all of it conveniently *temporally* arranged to erase and replace the pagan celebrations of the winter solstice. Oops.

Of the two, I greatly prefer the Mahabharata. This is basically the story of a super-powerful ruling family in central India gone bad. There are the Good Guys – the Pandavas, who for the most part *literally* embody the virtues of the age – great strength, great wisdom, fabulous skill in warfare and manly arts – while at the same time are driven by the necessities of the narrative to do absolutely absurd, immoral things like gamble away their entire inheritance and their collective wife as well. There are the Bad Guys – the Kauravas – who are literally *their cousins*. The Pandavas are, like Hercules, all miraculously descended from or are avatars of various Hindu gods and inherit attributes from them. After literally decades of conflict, the two sets of cousins go to war over who will rule their kingdom/empire, where the Kauravas have the advantage of position, power, wealth, and arguably the greatest warriors, but the Pandavas have another cousin, *Krishna* to support them, even though it is only as the charioteer of Arjuna, the greatest hero among the Pandavas and BFF of Krishna. Naturally, the good guys win, but only after the clan’s grandfather, fighting on the side of the bad guys, decided *not* to unleash the astra Praswaapa, the contemporary magical-arrow equivalent of nuclear weapons, upon the Pandavas and Kauravas alike and thereby destroying the world.

In the middle of all of this, Arjuna loses heart and decides that he’s sick of killing his cousins over what is, after all, just power, wealth and status. His charioteer, Krishna, then launches a guided dialog, the Bhagavad Gita,¹ which over its eighteen short chapters is one of the most important scriptures in all of Hinduism, basically a statement that *it is all just a game* in which he, Krishna himself, is the entire Universe and all of the players in it, establishing Hinduism as *truly* being a monist pandeism where the One Universe became many mostly to, well, have *legendary* fun sorting out everything. He reveals his true self to Arjuna, who realizes that he and Krishna and all of his brothers and all of cousins and all of the allies and enemies fighting on the field of Kurukshetra are just *sock puppets*, momentarily ignorant avatars of Mahavishnu, where Krishna himself is the *self-aware* avatar of Mahavishnu. This forces Arjuna to realize that even the killing of his grandfather and uncles and cousins and good friends on the other side are without *sin*, as the entire affair is merely destiny playing itself out, and the best he can do is *do his duty* and slaughter like the best of them – which,

¹Wikipedia: http://www.wikipedia.org/wiki/Bhagavad_Gita. Literally “The Song of God”

actually, he was! And then did!

Why do I go through all of this? Because *mostly* in India, people are aware that this story *is* a story, a myth, perhaps a legend with some basis in truth but most unlikely to be *literally* true. After all, the *Ganges river herself* is the *great-grandmother* of the Pandavas and Kauravas alike, which is surely a beautiful metaphor for the river that in fact gives most of central India its life. The broader story is full of talking snakes, the irrational curses of holy men, people taking deontological ethics to extremes so that even an *unintended* word from a respected elder becomes a *lifelong command* even if the command itself was for one woman to marry five brothers at once, hardly a norm even in polygamous India of the time. It teaches *all sorts of moral lessons* at the same time it is such a rollicking good story it is almost *the* foundational story of all of India, one retold so many times and so many ways that its is a common memetic basis for everyone from the poorest to the wealthiest in the land.

The Ramayana isn't bad, but the bad guy in it is basically a demon-king on Earth, so it isn't quite as *human* a story. The gods get more personally involved, although Rama is yet another self-aware avatar of Vishnu and hence destined to succeed and wipe out the evil demon who – plot twist – kidnaps his wife. It is the parent of some of the best celebrations, though.

Similarly in the myths communicated in *A Thousand Nights and a Night* convey many a moral tale while providing endless entertainment. Most of the myths in the Norse sagas and folk tales do the same thing, but perhaps in a bit more depressing way. The Greek and Roman pantheons are not complete without the many, many stories of the gods, the legends of Hercules, the Argonauts, the story of Troy. In all cases, it isn't *just* entertainment – there are great sins committed, great penances paid, pride cast down and the humble lifted up, and throughout it all, *rules for living* are conveyed along with the stories, as surely as they are when our parents read us Peter Pan, or the Oz stories, or (more recently) Harry Potter.

The primary point I wish to so tediously make is this: Myths have power, and arguably they have *even more power when we know they are myths intended to teach and amuse and inspire* than if we are beaten and threatened with worse punishments if we dare to point out *that they couldn't possibly be true!* Not in that sense. Not unless you believe in talking fish, giant cobras providing umbrella service, or that a culture existed in India a few thousand years ago that had nuclear weapons capable of destroying the world, or that one can hang a man up on a cross until he is dead and that three days later he can miraculously

come back to life. Myths are powerful learning tools, and a **powerful myth** can – we know *empirically* from a study of *history* – inspire *generations* of humans to behave ethically according to its lesson(s), *even when everybody knows perfectly well that the myth itself isn't literally, or even figuratively, true!* Consider, after all, *Santa Claus!*

This leads us to our next set of axioms. Remember that these axioms are not divinely inspired perfect truth, nor are they manifestly obvious logical truths, they are *myths*, things we *invent* to structure our system of oughts in such a way that (and here is the critical part, pay careful attention) *maximizes our expectation of contentment as members of our society* in a lifelong way. I use “contentment” quite deliberately because almost everybody has felt contented, happy *enough* and satisfied *enough* at one time or another in their lives, while nobody I know has ever felt eudaimonical or utilitarian or self-actualized – those concepts are all so abstract that even people who know what they are don't *really* know what they are. If you don't like the simple word “contentment” replace it with a sense of well-being, self-worth, and expectations of protection and reward in one's society all mixed up, perhaps together with the feeling of being *loved*, recognizing that if we specify things too exactly here we just open the door for silly arguments.

Note well that I'm stealing these foundational myths, not inventing them. All of them are clearly imperfect and it is never particularly difficult to imagine exceptional cases in which applying them won't *work*, but even in those cases we will usually feel like we as a society intellectually *ought* to be able to avoid violating the mythical rules even if we as a society practically decide we *ought* to violate them for the greater good². Let's start by laying out the grand principles in sound bite form, without attribution (although in many cases you will immediately recognize at least some of the authors). There is also some redundancy or overlap to them – this is simply evidence of their universality as well as the fact that sometimes one society has done a better job than another at *reducing* the principles to sound bite levels.

The basis of a *Good* society is one that, as best it reasonably can, promises its members (in no particular order – this is *not sorted* on any sort of priority basis):

- Life
- Liberty

²Often historically defined to be “whatever the rulers of the particular society deem to be ‘the greater good’ for completely and personally selfish reasons.”

- The ability to Pursue Happiness (or at least, contentment)
- Equality
- Justice
- Brotherhood
- Minimal Suffering
- Protection
- Satisfaction of Basic (biological and other) Needs (like)
- Love
- A Purpose
- A Living

and finally, *a requirement that its members de facto accept as a duty a lifelong commitment to living in accord with these myths as best they can*. The rules need to be part of the *implicit social contract* that is the ultimate definition of *ought*, both what you *owe it* to society to do, what society *owes it* to you in exchange, and your *accepting this deal as an owed duty* and not something you constantly try to weasel out of or work around for an *unbalanced* advantage.

Note well that this list (and to some extent, the implicit social contract itself) is *highly unnatural*. In fact, almost every one of these components of a “good” life is absent or hard won in the proverbial state of independent, society-free nature. In Nature³ humans do *not* have any sort of right to life, and nature itself routinely and regularly takes it away, often aided by other humans who are *themselves* part of nature. In Nature humans might well be unconstrained by other humans, but this hardly makes them *free* in any useful sense as they will only enjoy an enormously constrained set of choices in their brutish, short lives.

It is difficult to pursue happiness in Nature – one’s entire time is spent pursuing the most basic necessities for life, not amenities or luxuries or relationships capable of making us “happy”. Even in civilization, humans have vastly different abilities to “pursue happiness” due to inequities we’ve built into our *economical*

³I’ll capitalize this word when I intentionally refer to the Hobbesian view of Nature – more or less life as a feral human without any of the constructs, advantages, or protections of a society. It also embraces human societies based the right of the strong(est) to do what they please and the weakest to endure it – also known as ‘third grade when the teacher isn’t around’.

system, which is *de facto* most of the basis of “ought” in the literal sense in human society, no matter what other lofty principles we might espouse. All the ethical systems ever proposed in the world can easily crumble when there isn’t enough to eat, when war destroys all wealth and possession, or when a child is raised by an abusive parent.

Continuing, Nature does *not* create all humans equal. That’s perhaps the greatest mistake in Jefferson’s Declaration of Independence – it is a marvelous, inspiring sound bite – and simply untrue. Humans are anything *but* equal. Our system of self-accepted duty to live as we *ought* to cannot afford to base itself on not just a powerful myth, but an *obvious fantasy*. Some humans are short, some are tall, some are big, some are small, some are smart, others not at all, some are male and some are fe-mall⁴. Our society is a step *up* from Hobbes’ brutish, nasty “Nature”, or should be, and its ethics should *reflect* that. We cannot (yet) repair all natural human ills and shortcomings, but that which we *can* do, we *should* do.

We *ought* to do.

Still, we cannot make a world where my next older brother with Down’s Syndrome could have become a theoretical physicist where I, two years younger, was fortunate and gifted enough to accomplish this, nor can we make one in which I can dunk in a regulation height basketball net or remember the names of all of my students where my wife remembers *thousand* of her patients’ names. The best we *can* do is to strive for a world where we all have the *opportunity to try* either one and succeed or fail to the best of our invested effort and natural capabilities. We cannot make life perfectly fair, but we can *avoid* making it even *more* unfair. Thus *justice* is a thing that we *ought* to seek in our ideal society, not blind, uncaring deontological justice but something much more difficult – *actual, caring* justice, justice *tempered by human judgement* and a willingness to intelligently treat edge cases.

In Nature, to be honest, there *is* a strong drive towards “Brotherhood”, the inclination to build families and societies. This is where Hobbes was *wrong* due to the fact that *anthropology and evolutionary theory hadn’t been invented yet!* The solitary existence Hobbes envisions is completely unstable – humans self-organize into a society where life is better than it is in solitary nature almost instantly if given the opportunity⁵.

This is essentially a reflection of an evolutionary imperative. Human repro-

⁴Sorry.

⁵Even in third grade...

duction involves other humans, after all, and human reproduction *with a higher probability of success* (all a mindless process like natural selection sort-of not-really cares about, after all) involves bonding individuals into families, families into tribes, tribes into larger societies until they become too big to manage or lose *large scale* evolutionary competitions for things like resources and social wealth and privilege – the *real* origin of the “warre” Hobbes considered to be “natural”.

It would be silly of us to leave out minimization of suffering in our list, because after all, suffering is how we learn our biological and social rules as we act to avoid it. It is, as the song goes, “Nature’s way of telling you something’s wrong”⁶. When it fails (as it does at the neural level, for example, when you have uncontrolled leprosy or diabetic neuropathy) *bad things happen* as you fail to do the countless *little* things you do automatically to minimize it, but our existence in societies often dominated by amoral bullies has opened up whole new vistas of suffering.

Buddha was right to make it an axiom for his system; he was wrong to make it the *only* fundamental axiom for that system and he failed completely to see the *beneficial* aspect of pain, the evolutionary reason for its existence. Without pain, we would never “take arms against a sea of troubles And by opposing end them”⁷. The ultimate state of freedom from pain and suffering is death, after all, as Hamlet goes on to make clear, and we must make an *existential choice to live* in spite of the fact that life and pain and suffering are inseparable companions. After all, so are life and *joy and contentment* – the antitheses of suffering.

Society itself is an *essential part* of our ethical system for the simple, reasonably self-evident reason that society promises *protection* against many of the “Natural” evils attendant upon the solitary life while, sadly, adding some of its own back in because society is *not* acknowledged as an axiomatic part of the good to be *increased and optimized* even when there are perfectly obvious ways to optimize it.

Then, what exactly *is* “protection”? This is somewhat open to debate, but I will propose as a starting point, at the very least, the regulation of the social and economic constructs that define the society so that individuals and social sub-groups can satisfy their basic (e.g. biological, but also psychological, economic, and social) needs. If those constructs are ever *too* far out of whack, again, the society in question becomes internally unstable and externally vulnerable to social

⁶Wikipedia: [http://www.wikipedia.org/wiki/Spirit_\(band\)](http://www.wikipedia.org/wiki/Spirit_(band)). If you google for them, you can find many links to the band playing the song, in case you never heard it.

⁷Hamlet’s soliloquy, in case you don’t recognize one of Shakespeare’s most famous lines offhand.

groups that do a better job, or to simple *memetic shifts* that *change* the society to do a better job. It isn't all about social Darwinism through actual "natural selection"; we as humans can quite deliberately practice *memetic* Darwinism and apply selection to our *defining memes* – our ethical axioms and the entire structure of customs and laws and unwritten rules and linguistic imperatives that make up our basis for reasoned behavior as "good" or "successful" members of society.

Finally, it is absolutely worth listing as myths of "the Good" those concepts that are very difficult to precisely define, but that again sociology and human psychology have found through empirical research to be nearly universal "needs" that humans must have satisfied in order to be happy, productive, contented members of a society, and whose protection should thus be *clearly stated* ethical axioms *of* that society if we are trying to optimize it. We all *need* love, and there are very clear, well-documented, empirical negative consequences to being raised without it or living without it. We all *need* a self-selected *purpose* – something we want to *do*, or *accomplish*, no matter how ephemeral the rewards we expect for succeeding. Life without any purpose is rarely either satisfying or particularly long, as evidenced by how quickly we tend to die when we retire, all the faster for how intense and engaging our purpose was while we held to it. Finally, we should never forget that *everybody needs a living*, from the best and most capable of us to those who are crippled as the result of accidents or war, or those of us who lost the genetic rolls of the dice that are supposed to give us things like a properly functioning, reasonably intelligent brain or functioning limbs.

We seek to optimize all of this for *ourselves*, note well! *All* of these myths are highly non-mythical things that *all of us want for ourselves* – it's just a matter of laying them out as general *social* ethical principles and accepting the *duty* of choosing to live by them as best you can and agreeing to be judged on your performance as demanded by members of your social group for *their* own protection *from you* and expectations of contributions *from you* for the "greater good of the society" on the basis of the *exact same set of rules*.

I hold the desirability of these honored myths to be, to borrow one last time from Jefferson, "self-evident". What, precisely, on this list, do you *not* want for yourself?

Well, time to look in on the *dark side*. You *might* want to add to it the right to be *lazy*, and get all of the advantages *from* society without doing any of the work required to produce those advantages. Your lizard ancestors, like mine, were perfectly contented as they *basked on warm rocks* after a good meal

and bout of satisfying sex. You *emph*might prefer not to give up the right to prey on weaker members in the society and *force* them to protect you, work for you, die for you, preserving *your* life and perhaps *your* offspring. Again, your tribal human ancestors, like mine, utilized this exact scheme for almost the entire period from when we climbed down from trees to stand erect with our opposable thumbs and earliest languages up to the remarkably recent present, and evolution *does* favor propagation of the strongest all things being equal – it’s part of what makes it work! You *might* have been taught to supress compassion, or reserve it only for the small subsociety of your own family, your own “peeps”, your own confederates, that collectively maintain your position of power and privilege at the expense of pretty much everybody else.

Note that the closer societies are to the good old state of Nature, the more they leave the strong and amoral to prey upon the weaker and moral, even though there are often far more of the latter, without negative consequence. In the (very) long run, that has proven to be somewhat unstable. Societies that are too brutally and *obviously* unjust, that *too* openly violate the *implicit social covenant* by acting unfairly, often enough breed rebellion individually or collectively to act against even the comparatively small but strong rulers to eliminate the threat⁸. Sadly, such rebellions historically often simply replaced one set of feudal masters with another, with a clear but very slow memetic evolutionary tendency towards increased fairness and freedom and limits on authority.

This is why all of the rules above have to be somewhat qualified to create a stable, *fair* society. Your “right to life” requires that you *give up the right to kill*, except that it is *ridiculous to think* that giving up the right to kill includes not killing when, for example, you have to do so to prevent somebody from killing *you*, or your family members, or your brothers and sisters in your community. Yes, some societies and some social orders try to enact *pure* rules like this as *inviolable axioms* into *law*, but this just doesn’t work⁹ This is empirically because “people” in general are *not by any stretch of the imagination* “Naturally” virtuous and compliant with *any* set of rules. All imposing rules without the flexibility and judgement to *pragmatically* handle the inevitable edge cases and exceptions where people are *going* to break them – and do so in a self-righteous glow because *it is at the time the right thing to do* – does is make your non-pragmatic society unstable, usually resulting in a bout of killing that *dwarfs* the inherent evil and inequity of the original system and – sometimes – left us historically with an arguably *better system*.

⁸Quite possibly with, as they say in spy novels and crime stories, “extreme prejudice”.

⁹Or at least, it never has.

The next chapter examines this in more detail, and establishes a set of individual prescriptions, things we *ought* to encourage in ourselves in order to *give ourselves the best possible shot* at optimizing and stabilizing the desirable advantages of social living in a Universe that Does Not Care if we, or our entire society, fail. This self-assumed set of duties is something we will call ***the Virtues***, with a capital “V”.

Chapter 20

Pragmatic Virtue Ethics

Do not do unto others that which you do not want done unto you!

The “silver” rule, attributed to Confucius

Let’s begin by acknowledging, as Ayn Rand once put it, the “virtue of selfishness”¹. Whether or not you accept Rand’s broad thesis that this is the fundamental virtue is not the point – I certainly don’t think so myself. However, it is *equally* foolish to assert that virtue is purely altruistic behavior, that self-sacrifice to the benefit of the social herd is the greatest good. I join Rand in holding this assertion contemptible, while also joining many of her critics who deny that pure selfishness is in any useful sense the greatest good.

Heaven (metaphorically, of course) protect us from people who want “the good” to be some *single deontological platonic ideal* that can be etched into platinum plates and stapled to every forehead together with the *absurd assertion* that life would be *perfect* and we’d live in a *near utopia* if only we would all, *always*, pursue our own self-interest, or *never* pursue our own self-interest, or *always* obey the Ten Commandments, or *completely reject* the Ten Commandments, or *pursue pure capitalism* or *pure communism* as absurd and evil in and of themselves. Zealotry leads to conflict, suffering and war, and besides, neither assertion in any of these deontological pairs could *possibly work!*

What could? Well, defending your self-interest *is* pragmatically necessary in any system of social ethics that will have a *hope* of surviving in a competitive environment, because we are pre-programmed even *before* we are taught and conditioned by our parents to pursue pleasure, avoid pain, and fight as necessary

¹Wikipedia: http://www.wikipedia.org/wiki/The_Virtue_of_Selfishness.

to obtain such things as we need to ensure the continuation of life itself. Acting to defend our own interest in living a reasonably pleasant, rewarding, pain-minimal life may not *always* be our open, enlightened choice, but individuals who *never* act in this way are not virtuous, they are a burden on *everybody else* for their entire (usually short) lives until they are dead.

This is the basis for Jefferson's Big Three Myths: A "right" to life, a "right" to pursue life's necessities and choose our own "ought" consistent with this, and a "right" to pursue all of the things material and immaterial that contribute to "happiness" without going into any sort of eudaimonical detail, as those are *part* of what we, in principle, are supposed to be free to choose. So far, this has worked *better than most of the alternatives* as fundamental principles for an ethical society, so let's adopt these myths *subject to revision and qualification*, as *virtues*². It is *good* – within reason, in most circumstances – to act *intentionally* to preserve your own life, to use your reason to *think critically* about your *own* set of "oughts" – the rules you use to guide your own actions to the extent that they can be put into words and higher order concepts – and accept or reject or modify them *within the constraints of needing to live in a society with everyone else* in order to obtain the benefits of that society, so let's make this an *explicit virtue*. It is similarly *virtuous* for you to strive for more than "just" bare-bones survival – to pretend that you have the "right" to at least *strive for* a life that minimizes your own personal suffering and maximizes your opportunities for love, family, security, status, contentment, all *within reason* given again your need to live within a society of others with *similar* requirements in order to obtain the benefits thereto. Note well the latter bit! If we don't grant others that which we expect to get from them, how is that *fair*? From a purely practical point of view, *how do you expect that to work out*?

Also, note well the exceptions! We must *also* recognize that our *society* is an entity that must "live", that has "rights" that at times must supercede our own, and that *also* needs deep motivating principles to give it direction, for example maximizing *its* long term survival chances in an uncaring Universe containing competing, often hostile, societies, while minimizing the *collective* suffering of its members, maximizing their *collective* contentment as part of its deal with them. You all give up some of your "rights" to do as you damn well please to anyone

²Primarily because it sounds better and is certainly shorter than continuing to call them "myths we accept as rules we follow as a duty in hope of a *good life* as members of our society", but either way, never forget that we are just making them up. They are art. They are beautiful stories. Fundamentally, they are things that we *wish* were actual truths, rights, virtues, that would form a roadmap to – not a perfect life, that is impossible, but to a life that is most likely to be *good enough* to make acting against those rules more trouble than it is worth.

weaker or when you think you can get away with it in order to (for example) be protected themselves from bigger, meaner, better organized persons who want to do as *they* damn well please at *your* expense, and accepting this and the duties it entails must *also* be a part your duty-practice for a virtuous life.

Thus pragmatic ethics may not quite *focus* on society per se, but it at the very least has to recognize the *reality of the social contract*, written or unwritten, that extends all the way back to family groupings and the most primitive of “tribes”. Rights and obligations, judgements of altruism and selfishness, including the judgement of “good” versus “bad” as imperfect labels for complex behaviors, have to flow *both ways* as *practical rules for the behavior of the individual and the society itself* for an ethos to *work*, and if it doesn’t work, it doesn’t *matter* how beautiful or compelling the principles are that don’t work, they *practically speaking* will lead to suffering and extinction for all involved unless the unworkable ideas are changed first.

This makes the the “silver rule” given above an absolutely critical virtue, as it guides our responsibilities to *others* and limits just how *selfish* we can make our ethos. It requires a core recognition of both equal value and compassion in our ethical decision making insofar as it directly impacts other people. ***Do not do unto others as you would have them not do unto you!***

This isn’t *quite* enough to function as a fundamental barrier to most “bad” actions. If we are feeling suicidal, we might *want* somebody to come along and kill us and save ourselves the trouble, and use the silver rule to justify committing suicide by cop, or the murder of a large number of people in the hopes of being murdered back (or just killing committing suicide ourselves at the end of it), but most of us would, I think, consider this – however permitted by the rule – to be highly unethical.

We therefore need to modify Confucius’ original rule *just a bit at the end*. We need to: ***Refrain from doing unto others anything we might reasonably expect that they would prefer that we not do to them!*** Note well that this absolutely requires that we expend *effort* on figuring out what others would prefer that we not do unto them. We have to have a *minimal practice of compassion* as an accepted, virtuous, *duty*, not something we can conveniently ignore when it crosses our own purposes.

This is a *really important* distinction, and one whose purpose is quite clear³. Even if you are a masochist and somehow take pleasure from pain, you must

³There is an old joke: “Beat me, beat me,” says the masochist. The sadist looks at them with a sneer and says “No!”

understand perfectly well that most people are *not* and not inflict pain on them simply because *you* wouldn't mind it. Virtue ethics ***absolutely requires*** empathy, compassion, a sense of the sanctity of the rights of other people, and not just your own.

OK, so we've incorporate the silver rule as a virtue, with an implicit requirement of actually striving to compassionately recognize *at least* the ways our neighbors would prefer us to *leave them basically alone!* But what about positive actions, things like the golden rule? Aren't they virtuous as well?

This again has to be yes, but at best only a qualified yes. It is much easier to twist the golden rule "Do unto others as you would have the do unto you" into an excuse to violate the silver one, and in my opinion at least, in pretty much all cases where the two conflict, *the silver rule should have precedence.* Don't go foisting your holier-than-thou bullshit concept of "the good" on *me* without any invitation or desire to receive it, thank you very much!

At the same time, we have a perfectly natural desire not to live in a disaster zone. It is difficult to feel safe, contented, protected, and so on if you are surrounded by the four horsemen riding rampant through your society: ignorance, poverty, disease, and war. Here's the virtuous bit and its reason and a pretty *damn* good way to fill in any existential hole left by the previous part of the textbook, all rolled into one. Yes, heaven almost certainly doesn't exist, it is merely a *beautiful, mythical version* of the world we would *like* to live in. That doesn't mean we cannot accept *making the world we do live in as close to heaven as possible!*

Let's make *this* the modified "golden rule" virtue, as it is far more powerful and explicit, it leaves little doubt where one's duties lie, and it even provides a *selfish rationale* for accepting *altruism* as a duty, much the way evolutionary biology has observed it and explained it as a selected behavior *in Nature*:

It is virtuous to visualize a better world and act to help bring it into being even at some cost to yourself.

This is so gentle a requirement that it covers simple acts of kindness and compassion, holding the door for someone who is in a wheelchair or donating change to a suitable charity, and yet so *encompassing* a requirement that it recognizes the virtue of those who *devote much of their lives* towards creating a better world for everyone, often *not* at any particular cost to themselves in the coin of contentment or the coin of the realm. Indeed, people whose lives are useful and *help* others, rather than *hurt* them, often derive considerable contentment from doing so, *because* it is very natural and easy to be virtuous in this way and

it often comes with its own rewards.

It does, of course, consider *making your sense of compassion broader and deeper* a virtuous *requirement* than does the silver rule (modified). Your vision of heaven on Earth may not match mine, and silver rule wins conflicts! However, it is pretty clear that *nobody* benefits from starving, sick, stupid people fighting wars and disturbing everybody *else's* peace and threatening *their* security and chance at contentment, leaving an absolutely enormous field of action for those who wish to practice *positive* virtue ethics and move us *a few steps closer* to heaven on Earth, or at least a few steps further away from the *hell on Earth* that still prevails on far too much of the globe.

Note well that an interesting thing has happened. In developing pragmatic ethics, we are more or less *forced* to consider ethics as a *two way street!* This is in sharp contrast with the work of the ancients (and moderns) who consider ethics to be an unconditional guide to the ethical behavior of the individual and don't properly consider the society of which the individual is a member. However, it not only makes sense, it makes fairly *obvious* sense that 'right action' for a slave in a slave-based society might well be to revolt, escape, to *wage a violent war* against that society using every tool at their disposal, while right action for that same person in a non-slave society might be to support their society – at least against competing slave societies or forces within their own advocating a return to slavery – using every tool at their disposal, including violence and war! At the same time, of course, it suggests that slower, non-violent paths that have a decent chance of accomplishing the same goals be at least considered and weighed against the costs of war.

The point is simple. At the risk of repeating myself, not even a statement like 'Thou shalt not war on thy fellow human beings' can be viewed as a truism of pragmatic ethics. As we have observed over and over again in our history, it only takes one *evil, selfish* culture to initiate an unjust war and destroy the contentment and lives of millions of people, and there are numerous cases on record of *just* war – even when fought for reasons not devoid of greed and self-interest – that left the world better off afterwards than it was when the wars started. The worst part about war – except for the pointless destruction of property and loss of life and health and freedom on a mammoth scale – is that it is so *unnecessary*. In a rational global society with an open, pragmatic ethos, no disagreement should ever arise that makes war itself the lesser of evils.

It is *silly* to consider ethics to be a one-sided set of rules, in other words, and beyond silly to consider any set of *simple* ethical rules for individuals that are

supposed to work in all possible social contexts. Again, that's a reason it is so easy to find exceptions to simple rulesets that have been proposed over the ages. Thou shalt not kill has *always* meant not to *lightly* kill the members of your own tribe or society, not that killing is always unconditionally wrong, and people who have accepted the latter and refused to kill to defend themselves and their families against mortal threat may have been enormously moral, but *impersonal evolution doesn't care* – they are simply pieces that get removed from the board so that their genes *and* the killing-is-always-wrong ethical meme fail to be passed on to the next generation. Even within one's own tribe, the rule has an implicit if unstated “and the tribe will generously refrain from killing you in exchange”.

The idea of ought, which is fundamentally a *personal* thing applying to the individual, ***ought not be accepted*** if the price of restricting yourself only to virtuous behavior relative to the tribe is rewarded by non-virtuous behavior of the tribe back. This is one of the *major* problems with the American “tribe” with regard to slavery and its black population. Black people are expected to comply with the law and participate socially and economically in the operation of the social group, but the reward for this isn't equal treatment socially, economically, and legally, it is being held to very rigorous unequally applied standards to this effect by law enforcement, having reduced opportunities in the economy, active suppression at the polls.

What is “right action” in this case? On either side? *Ought* black people accept second class rewards from a civilization in compensation for first class sacrifices? Hopefully the answer is pretty obviously no, but traditional deontological ethics, as expressed in laws and unregulated human behavior, have so far managed to say yes (with the assurance that *eventually* it will all work out). In consequentialist ethics the answer is *also* yes. After all, the greatest good for the greatest number is the greatest good for majority/plurality *white people*, unless and until black people add some sort of *additional penalty* to inequitable behavior by law enforcement, economic institutions, schools, and state governments and political parties who rely on their racial majority status to retain political power. Without endorsing it, it is hardly surprising that the penalty is rioting in the streets, massive demonstrations, and more.

In the next chapter or two, then, we need to present our virtues in matched sets. It won't just be a set of rules for individuals to use to govern their own behavior, it will be a set of *complementary* rules evaluated on the basis of the virtues already given above – one for the individual living *in* a society, and a *reciprocal* one for the *society* with regard to the individual. These will usually be so very simple that a child could understand them – in fact children *do*

understand them, as they are *precisely* the sorts of simple reciprocal ethical rules taught in kindergarten, and first grade⁴.

There is one last topic we must cover here before we actually assemble virtue ethics as a matched set of ethical virtues you can use to guide your behavior in a society *to the extent that you can help move that society so that they are reciprocal rules back* so you aren't just acting like a human punching bag and 'not biting friends' while *they* chew off your own leg clean off in return. That is so important that it merits its own named section in this chapter.

20.1 The Tragedy of the Commons

Some of you – more likely students who've taken econ courses than those of you who've take ethics courses – are already nodding to yourself will recognize the title, taken from a famous paper by Garrett Hardin written in 1968⁵ although the original problem was pointed out almost a century earlier. The tragedy of the commons *inevitably* arises when a civilization (or really, even single individuals) have to *compete for access to a limited resource* whether or not that resource is "renewable" or finite. It is a classical problem with value and regulation of these resources in political science and economics, but it is also a key *ethical* problem that we simply must address or people are going to come out of this book all full of piss and vinegar with a renewed sense of commitment to mythical things like the Declaration of Independence, the Scout Law, the Bill of Rights and so on, and then assert that they have the *right as free citizens* to equal access to the vast range of things that comprise "the commons" of the world⁶, even if

⁴See: <https://www.youtube.com/watch?v=U6UWNA-WQgI> Don't, Don't, Don't Bite your Friends (and they won't bite you!) All of human ethics (almost) in a single, catchy tune. If this youtube video vanishes before you get to it (it happens) google up "Don't Bite Your Friends" and find another source.

⁵Wikipedia: [http://www.wikipedia.org/wiki/Tragedy of the Commons](http://www.wikipedia.org/wiki/Tragedy_of_the_Commons). You should read this. Seriously. It's pretty short.

⁶It's hard to even make a list: The oceans (70% of the Earth's surface). All the farmland of the world. All of the freshwater sources of the world. All of the mineral wealth of the world. All of the ecological/biological wealth of the world. All of the wild places left in the world. All of the species of all of the animals of the world. All the women in the world (to all men of the world, many but not all of whom view women as an exploitable resource in the commons – I really should have put this first or second as it is so shockingly common). All of the air in our atmosphere. The moon. The most useful orbits around the world. The various radio frequencies used to communicate information around the world. All of the available energy resources of the world. Fill in your favorite scarcity-limited shared resource here – it will have a tragedy of the commons associated with it!

all they want to do is piss on it. This simply won't do.

I've already hinted at this. If ethics and ought are tied together, and economics is the science of owing and the study of the value exchanges associated with *actual* debt, then ethical oughts and economics oughts can't be treated as distinct entities – they are basically different aspects of *one* thing, both *equally* necessary to make a society run at some level higher than a universal Mind Your Own Business rule without *any* of the organized value exchanges that allow us to realize the *improvements in our life style* that are a major reason for people to group *into* societies in the first place!

Really, it isn't just ethics and economics. We can throw in *energy* as the *fundamental* scarcity in the world of scarce resources, and physics is all about energy, and energy is equivalent to work, and work is *economics*, and economics is a functional form of social *ethics*, and I'm a physicist, and hey, maybe I'm *not* completely incompetent to be talking about all of this stuff after all! And I've already talked about *education* – the process whereby ethical memes are transmitted between generations subject to both directed and undirected drift along the way, which is *evolution*!

It turns out that ethics is a *synthesis of a lot of different concepts beginning with 'e'!* Who knew⁷!

What is this commons, and why is it tragic? And why is it a serious, serious problem to non-pragmatic ethical systems? I'm glad you asked...

I'm going to present it with a different example to those used by Hardin. When Europeans settled North America, there was an animal that was found pretty much from coast to coast – there was, for example, a goodly population in North Carolina where I live – although it was *enormously* common in the great plains of the west. This animal, as you may have guessed, is the Bison⁸ – incorrectly called “buffalo” because they are both large ruminants with horns but otherwise only distant relations.

Bison were so numerous that it could take hours for a single herd to pass an onlooker out in the great plains. The Bison population of the country at the start of the 1800s is difficult to estimate, but was likely tens of millions to as many as a hundred million. They were a key resource to the tribes of native

⁷I'll stop now. Although this listing is not at all tongue in cheek. I'm *not* throwing in anthropology or psychology or sociology or history or statistics, though, even though they belong there, because they don't begin with 'e'...

⁸Wikipedia: <http://www.wikipedia.org/wiki/Bison>. See for example the picture from the 1870's of a *mountain* of bison skulls

Americans who roamed the plains.

They were also literally dumb as oxen and incredibly easy to kill with modern rifles. Their pelt was worth some money, their meat worth a bit more (but impossible to transport very far without refrigeration or expensive and time consuming preservation), even their skulls had some value, and so they were instantly treated as an unregulated resource by American settlers as they moved across the plains. They were also a problem both for ranchers seeking to subdivide the plains and claim it for domesticated cattle, sheep, and farming and for railroads seeking to build transportation carrying people and wealth both ways (who offered up a bounty on them). Killing them also took away the means of living from the native American tribes that relied on them and forced them to move away or starve, freeing up the land for (mostly) white settlers.

This was the perfect storm. *Everybody* shot them. Sometimes people used the carcasses or took things of value, but often they were shot from trains and left to rot where they died. They were a commons resource where they were of critical value to some populations (e.g. the native Americans), of *some* value – dead – to another population. By the end of the century, there were only around 1000 American bison left *in the world*. At that point – finally, after accomplishing its indirect aim of forcing plains indians off of the plains to leave them free for white settlement – the US government stepped in, protected the species, and at this point the bison is a *farmed* species and no longer endangered, although its population, range, and diversity are tremendously reduced.

The white people who killed all of those bison, especially those that left them to rot, were ‘bad’, right? That’s what we’ve been taught. But why? No individual involved did something that directly violates the principles we’ve laid out so far, *including* the reciprocity clause. They were actually *paid* to kill them, or harvested some value from the carcasses, so they were pursuing their own self-interest with the full approval of their tribe. Yet I’m *betting* that you are shocked and horrified that this even happened, even if you *do* live in the plains area in a town founded on the land where those bison used to roam.

Don’t misunderstand, it isn’t just the white people – the native Americans and their counterparts in Europe and Asia and Australia had *already* (probably) wiped out most of the megafauna that were alive at the end of the Pleistocene⁹

⁹Wikipedia: http://www.wikipedia.org/wiki/Quaternary_extinction. Although this remains controversial, as human overhunting of the *common* resource isn’t *entirely* consistent, and alternative half-formed hypotheses such as attributing it to “climate change” do exist. However, the persistence of a number of species in environments that humans had not *yet* reached right up to when – gulp – humans reached them, plus the fact that the genera of those animals had

. So just what is the tragedy here, and what does it have to do with ethics?

In 19th century England – a land that has been settled and relatively heavily populated for a long time – property was largely split up into parcels that are owned individually (much of it by the landed gentry and thereby protected), but there were also large tracts that belong to townships and reserved for the common use – “the commons”. This common land was often covered with grass and represented a major *resource* “belonging” to the entire township. At the same time, land where sheep or cattle could graze was a limiting factor in the wealth and happiness of those who raised cows or sheep (which was practically everybody) and if *no* livestock were permitted to graze the commons land, *nobody* benefited.

But this state of affairs creates an *ethical dilemma* that persists *today*, because the primitive ethical systems we learn from our parents, based in part on really *silly* deontological lists like the ten commandments, aren’t *based* on social contract and economical balance, are utterly blind to the problem, and provide no useful guidance. Oh, and because it *really is a dilemma*. As far as I know, no solution that mathematically optimizes compliance with a clear ethical *or* economic principle exists – it is a monotonic slippery slope from waste to extinction. I’ll explain.

You personally own a farm with a small field, overgrown with grass, to support your cow and a handful of sheep. Eventually, with a bit of help from a neighboring bull, your cow has a little calf that *you* don’t have the land to support unless you kill the cow you have, and refrigeration hasn’t been invented yet leaving you with no way to profit from all of that meat. So, what the heck, you *put it out on the commons*. The calf eats the commons grass – and initially there is plenty of grass – and you retain title to the cow the calf will grow into, so you are magically wealthier than you would be if you’d killed a cow to make room for the calf or killed the calf ungrown. So far, so good.

Well, there’s *still* a lot of room, your sheep produce lambs, so you throw a couple of sheep out there to keep your growing cow company that you otherwise couldn’t support, and now you have even more wool to use for clothing or for sale, even more milk and butter to use or to sell, and a surplus cow you might be able to drive to market in a city and sell for actual money. Prosperity looms!

But your neighbor is no fool. He too has cows and sheep and a tiny plot of grassland in which to raise them, he too has calves and lambs come spring,

survived interglacial transitions multiple times before when humans were not an issue suggests that human predation played a major role in what *was* probably a multifactorial process.

so he takes a page from your book and instead of dining on spring lamb come Easter, he pops them out on the commons alongside your own. This doesn't bother you, there is plenty of land, plenty of grass, and your neighbor suddenly becomes a wealthier man as well, although now there isn't quite as much grass on the commons.

At this point, *everybody in the town* can see the advantage of having extra livestock grazing the commons, they *all* have calves, lambs, goats, pigs, chickens and horses to feed. *Every one of them* (in utilitarian economo-speak) gains an *economic benefit* from putting one more animal on the commons for food, and *every one of them* has an equal right to do so, as they are all members of the township! And lo, a miracle happens! They overgraze the commons, the grass disappears, and all of the animals that were put there starve. The overall wealth of the community plummets. *Or*, more likely, the ones that got there *first* get into fights with those that are trying to horn in on their sweet deal, steal their livestock in the dead of night, or get the town council to grant *them alone* grazing rights on the commons supported by some hefty bribes funded by their newfound wealth that the ones who are still land-poor cannot match.

This is the problem. There is a shared/common resource with value. Everybody benefits if it is used instead of left fallow – in the example it is even a *renewable* resource so in a year at most it would be ready for grazing again *even* if it were overgrazed to the point of starvation of the animals using it. Every citizen in the town has an equal “right” to the resource. We have already asserted that one of our virtues is that they should be *free* to pursue their own happiness and advantage as long as it doesn't *directly* harm their neighbor. Nearly every citizen in the town would benefit if *they* got to use the resource, but *only if most of the other townsfolk do NOT get to use the resource*.

This problem has no ‘good’ solution, or at least, no *simple* good solution that will actually work¹⁰. All reasonable solutions involve both limiting the freedom of those involved, special selection and regulation of those who are permitted to take advantage, and leave those that are *not* selected comparatively worse off. Simply

¹⁰Communism is often advanced as a solution that works by making *everything* into commons, farming *everything* for the common weal, and splitting up *all* of the wealth equitably. But empirically, this has failed for numerous reasons every time it has been attempted. In particular, it is a solution enormously unstable to abuse by those who – inevitably – are given the job of *regulating* access to the commons, *determining who will do all of the work*, and exactly *how* the wealth thus generated is split up. In practice, it just turns into yet another form of feudalism or extreme capitalism, which also “solves” it by not having any commons or private ownership at all, only property belonging to the local Lord and serfs employed by that Lord at whatever wage he cares to leave them with.

prohibiting grazing in the commons altogether continues to waste the resource so that the whole town is poorer. It even – as I hinted at above – creates a situation that *breeds corruption* in the governance of the town as people compete with *bribery, cronyism, extortion and worse* for the limited number of “commons grazing permits”, essentially corrupting the decision makers by ensuring that they get a direct share of the new wealth generated.

A tragedy indeed.

Hopefully it is pretty obvious what this has to do with the story of the bison, the now extinct megafauna, the passenger pigeon¹¹, with the corruption of what little regulation exists on our overfished coastal waters, with the plight of the rhinoceros whose horn resembles a penis to the point where idiots buy ground rhino horn powder imagining that it will make their own penis resemble a rhino horn once again. It permeates *all* of the industries that rely on mining non-renewable resources – oil, gas, metals. It is at the heart of the oligarchic corruption now threatening democracy itself, as the so-called “1%” who own 60% of the wealth in the world simply buy themselves the perpetual protection of that wealth by funding 95% of the cost of running for office for members of *both* parties in the United States, after the Supreme Court inexplicably and foolishly altered the US constitution far beyond anything our founding fathers could have anticipated by recognizing corporate entities as having “rights” beyond whatever the law grants them.

In other words, the *economic, social* tragedy of the commons in its general form is arguably *the* fundamental *ethical* dilemma facing the *human species itself*, and simply asserting that people are free to do as they please as long as they don’t injure their neighbors and their neighbors agree not to injure them *won’t cut it* as a solution. For one thing, the things that we *use now* as a – not quite “solution”, put perhaps “means of staving off disaster” – rely on a democratic majority pursuing *enlightened self-interest* by recognizing that yeah, if we wipe out our major coastal seafood stocks by overgrazing *that* particular commons they ain’t gonna come back in a year. They may not come back *ever*, as we *should* have learned by driving numerous species to extinction as free individuals in our society have pursued just one more tiny notch of advantage in the exploitation of a commonly held resource.

There are several problems with relying on “enlightened self-interest” as the basis for democratic solutions to the tragedy of the many commons and commons-like resources we have to share in order to remain healthy, wealthy and wise. One

¹¹Wikipedia: [http://www.wikipedia.org/wiki/Passenger Pigeon](http://www.wikipedia.org/wiki/Passenger_Pigeon).

is the one I've alluded to a number of times – humans are *not* all equal in their ability to reason. A second one is that it is all well and good to say – based on clear, scientifically accumulated evidence – “shrimping in sound waters in North Carolina kills four pounds of fish bycatch for every pound of shrimp harvested, usually juveniles on whom the future population of these species rests”¹² – and it is quite another to tell someone that relies on trawling shrimp in the sound for a living that they can no longer do it, especially when their family has been shrimping in the sound for *generations*. To *them* the shrimp appear infinitely renewable, as they have always renewed in the past, and *they may not much care* if croakers or southern flounder disappear from the waters as long as *they* can continue to make a living. What is *their* enlightened self-interest in cases like this¹³.

To their credit, a *lot* of the people who *do* make a living on shrimp harvesting in North Carolina *welcome* the regulation of their industry because they *do* recognize the necessity of preserving not only the population of the shrimp they seek, but the other species that are taken and incidentally killed and wasted while trawling estuarine waters that serve as fish nurseries. From the point of view of the *state* of North Carolina, the issue *should* be a no-brainer. Wild-caught harvesting of seafood is worth about \$300 million per year to the state, with a lot of it money moving around *in* the state. Recreational fishing – largely targeting those very species impacted by sound-side shrimping either directly or as part of the food chain – is worth *\$1.6 billion* per year to the state, with a lot of it coming *into* the state from *other* states as people come from all over the US to – they hope – experience the great fishing North Carolina has historically provided to all comers.

No matter how you slice it, though, this is a tragedy with no solution that isn't going to hurt *somebody* or be unfair to *somebody*, including the non-solution of doing nothing and waiting for the commons to fail.

Clearly the tragedy can only be *ethically* averted, averted in a way that *everybody recognizes as good*, if we add additional axioms, additional “virtues” to our list, ones that significantly *expand the scope* of our social contract beyond

¹²See: <https://ncwf.org/blog/shrimp-trawling-bycatch/>

¹³I'm not picking on sound shrimpers in particular, by the way, in spite of the fact that yeah, I *watch* them passing down Core sound, shrimping away, while North Carolina has been forced to limit *recreational* fishing for Southern Flounder to three weeks a year because stocks are so low. One can find the tragedy of the commons anywhere you look, as it or a variation of it will occur *wherever* humans seek to control a scarce resource, even “resources” like human knowledge itself that are scarce because of e.g. patent laws or copyright laws, purely artificial scarcities.

our own person, our own family, and our own tribe. We must extend it *beyond our own particular society and even further, beyond our own species*. The tragedy of the commons, after all, is *global* in its impact, and involves the one fundamental “commons” we all must share – *the biosphere and resources of the planet Earth itself!*

Here’s a try:

It is *virtuous* to act in such a way as to *preserve the renewable and non-renewable common resources of the planet*.

This virtue must *trump*, or at least extend, our “do no harm” silver rule. It isn’t enough just to develop enlightened compassion for our fellow humans in our particular social group, and to the extent possible and in a reciprocative way avoid doing things to them that you know they don’t want done. It isn’t enough to use that compassionate sense to try to make the world a better place to live *for your own social group* to the extent you can afford. Ultimately, *all* social groups – families, tribes, societies, countries, alliances *have to live on, and share, the biological and material resources of the Earth itself, and the Earth itself is a finite resource*, so that the tragedy of the commons is a great deal of the tragedy – and ethical failing – of the human species throughout human history and to the present day.

You don’t think so? Consider the *myth* of *ownership*. Owning things, after all, is what economics is all about. Almost all ethical rules that regulate human interaction have ownership at their root, if you think about it¹⁴. One of my examples of early transmission of memetic ethical rules by parents involved two year olds negotiating *the possession/ownership of a dolly!* That dolly, in actual fact, could have been a *common* dolly, a dolly belonging from the point of view of human law to the day care center caring for the two children, not the “property” of either one and wouldn’t make any difference – to a two year old, possession *is* – transiently, at least – “ownership” as they have no strong concept yet of permanence and are *learning* the meaning of ownership as semi-permanent possession as they go.

I know, I know. I’m attacking one of the most sacred of myth-cows known to man, one that transcends societies and goes all the way back to the most primitive tribal arrangements of humans in prehistory. If I pick up a rock, and invest time and energy to make it into an arrowhead, it must be *my arrowhead*, right? If I am born, I must at least own *my own body*, right?

¹⁴So please, think about it!

I'll put this as gently as I can, but historically, the answer is clearly no. In the state of isolated Nature, even, the answer is no. In Nature there is no ownership, *there is only possession!* Assigning some *permanence* to possession and *making it a purely invented socioeconomic rule and backing it with an ethical assertion* is clearly *memetic*, not *intrinsic*. You can tell the difference because human myths have to be written down to make them “real”, while natural rules just “are”. Does the wildebeast in Africa “own” its own body? Not according to the crocodile. At best, it is in possession for as long as it can avoid crocodiles, lions, humans armed with a gun, other stronger wildebeasts seeking mates, mambas in the grass, starvation, disease, old age, or just pure bad luck, such as being struck by lightning. Its body is *borrowed* from the stuff of the Earth, and to that stuff it will one day return, and the wildebeast retains possession only as long as it can stave off all of the natural forces that challenge its “right” to possess that body. And thus it has been since the first animals crawled out of the sea and onto the land some hundreds of millions of year ago.

Nor is it just wildebeast. Humans, who *invented* the myth of ownership as a necessary adjunct to creating societies with an ethos a bit more nuanced than “if I can take it from you, it must be mine, for as long as I can hold it” by agreeing to *gang up on* people who take things freely from others so that *collectively* they could hold onto their possessions longer, have *almost always* treated *other* humans as entities that can be owned. In the Bible, Leviticus 25: 44-46 clearly spells out “*God’s*” rules for owning people. If you were born the child of a slave back then, you *never* owned your own body in the formal legal sense – you merely were in possession of it until your *true, legal* owner saw fit to dispose of it, and you, in some way.

The myth of ownership is central to the tragedy of the commons, just as it is central to the entire field of economics, energy, education, evolution, and good old ethics. I’m sitting in a house that I “own” as I type this, on property that I co-own with a bank, surrounded by possessions that I “own”, working on a computer that I don’t exactly own but that is nevertheless “permanently” in my possession, and putting down words that *may* be – briefly – things that I own as in the thoughts and concepts they represent, for now, exist *only* in the temporal cusp of my ongoing consciousness, the central “I” of my existence as a sentient being. That cusp, perhaps, I own, because although others might interrupt my borrowed body in a way that causes it to cease, although eventually in time *nature* will cause it to cease, as long as it continues I don’t “possess” it, I *am* it.

Everything else that I nominally own, right down to the eleventh molecule from the left in my big toe, is not really mine, I’m merely transiently in possession

of it.

Mind you, I feel pretty strongly that I should *remain* in possession of all of this stuff, at least while I live. It *is* part of the social contract, the tower of myths, that have regulated my behavior since I was born. I was taught way back then that some dollies were *my dollies*, although the possibility of their confiscation by annoyed parents if I was ever “bad enough”, theft by siblings or strangers, or accidental loss was left open..

Note that I still *have* my dollies upstairs, ratty and missing eyes, filthy, but they are there. I will probably remain in possession until I die, if nature, fire, theft, or children moving me into end-of-life care and getting rid of all the junk I’ve accumulated under the myth-taken belief that it is somehow “mine” return them to the disorganized “stuff” from which they were long ago assembled earlier than that. I work hard and participate in an economy with implicit ethical rules *because* I expect that the “free” exchange of “value” inherent in the work will result in my continual ability to obtain things I need in order to live and retain those things that I have previously obtained to make that life comfortable and keep me reasonably content. The myth of ownership is in some sense the *foundation* of all that is good in my life, for all that it is a myth.

History teaches us just how fragile that myth is – one good war, one home invasion by somebody who has decided *not* to abide by this particular garment in the Emperor’s clothes, and I could lose everything, in the sense that *not even the myth of ownership* can survive the death of the owner¹⁵.

My purpose here cannot be accomplished unless you realize *precisely* which of your beliefs are beliefs¹⁶ as in “purely human myths” and which are founded in reality, or at least, are *probably* founded in reality on the basis of *observation and evidence*. Ownership is just such a myth.

Recognizing this gives us an unparalleled freedom to *amend* this myth in ways that lead to a “better” world, defined simply as one that, on average, we would all prefer to live in, given the constraints imposed by *uncaring Nature* and the *demonstrable scarcities* of things we might desire to possess, whether it is because those possessions are, like food, water, and air, critical to our continued existence or they are, like a fishing pole or TV set, simply things we wish to possess for more subtle reasons but could live without if we had to. In Nature,

¹⁵Although many cultures of the past have tried, and religions have exploited our *desire* to continue ownership past our deaths by inventing an entirely imaginary heaven where it can continue.

¹⁶Uh, did I just say that? I *think* the answer must be – all of them.

you have no “right” to own anything because in Nature there is no ownership, only transient possession.

We must then ask ourselves: Is it possible to *amend* the myth of ownership in such a way that ownership as an agreed upon axiom of our “ideal” society survives (because it is very, very useful and something that even *two year olds* seek to invent on the basis of what must be *evolutionarily inherited tendencies* to assert “permanent” possession of things to which we assign any sort of value) and yet avert or avoid the tragedy of the commons that arises whenever we try to split up the “stuff” of the Earth upon which we live? After all, when William Forster Lloyd, and after him Hardin, wrote of those English villages and their commons, they *completely failed to note that the land the villagers “owned” in the village and surrounding area as well as all of the land “owned” by the prevailing landowning lord was **already** a commons, really belonging to no one save by local custom, mythical definition, and the extent to which such ownership claims could be **violently** defended!*

The right of the villagers to graze their cattle on the parcel of land recognized as “their own” was just as artificial as the right of any one of them to graze on the commons. If an invader had conquered England and slaughtered the villagers, their “right” to own those chunks of the Earth would have been revealed to be the myth that it is, as the invader then chopped it up and assigned the myth of “ownership” in the form of a reciprocative social contract to one or more of *its* members. If the plague had decimated the village population, the whole village might have reverted to nothing *but* unpossessed commons. If a villager committed a crime, or incurred a debt, their “property” might have been *seized* on the basis of *other* myths, backed by the practical reality that collectively the population of the village as a whole, or the country as a whole, outnumbered the land’s nominal “owner” by everybody-else-to-one and that the former were prepared to back up their assertions concerning “ownership” with *violence!*

From this point of view, it is possible to re-interpret many of the most *ridiculous* tragedies of our age. The eternal conflict in the Middle East, for example, has at its root the idea that *God transferred ownership of all of this land* to some *particular tribal entity* somewhere in the remote past, and that this *right of ownership* is itself eternal, so that anybody who is *not* a direct descendant of and contemporary member of *that tribe* is not the land’s “true owner”. To make it even sillier, this is the assertion of *both sides* of the conflict, and it literally comes down to *which family from a tribe that was transiently in possession* supposedly has the golden feather of land ownership as granted by their *common* God.

To hell with the e.g. Midianite tribes that possessed it before that tribe's predecessor's got there – they were slaughtered in one of the first historically recorded acts of genocide (see e.g. Numbers 31 and following in the Bible). God “commanded” this slaughter, of course – God, or Gods, of all names and cultures are always doing stuff like that – but the description of the loot seized in the slaughter and how it was split up occupies several times the space describing the killing of all of the Midianite captives *except* the young women, who were given to the troops as sex-slaves as a reward for spitting Midianite babies on their swords, hacking up young boys and old men, killing mothers and their unborn babies as they were obviously no longer virgins and desirable as slaves.

Similar arguments persist in the United States over just who “owns” the land that was taken once the Bison were all cleared out. The “native” American tribes in possession – note carefully the word – moved around all of the time. They fought all of the time amongst themselves over the possession (notice I do not say “right to own”) of the land. Before the native Americans came over the land bridge from Asia, the *bison* were in possession of the land, and before that, go back far enough, *Tyrannosaurus Rex* was in possession of the land and all of its fruits that it could catch, until a giant *asteroid* decided otherwise. Almost every single piece of land settled by – possessed by – the whites after it was emptied of the previous possessors, Indian and bison alike, has been re-possessioned through transactions legal and illegal, moral and immoral, over, and over again over a century and a half of births and deaths, and possession is (as they say) nine tenths of the law although the *intent* of the law is to make it the other way around, with law regulating possession.

Oh. My. Frickin'. God. Are they insane?

Are *we all*, arguably, insane?

I think that the answer has to be yes. We are still trying to get by on ethical systems that are literally thousands of years old, that were founded by and in cultures typically ruled by a tyrant and small group of the ultra-wealthy and powerful by the standards of the age. Ownership was a convenient myth for *them*, as it *protected* their “right of possession” of nearly everything, while still providing *just enough reciprocative* right of possession to everybody else for them to mostly get by. It took several thousand years for us to readjust our cultural *myths* of ownership in generally beneficial ways and produce a fairer, and more productive, society¹⁷.

¹⁷Well, beneficial to *some* people, anyway. Seizing the lands of the aristocratic landowners in France was great for the peasant, not so good for the beheaded landowners. The Russian Revo-

If we cannot do better than just muddle along on the basis of myths that are leading us to disaster after disaster of precisely this sort, we will *deserve*, as a species, the Great Culling that is inevitable in our future as the tragedy of the commons and the myth of ownership conspire to *prevent* us from doing what we need to do to keep from ruining the planetary ecology itself and/or wiping out a significant fraction of the human species in a global thermonuclear war.

I think we can fix our ethical system, or I wouldn't be writing this. The world has, for the most part, been moving in the *direction* of an improved ethical system for some (historical) time now over the last 500 or so years, following the Enlightenment and invention of Bayesian reasoning and science and the associated scientific worldview. This progress, however, is being threatened as never before as the population of the world continues to increase, augmenting the already serious stress on the global commons, and our failure to recognize that *we get to choose* those myths that govern our society, that they are *not* a set of God-given rights, or self-evident truths, or laws written in stone, they are an *entirely pragmatic* set of rules defining an ethos for our social groups all over the planet, rules we are free to change, and tweak, as needed to *optimize their function*, if only we can agree on what that function is.

Speaking for myself, selfishly, I think that function should be to visualize the world we want to live in and that we want our children, and our children's children, to live in. First of all, do we want the world, and our children, to even be *there*, to *survive* the challenges of the next century? Second of all, do we want our grandchildren to grow up in a world where the commonwealth of the planet itself is "owned" according to our global myth that lays out the rules for ownership, by a tiny, tiny fraction of the world's population? Even if you *now* happen to *be* in that tiny fraction, you should never forget that everybody else outnumbers you a hundred to one, and your "right" to own anything at all is both all that restrains them from *taking your possessions from you violently* and is ultimately just a *myth*, not an actual right at all, as proven by the many, many times in human history where this is precisely what has happened! Third, do we want them to live in a world where all of the readily accessible non-renewable resources have long since been exhausted? Do we want to leave them the barren

lution wasn't soo great for *its* aristocracy, and their great experiment of nominally *eliminating* ownership failed miserably. The post-independence partitioning of India was a tragedy of the commons of cosmic scope as Hindus and Muslims fled in opposite directions, being slaughtered as they travelled, to arrive *without* possessions at their destination only to find that the land liberated by flight had been snapped up by the people who were already there so that they had to live – temporarily – on the street.

They – or their great-great grandchildren – are in many cases *still there!*

wasteland of an exhausted commons because we simply couldn't figure out how to keep from adding one more bloody sheep to graze there after another?

Our ethical system had better prioritize – in my opinion, anyway – in this order. **First** we must ensure the health of the Planet itself, as the fundamental scarce resource. Perhaps in some indefinite future, humans may learn to travel to the stars, settle other worlds, but for now, the Earth is it. If we ruin it, we're done, and it won't make a damn bit of difference how “ethically” we behaved preserving “freedom” and “human life” or “property rights” in the meantime.

Second, we must protect the commons of the biosphere. Every species that disappears takes with it values that we are only just beginning to appreciate. I don't just mean that I'd like my grandchildren to still be able to go fishing with *their* grandchildren in an ocean that is still teeming with fish to be caught (although that is true enough). I mean that we continually discover useful biochemicals, food sources, key but hidden ecological relationships, among the species that we are always studying. Somewhere in the rainforest, there might be a species of something that looks utterly useless but that exudes a chemical evolved for its own protection that cures cancer. When we lose the commons of the rainforest, we not only lose the oxygen it constantly regenerates as it recycles CO₂ out of the air, we lose all of its biodiversity and all that might be valuable to us, whether or not we know it.

Third, we must protect the *human species itself*. Up to now, we've squeaked by in a world where one *social group*, united by some mix of racial, political and religious ties plus the practicality of sharing a geographic location, is in Hobbes' perpetual “warre” not with all other men, but with all other *societies*. Some of this war has been enormously beneficial for the human species and its overall ethical growth – the last two and a half centuries, for example, have seen the end of feudal systems, monarchies, aristocracy, and the *myth* that some of us are more entitled to ownership, to wealth, to political power, than others *simply because of the family we were born into*, which is, sure, *absurd on the face of it* but was an *explicit part of religious deontology as a condition for its continued survival in the social group* for most of recorded history and religious scriptures.

It is not certain where *this* century is going yet, but it may well carry away the last, laughable, *indefensible* remnants of the aristocracy – the “royal” family of England, the remaining shieks or kings on the planet (we're almost down to single digits at this point) for starters, and continue on to carry away most of the world's religions, as people increasingly point out the obvious truth – they are just things that *people just made up*, with an anthropomorphic God or Gods

that looked *exactly* like a super-powerful king, or in polytheisms, aristocracy.

We could start by eliminating their “exceptional” status in law. The Catholic Church, for example, is in clear violation of US law at all times, as it is an organization that literally prohibits women from holding any of its significant offices. Say what? If Duke University issued a pronouncement that only Men, from now on, could be professors, provosts, deans, and the president of the University, several things would happen. Riots on campus. Lawsuits galore. The breakdown of day to day operations, as women ARE deans, professors, presidents, etc. And ultimately, *prosecution by the United States Government* of one sort or another for *violating the law!* In a remarkably short time Duke would either cease to exist or go back into general compliance with the law and continuing to work on *deliberately increase* the diversity and representation of its faculty and staff as a *virtuous choice*.

Why doesn’t that happen to the Catholic Church? Oh, yeah. It’s a *religion* and hence *exempt* from the laws of the land, sort of, when they don’t involve pederasty and peculation by its minor members that come to light in spite of efforts within the church to conceal them. It’s time to realize that *all religions are myths* to everybody *except* its own members and should be held to the same *pragmatic* social definition of good and bad behavior as any *other* organization in any given society.

Not just religions. We, as humans, have a *virtuous obligation* to interfere with families, organizations, tribes, societies, *countries* that are not “righteous”, in the specific sense of being in reasonable compliance to the myths we collectively agree on as the definition of “right”. Again it is a matter of “ought”. I *owe it to myself* to work for a world where women are equally treated (according to the equality axiom and virtue already established) not only in my household, but in my city, state, country, and *all the other countries* where currently women are still treated like *chattel*, often with the direct support of the locally prevailing religion! If I don’t, I risk living in a world where women are slaves everywhere, as either it is wrong everywhere or right everywhere and I don’t think it is right, or that creating a *myth* that 51% of the human population of the planet is inferior or property is going to lead to a world with minimal suffering and maximal contentment, even for the men.

Fourth, sure, we should work to create an ethical society *locally*, wherever we live. This goes without saying. I’m not arguing for the elimination of social, political, or national groupings in to tribes, political parties, interest groups, clubs, religions in general or specific as pragmatically, it wouldn’t matter if I

did. Humans form them as naturally as they breathe air, starting with the friendship groups children form whenever you put them together in a room with other children for more than a few minutes. They serve an important purpose, too, in *memetic* evolution as we strive to create a more just society *overall*. Experimentation, within reason, is to be *encouraged*, which is part of the reason for freedom. I have no problem with a woman (or a man) who *voluntarily* behaves as if they are chattel, a possession to some other woman or man, as long as *they always have the right to change their mind and walk away*, within the necessities of fairly balancing rights of “ownership” according to the prevailing mythology of socially protected possession and dealing fairly and protecting any children associated with the deal.

Still, if we can agree even on the *broad strokes* of the myths we are going to call “human rights” and “the virtues that should guide human decision making relative to the planet, the biosphere, the species, and their own social group, tribe, family, and self” the number of places, times, and ways conflicts arise should *diminish in time* as pursuing virtuous action should *reduce the competition* between humans for wealth, status, protection, access to resources, and warm rocks to lie on and doze, safe from predators, in the long run.

That is the *entirely pragmatic, purely human-invented purpose* of ethics, after all. We are virtuous in order to increase our chances at a contented, safe, existence *here on Earth*, not to assure an extremely improbable contented existence in an entirely fantastic and ill-imagined post-mortem Cosmos built, as it were, “just for us” (or worse, to avoid being tortured in another equally absurd, highly specialized, post-mortem Cosmos).

Fifth and last, we should apply our rules of virtue in defense of our increasingly local interests. If you belong to a religion, good for you! Be as virtuous a member of that religion as it is possible to be, as long as you maintain the priorities in the list above and don’t e.g. claim that *your* religion makes it virtuous to wipe out every last bison if you feel like it, or own slaves, or treat women or homosexuals like second-class citizens, or protect your children from being educated according the standards of best belief either factually or ethically because *your* religion claims that the world is only 6000 years old and granted your particular tribe or family sole possession of a few million acres of land (regardless of who is *in possession now*) and you want it back and will go kill everybody you need to until you get it.

If you are employed by a company, belong to a political party, are a Mason, or just a plain old boy scout, Enjoy! Again, *don’t use your membership as an excuse*

to violate the common standards of virtue in your daily *actions*. At the same time, feel free to *argue* – as I am now – that those standards should be changed. If you wish to propose a *different* standard of virtue, *that's what the marketplace of ideas is for* in a free society. If you convince enough people, perhaps you can make it all change for the better, but don't expect that just because *you* think something is good (perhaps because your local club, team, tribe, religion has deontological rules written down somewhere that says it is good and *you* were raised to believe that these rules *must* be true regardless of whether or not they actually work) that everybody else is somehow *obligated* to agree or that you have the right to *force* them to agree.

Also, *please* make sure that your proposed ruleset revision *preserves* the constraints above, and doesn't just return us to an ongoing rape of the ecosphere. As a single example of this sort of insanity, consider Eschatology¹⁸ – specifically, Christian religious eschatology concerning e.g. the return of Jesus, the tribulations, the rapture, etc. Belief in this is based on a very specific set of prophecies one can ferret out of the Bible, provided only that one is extremely generous in one's "interpretation" of the passages involved in some cases, and simply ignore contradictory passages in the main body of the Gospels in all cases that would otherwise identify them as *failed* prophecies at best.

Sadly, people who continue to believe in the second coming (in spite of the fact that it did *not* occur during the lifetime of the immediate disciples of Jesus, as Jesus himself reportedly predicted on numerous occasions in the Gospels) *also* inevitably believe that it will happen *now* – during *their* lifetimes. At that point, after various apocalyptic horrors, Jesus will put everything right and magically restore the Earth, reversing any and all damage we might have inflicted on it during the extended tragedy of the commons called "human history", much of it unguided by any sort of science and sound belief. Placing people with this particular belief set in *charge* of our *stewardship* of the commons – as has been done on several occasions in the United States – has proven to be a *very bad idea* because if the end times are just around the corner, what the hell, let's strip mine coal, fish the oceans to extinction, pollute the water and air! Jesus is coming any day now, and it will all first be destroyed anyway and then Jesus will fix it all with pure magic, but *only for true believers*.

The *hell* with the rest of you, who foolishly tried to preserve the last handful of blue whales or bison...

¹⁸Wikipedia: <http://www.wikipedia.org/wiki/Eschatology>. The religious (or scientific) predictions concerning *end times*.

This is the *cost* of believing in magic, believing in things that are *not* evidence-supported best belief. Believing in an elaborate future supposedly written down by specific humans long ago because of their *dreams* is literally insane when compared to believing in the far more mundane futures we can predict based on a mix of common sense and scientific observation and reasoning. That reasoning suggests that lead in gasoline and mercury in coal and a cornucopia of crap in our water is *bad right now, and will be worse in the future* in easily understandable, observable ways, and that our stewardship of our shared commons should *prevent* this instead of pretending that it doesn't matter while – inevitably – giving special rights of exploitation to a favored in-group.

Ultimately, you are responsible to your own family, and within your family to yourself. You yourself are the sole agent of the “ought” in your life, and you *can* pit your vision against that of the entire world, but if your ought includes things like “I *ought* to be given wealth, status, protection, *just because I'm me* and not as part of a regulated exchange with the other members of my tribe, whose rules *do not apply to me*”, well, good luck with that. Unless you are surrounded by idiots, they will simply but a stop to that because it is not *just* by any reasonable standard of justice that you should receive the fruits of their hard work and contribute nothing of your own in exchange, and it is absolutely *silly* to think that you can rape, rob, murder, beat, torture, extort from, slander, (and so on down a very long list), *hurt* anyone that it suits you to hurt, whether you want to hurt them because they belong to a different family, tribe, racial group, religion, country or “just because”, e.g. you feel cranky today and *not have your neighbors take action against you to make you stop!*

Chapter 21

A (Tentative) List of The Virtues

A scout is Trustworthy, Loyal, Helpful, Friendly, Courteous, Kind, Obedient, Cheerful, Thrifty, Brave, Clean and Reverent.

The Scout Law

I was, as it happens, a Boy Scout back in the day when *being* a scout was viewed as *being* virtuous. It certainly was something that had a long-lasting impact on my ethical development, as it was really the *first* and to this day one of the *only* places I was exposed to a pure philosophical ethos in a global social context with a merit based system of status and rewards. All in the context of *going camping*, learning to live in nature, and doing that all important good turn daily. The scout oath involves things like promising on your honor to do your duty to God and Your Country – scouting is international and multireligious – but it also conveys a duty to help other people at all times, and keep yourself physically strong, mentally awake, and morally straight.

We could all do much worse than adopt the scout oath and scout law as set of pragmatic virtues in a system of virtue ethics!

Well, maybe not *all* of it. For one thing, as you no doubt have observed, I have discovered no compelling reason to believe in God in decades of the most intensive mental awakesness and search. I have, on the contrary, discovered proofs that the concept of God I was being taught back then, one that was implicitly in the Scout Oath and Laws themselves, was *logically impossible*, a Standard Model God that literally could not possibly exist. I've also learned that much as I love my country – and I *do* love America, very much, and think that in *many ways*, some

of them imperiled, it has set the standard for the development of a global ethical culture as you might guess from my love of the Jeffersonian axioms – my country is perfectly capable of making absolutely horrendous moral decisions, decisions that are actively *evil*. Not only capable, it makes bad geopolitical decisions quite regularly, as it pursues *pragmatic economic and political advantage* at *almost* every decision cusp over propagating the very principles of liberty, equality, and fraternity that it shares with countries like France (who also has ignored them, sadly, whenever it was in *its* interest to do so).

It would be interesting to go down a list containing things like the war in Viet Nam (where we got involved after the *French* abandoned it after treating it like a private preserve of exploitable human and natural resources almost without restraint for a century or so), the more recent second war in Iraq, fought in violation of our own ethical code after the *first* war in Iraq left a tyrant in place and betrayed our own allies for *other* geopolitically pragmatic and highly unethical reasons.

The Scout Oath leaves no room to interpret a *higher* duty, a duty to the *principles on which America was founded* rather than to the *laws and decisions* of lawmakers motivated as often as not by obligation to special interest groups when those laws and decisions *obviously* violate the very principles that make America what it is – but that only hurt or suppress the “rights” of those in other countries, or minority racial or gender groups in this one, while preserving access to their wealth or tax money. We are not consistently in the wrong – we have sacrificed much righting *true* wrongs all over the world – but “doing my duty” towards America is not something as simple as “joining the army and following orders” when those orders themselves are immoral, or standing by while white majority rule votes dark-skinned Americans to the back of the bus.

If we leave out the God bit, and at least modify the implicit religious aspect of reverence, and qualify duty to country with, I dunno, duty to the *planet earth*, the biosphere that supports the human species, the human species itself, and *only then* consider duty to country *contingent on compliance with these requirements and the ethical basis for its establishment in the first place*, then I’m still pretty down with it.

Here, then, is a set of virtues, starting with the *explicit* promise to *yourself* to make these virtues your ethical/moral guide as a self-assumed duty:

I promise to *do my duty* (that is, do as I *ought*) to:

My planet, and protect its irreplaceable physical resources with

my decisions and uses;

Life on My Planet, and thereby preserve its *renewable biological* resources and the ecology upon which human existence and wealth rely;

My Species, in its entirety, defending the rights of all humans in all countries, not just my own, with my actions and political choices;

My Country, working to ensure that it treats all of its citizens equitably and sensibly, in particular working to ensure the *reciprocity* of virtuous behavior so that the Good that we do and Bad that we do not is balanced and sustained in the form of the opportunities, rewards, and protections inherent in a reciprocal social contract;

Others, being ‘helpful at all times’ to the extent that I can, especially when being helpful comes at little cost to myself but beyond that as I can afford it and my compassion moves me to.

My Family, that provides me in youth with opportunities, rewards and protections as I expect to provide them in turn to those that follow;

My Self. In particular, I accept the duty of *being as self-sufficient in the world as it is possible for me to be* and not to rely on others to provide me an unearned living. I accept the duty of keeping myself *physically healthy* so that I am not a burden to others around me. I accept as a duty the need to work throughout my entire life to the extent permitted by my life circumstances to *improve my knowledge of self and the world* and *develop and deepen my sense of compassion for others*, both so that I can survive in an uncaring and dangerous environment and so that I can help others as I might hope to be helped when circumstances leave me unable to fend for myself. Finally, I accept as a duty the obligation to *constantly audit my own behavior* for compliance with the rules of virtue that I voluntarily recognize as the best guide to action, at the same time I continue to *test* those virtues, using compassionate reason and observation, for possible improvement as they are only a guide, not laws or rules for all time that are true beyond any doubt or question.

That said, here are – not laws, for these are *not* law except in the specific

sense that you make them your own personal laws – but the virtues themselves represented *by* the Scout Law – things you might rationally accept as guides to better behavior leading towards a better world for everybody and everything, *including* but not limited to yourself:

A human being *ought* to be:

Trustworthy. The entire system of virtues and laws *only works at all* if there is a reasonable degree of mutual trust. Otherwise it devolves into chaos, anarchy, and injustice galore. Honesty isn't always easy, but *everybody* should *strive* for utter, brutal honesty in their dealings with others and especially – to yourself. Note well that *you yourself* are the easiest one for you to lie to, and *you yourself* are the person least likely to call yourself out on just such a lie. Start by being honest with yourself, and then work on being equally honest with everybody else¹. Keep your sincerely given word unless doing so requires you to commit evil, and don't give your word on things if you don't mean it or if you think it *might* require you to do evil.

Loyal. Loyal rhymes with Royal, unfortunately, and it has a connotation of being loyal *to a King* or liege lord of some sort, an example of what perhaps *used* to be a virtue but that no longer works in a modern, post-feudal society. However, being loyal to friends and family and society in general, however, is a virtue, as long as it doesn't devolve into *dishonesty* – supporting a friend when that friend is *doing something wrong* or *lying for them* in some significant matter. Similarly, being loyal to an employer – within reason, note well – is closely connected to being trustworthy. Finally, even in the medieval sense, the virtue of loyalty *ran both ways* – your employer, friends and family are required to be reciprocal, rewarding loyalty with loyalty and protection, not abandonment and betrayal. Living a virtuous life doesn't require you to become a target of abuse or allow yourself to be used!

Helpful. This is already in the oath above, but it is worth stating twice. **If you want a better world, help the world become better.** Help anyone that needs help as you have time

¹If this sounds like a slight rehash from a famous speech by Richard Feynman, that is because it is: <https://calteches.library.caltech.edu/51/2/CargoCult.pdf>

and can afford to do so. Help to sustain the world itself by minimizing and repairing the inevitable stresses associated with your life upon it. This isn't a requirement to martyr yourself for the world, give up all of your possessions, or abandon technology and its advantages, but it *is* a duty to *take action* as your compassion moves you when you live among others less fortunate than yourself and to weigh global costs of your luxuries against your personal benefit in a fair way.

Friendly. It is better to be likeable than hateful. Note that the virtue of friendliness doesn't mean that you ought to go out and pester everybody around you in an effort to make friends, but at the same time, it *does* mean that you should refrain from being *hostile* or *cruel* in your interactions with the other humans you inevitably interact with in the course of your life, and be as positive as possible in your dealings with them. Don't brand others as *a priori* enemies, especially on the basis of race, gender, or religion. Give people the benefit of the doubt whenever you reasonably can.

Courteous. This is a virtue that has been largely forgotten in a world gone astoundingly rude, but it is a *damn good one!* Courtesy, manners, and many social customs are the interpersonal lubrication that permits humans to interact with one another without giving or receiving offense. Even if you are in deep and abiding conflict with some one, and honesty compels you to oppose them at every turn, *be polite* while you do so! Recognize that if you are rude to others, the natural reciprocation is for them to *at least* be rude back. Rudeness is also generally not very friendly...

Kind. Again, kindness is the simplest path to improving the world. Recognizing the needs of others around you and – when and as you feel that you can afford to – helping them to achieve those needs only makes *everybody*, yourself included, happier and more contented in the long run. One day you may need a little kindness from others yourself. View it as an investment against that day, if you can't see the advantages any other way. Wouldn't you rather live in a world where people are kind (to you and those you care about) rather than its opposite, *cruel*?

Obedient. This again is a tricky one. Remember, Boy Scouts are

technically somewhere between 10 and 18 years of age, so they are still *constrained* by law and custom to be obedient to their parents and scout leaders in *loco parentis*, as they still lack the knowledge, judgement (and, literally, frontal lobe development) to be safe without their input and oversight. However, at *all* ages we need to generally obey the law and local mores at least when they are *just* laws and *reasonable* mores, and we should think hard before deliberately breaking them. Also, many, many human activities involve being part of a human hierarchy and simply *fail* if you fail to do your part, “obeying” the instructions of your teacher, your professor, your manager, your police, your government, your platoon leader. Being obedient doesn’t mean turning off your own judgement and allowing obedience to compel you to evil actions – *even in the army* you are not constrained to obey “illegal” commands – but it does mean doing what you are “supposed” to do unless you have specific reasons to redirect your activity or if compliance requires you to e.g. break a contract and hence violate *another* virtue. No set of laws, rules, or customs will ever free you from the need to *use your best judgement* and be guided by the *spirit of the virtues themselves* when edge cases cause rules to collide with virtuous behavior!

Cheerful. A *very* tough one, as we do not control our brains, our brains ‘control’ us², and we can’t alter our own biochemistry to make ourselves do more than *behave* superficially cheerful. If you are biochemically depressed, or if life has just dealt you a serious blow, or if you have PTSD, cheerfulness may be beyond your reach. We can still *do our best* (another Scout maxim) to remain cheerful, or if you prefer, peaceful and in a state of inner tranquility (see the virtue of “mindfulness” below), in our interactions with the world and others. It almost never hurts to try, and it may help. You might also interpret this virtue as expressing the need for you to *get help* if you are perpetually depressed, as this condition, even when it is a natural consequence of your own particular biochemistry or life circumstances, is *not desirable* and there are many ways to *get help* with it, if you try.

Thrifty. This is a direct part of our responsibility to ourselves,

²... or *are* us. We Be Brain!

to our neighbors, to the living things we share the world with, to our entire planet. *Don't deliberately waste scarce resources*, especially if they are *not* renewable or *are* under stress as a scarce part of the commons even if renewable. Don't take more than you need to eat, and then clean your plate. Buy products that will last and that can be repaired when they break instead of ones that are (perhaps) cheaper but break quickly and then are unrepairable junk, even if you have to save longer to afford them. Reuse, recycle, repair. Our whole *civilization* has become lazy in this regard, and we are all paying for it as we buy, and buy again, cheap junk that cannot be repaired, use it until it fails (usually a very short time compared to the cost) and then *throw it away*.

Oh, yeah, and we should be *economically* thrifty and save for rainy days and so on as well, but that's just pursuing pragmatic self interest in an enlightened way.

Brave. Life is scary. And dangerous. And often painful. And then you die. Accept this, get over it, and then *do your best not to whine*. Being virtuous will sometimes require you to risk your life and health, or endure pain and discomfort, with or without any promise of a greater reward later³. Being virtuous may even require you to choose to *sacrifice* your life at some point for those that you love more than you would love staying alive without them. Face up to it and accept it and move on. Life is no place for cowards – that far away from the state of Nature we are not, and probably never will be.

Clean. Being clean means being healthy (already in the oath above) and much more. Keep your *entire life* reasonably clean⁴. Your body. Your mind. Your brain. Your food. Your water. Your household and local living environment. The world around you. In Scouts we were taught to carry out anything we carried into the woods when we camped, to leave the natural world as close as possible to the way we found it. Today, you can't drive down

³Such as a mythically enhanced posthumous superreward called "heaven".

⁴Note well the term "reasonably". Exposure to dirt and germs is part of the process of developing a healthy immune system, and many jobs that need doing are *dirty jobs* where it is a *virtuous necessity* that you get dirty doing them. That doesn't mean that you shouldn't clean up when you can, stay as clean as is reasonable, and not stink up your local environment with e.g. body odor when you aren't working.

any road without seeing literal piles of trash filthy humans throw out of their windows as they drive by. This is *not good behavior* and *makes the world an uglier place to live for us all* in addition to having the potential to harm local wildlife or act as a source of disease. Keep the *world* clean.

Reverent. Not to God, unless you happen to (still) believe in God, but to – and I say this quite seriously – to *great ideas!* To *grand myths!* Revere people, like the Buddha and Jefferson and Hume, who at least according to legend admixed with myth, *came up* with some of the great ideas even if their lives were otherwise imperfect or they had other ideas that weren't so good. By all means, revere *Jesus* or *Mohammed* or *Guru Nanak* on the same basis, for their good ideas, at the same time you reject firmly the surrounding mythology along with their (reported) *bad* ones.

Revere those who make or have made great sacrifices for us all – it won't bring them back to life if they died in a war or died to save others from death, but our quiet appreciation of their actions is a small return, important to their surviving family. Reverence of those worthy of it provides us all with *role models* for virtuous behavior. Revere great musicians, poets, authors – not in the sense of worshipping them as gods, but again as a form of *gratitude* for the ways their work made our lives better. Feel reverence of a different sort when you come upon a perfect moment of sunshine on a forest glade, when a rainbow crosses your sky, when you see your first child born. Revere your wife, your husband, your children, your elders (at least to the extent that they earn such reverence in an imperfect world). Even in a world without religion, there will be plenty of room for reverence and its close cousin, awe, in the form of quiet appreciation of some *great good*, whether of human origin or natural.

No doubt you thought I was kidding when I put the Scout Law at the beginning of the chapter, but I wasn't, not at all. It beats the hell out of the ten commandments. As a set of practical rules for virtuous living beyond what you learn in kindergarten, it was and remains rather gangbusters awesome!

Still, there is no reason to think that this list is *complete* or *sufficient to provide guidance under all circumstances* or *static* – unlikely to change or require future modification over time. I'm therefore going to add a few more things to

our growing list below – the Scouts are far from the *only* sources of virtues out there, and some are (in my opinion, anyway) worth adding in for sure. Still, one could do far, far worse than simply vowing the oath to yourself, and then obeying these virtues as your personal law of ought. It would make truly *bad* behavior pretty hard to justify, if it might not completely spell out *good* behavior.

My next source of inspiration is Siddhartha the Enlightened Wise Guy⁵. Siddhartha Gautama, as you may or may not already know, is presumed to have been a real person who lived around 500 BCE-ish who was born a prince but abandoned his wife, family and duties when first he encountered suffering in the world after being deliberately protected from it from birth through marriage. The reason he walked away was – as was the local custom – to seek Enlightenment, some way to Make Sense Of It All. He had, you see, been dumped from heaven-on-earth princely delights in an apparently painless world straight into the Pit of Existential Despair surrounded by all of the poverty, pain and misery that had been hidden from him lest it damage his delicate sensibilities.

The customary *path* to enlightenment at the time was ascetism: to fast, meditate, afflict your own body with suffering in the form of stuff like icewater baths, and listen to “wisdom” as it was being passed around by local Hindu Rishis⁶ and Gurus⁷. Some of that wisdom was encapsulated in a marvelous collection known as the Upanishads⁸ dated to almost exactly the same time. The Gurus of the day pretty much recommended meditation and mortification of the flesh, fasting, etc, and according to legend, Siddhartha pursued this for some absurdly long time⁹, until he finally accepted a bowl of food, slept and meditated for a time¹⁰ and eventually awoke – Enlightened.

Tempting as it is to expound, this is as far as I plan to go into his nominal biography or the *religious* or *monastic* aspects of what he taught. However, it is quite possible to view Buddha as an early *atheist*, who realized as part of his Enlightenment that even if the Gods existed, *they* would experience suffering and life trapped on the wheel of existence and hence would have the same need for meditation and enlightenment – perhaps an early echo of the entropy/encoding argument that no sentient being, however complex, can know *itself*, let alone everything there is to know *including* about itself, and downgrading them to at

⁵Wikipedia: http://www.wikipedia.org/wiki/Gautama_Buddha. A liberal translation of “the Buddha”.

⁶Wikipedia: <http://www.wikipedia.org/wiki/Rishi>.

⁷Wikipedia: <http://www.wikipedia.org/wiki/Guru>.

⁸Wikipedia: <http://www.wikipedia.org/wiki/Upanishads>.

⁹Six years is a common enough legend, but honestly – nobody really knows...

¹⁰Seven more days... ditto.

best small ‘g’ gods irrelevant to his primary thesis. In that case, we can recognize him as perhaps the world’s first practicing *social psychologist and ethicist*, teaching that it is (at least) possible to live so as to *minimize suffering*. Indeed, the stated basis of his philosophy is that suffering exists, that it is caused by “attachment”¹¹, that ceasing to be attached leads to the end of suffering ***which is to be desired as the fundamental basis for “the good”***, and finally (see the recipe below) (The “Eightfold Way”¹²) as the way to give up attachment and thereby cease to suffer.

This is clearly an *axiomatic statement of social psychology or metaethical philosophy*, not a metaphysical *religion*. It has a fair bit of truth to it, co-opted in Freud’s similar recommendation to “devalue and sublimate” when faced with unattainable or unacceptable desires, but at the same time, it is easily criticized. For one thing, it gives no weight to the opposite of suffering, joy. For another, we all have the means to eliminate suffering close at hand by simply electing to commit suicide. Perhaps – perhaps – Siddhartha still really believed that to commit suicide was no solution as you’d just be reborn to continue suffering, but hopefully at this point we know that there is really no particular reason to believe in serial rebirth. Lacking judged or unjudged serial immortality, suicide *is* an option (and in many cases, may be the *only* useful option) for avoiding an otherwise unavoidable rest-of-life in a state of supreme suffering.

We see from this the critical importance of making our ethical system *pragmatic* and *consistent with our worldview* defined as the set of things we can doubt the least, given the direct evidence and the indirect evidence in the form of a network of evidence supported beliefs. It illustrates the impact of (probably) false beliefs when an ethical system is based on them as if they were true!

We have no good excuse for believing nonsense like this now. There is plenty of reproducible evidence that great deal of suffering is *not* caused in any useful sense by *attachment* in the sense the Buddha was referring to. It is caused by being in *actual physical pain*, Nature’s way of teaching us to *avoid dangerous choices and actions that cause physical damage and hence damage-associated pain!* Asserting that if the sufferer were less attached – to what, their body? to life? – the pain wouldn’t make them suffer both blames the victim and is clearly

¹¹An absurdity. Try telling somebody whose body is being devoured from within by cancer or whose skin is sloughing off from third degree burns that their suffering is caused by “attachment”, implying that their suffering is somehow *their fault for being attached to their skin* both literally and metaphorically, but don’t then be surprised if they, or their next of kin, *bop you on the head with a blunt instrument* to teach you that sometimes, at least, suffering is caused by *physical pain and injury* and not just desiring the things we actually *need* to stay alive.

¹²Wikipedia: http://www.wikipedia.org/wiki/Noble_Eightfold_Path.

sophistry of the rankest sort.

Spending a significant fraction of a life *in* a state of dedicated meditation is even a *form* of suicide, as it produces absolutely nothing of value while consuming things of value. Indeed, by the ethical standards I'm proposing, *monastic* Buddhism – which was the way the whole system was set up – is even today *intrinsically unethical* as it relies on the sacrifices made by and support of a great segment of the lay community who have to do all of the work supporting a monk so that he (or she) can spend the entire day meditating, basically doing nothing useful, thinking nothing useful, accomplishing nothing useful, until he (or she) *does* eventually die. You'll note that I consider it virtuous to *take care of yourself* and *earn your way in the world* as long as it is possible for you to do so, meaning that whether you rely on others to work hard to feed you and clothe you while you play video games, or smoke lots of dope and listen to music, or sit in lotus position and chant Om, it is *not virtuous behavior to do so* and you shouldn't be at all surprised if people refuse to *do* that work on your behalf while you live the life of a lazy-ass butt. Sorry, but there it is.

With that said, Buddha's *best* ethical advice came in the form of a lecture to a king who was hosting him and the lay community, laying out rules for all of those people who *don't* spend all day meditating but actually chop wood, carry water, run governments, grow food, collect garbage, and basically do all of the actual *work* associated with having a civilization with all of its advantages.

These rules more or less skip the monastic component and stick to the *common* basis for a *reciprocity* ethical system, where suddenly the Eightfold Way becomes a virtue based description that is equitable, giving all people who adopt it an *equal* chance at achieving not liberation from a mythical cycle of rebirth but a reasonably contented, balanced life and an improved world for themselves and their children by teaching them to *regulate their appetites* and to *minimize*, by acting as directed by their inner compassion and loving kindness, their own suffering and that of those around them.

This is good stuff, and provides at least a slightly different take on the virtues and duty laid out above. To include the list not as steps on a path but as virtues intended to guide life actions with no final destination but eventual death I'll have to *significantly alter* some of the traditional elements and interpretations of his Eightfold Way, as in my opinion they are "self serving" elements of *Buddhism*, not a system of ethics, elements specifically intended to facilitate the perpetuation of a monastic religious core devoted to propagating Buddhism¹³. This is lying

¹³You might (or might not, since almost nobody actually *reads* the Bible) recall that Chris-

frog territory – it forces one deep into cognitive dissonance territory to give up everything including your family and *then* to decide that *it was all a mistake!* It's a lot easier to go along with it even though you privately have doubts¹⁴.

Note well, then, that the commentary is *my* commentary, and *my* interpretation of the rules, which differs from that of traditionally taught or given.

Right Resolve. Traditionally, the first element of the eight calls for renunciation of home, family and all responsibilities to join a monastery and devote the rest of your life to begging for a living while seeking enlightenment following the rules.

By both ancient and modern standards, this often would make the renouncer nothing but a *deadbeat dad* (yes, Buddha originally intended his monastic community to be primarily *male*, another problem, although later he may have relented) which *I* don't think is very ethical as it involves *breaking promises explicit and implicit* to your wife and children in pursuit of a selfish goal – “enlightenment/liberation” for yourself, and *screw the ones you leave behind!* This shouldn't be surprising – in the story above, *Siddhartha himself was a deadbeat dad* who walked out on wife and children and all of life's responsibilities and lived on the charity of all of those others who did *not take this piece of advice* for the rest of his life¹⁵.

I'll actually go one step further than *just* cancel this – I'll point out that I've *already* established the “No Lazy Butt” rule as a virtue – the *true* “Right Resolve” should be to *support yourself* throughout life while *meeting your responsibilities*. If you plan to hare off and meditate and preach for a decade or two, *don't get married or have children* as that comes with an implicit lifelong

tianity has an similar meme expressed in several places, e.g. Luke 14:26, Matthew 10:35-37 and elsewhere. Interestingly, they also references “taking up the cross” – which hadn't happened yet. Not because it was prophetic – because all of this was written decades after any or all of the events described, at a time when “the cross” *had become* the symbol of the Christian. Note that throughout all or most of the first century CE, *it wasn't!*

¹⁴It is a *lot* easier to go along with it if you read Acts 5:1-11. Simply put, no holding back or going back or *we'll murder you and pass it off as a miracle!*

¹⁵Whoo-ee, am I criticizing the moral integrity and choices of an individual who is considered such a paragon of virtue that an *entire religion* is based on them? I am. Wrong is wrong, and just because nobody says it out loud doesn't make it right or a good role model for others to follow.

responsibility, and *plan to work for a living* along the way¹⁶

For all of that, Right Resolve is a good virtue, as long as we frame it as ***resolving to do your self-appointed duty by living a virtuous life***. There, how simple was that? We already *have* this as a virtue, the fundamental *free choice* you must make to live in some way other than by whatever ethical system you were programmed with when you were too young to choose.

Right Speech. *Here* the Buddha (and Richard Feynman and many others) is dead on the money. Don't lie, to yourself or others. Don't be rude or hateful. And finally, don't use words to sow discord or inflame passions leading to unreasoned violence. Donald J. Trump, are you listening? Is *any* modern politician listening? I doubt it.

Right Conduct. Don't take what is not given. Don't kill or injure either human or animal without sufficient reason. Don't injure or harvest from *the Earth* more than is needed or for insufficient reason, and Clean Up The Mess when you do. Don't engage in sexual violence. Note that my interpretations here are *very different* from the originals, and I am *not* suggesting the elimination of all material desires (which is easy to do – just commit suicide and Poof! they'll be gone!), only their moderation.

Basically, strive to put your frontal cortex in charge, not your appetites leftover from dinosaur days. You probably won't always succeed – I don't – but the scout *motto* is – wait for it – ***Do Your Best!*** After all, what more is virtuous behavior *ever* than doing your best...

Right Livelihood. Here is one of the main reasons I'm including Buddha's collection. An unfortunately common way for people to wreak untold evil while convincing themselves that they *really* are good is to practice virtue in your personal life, to act kindly and compassionately in your community, to love children and

¹⁶I have no problem with that work being paid for teaching the four noble truths and eightfold way to people who wish to learn, for example. What I object to is going around *begging for food* from people who have none too much for themselves, in exchange not for *teaching*, because the Buddha explicitly claimed that they were not really teachable, but for “a blessing”, or in exchange for some invisible *merit* worth a trade-in on a higher birth the next time around. Piffle!

pets, and then, every day, to go to work *at the local arms manufactory* making guns that are then used by people to commit suicide, to commit armed robbery, to murder, to rape, or that are shipped overseas to be used in wars or by drug gangs¹⁷. Or, make a living by selling drugs that destroy lives and minds and health. Or by exploiting the old, the stupid, the infirm, the young in ordinary business through deceptive trade practices. Or by harvesting fish from a dwindling population that will soon be *gone* due to overfishing, but that doesn't matter as long as you get the next payment on your muscle car first. Or by entering politics and making all of your decisions according to the directions of the handful of *really rich people* who pay nearly all of the cost of your campaign instead of what your heart and mind tells you would *really* be in the best interest of the constituents who elected you in good faith, not realizing who you would *really* be working for. Or...

Hopefully you get the idea. It's pretty easy to sort out jobs in terms of their *virtue*. Are they good for the planet, bad for

¹⁷Yes, guns *do* have some positive uses. I own several myself – I grew up hunting *for food*, and enjoy just plinking at a target and am a pretty good shot. But handguns, in particular, are made and sold with an implicit “this gun is intended to be pointed and fired at another human” label on it. People who own them often as not shoot at a target that is a human silhouette. We have long, long since had the technology that would prevent a gun from being fired by anyone but its individual owner, but every year handguns that aren't even secured are used by children to *accidentally* kill someone, or for someone with access, owner or not, to commit suicide.

Let me be clear, as a significant fraction of human society in the United States, at least, is a bit confused on this point in spite of the fact that most of them *claim* to be practicing Christians and yet could not rationally answer the WGWJUTSS (What Gun Would Jesus Use To Shoot Someone) question: ***Owning guns per se is not a virtue no matter what your intentions concerning them are***, although neither is it necessarily a vice, as guns *do* provide some protection for the weak who are being preyed upon by the strong by leveling the field. Guns *are* a purely practical necessity in the world of international politics and societies in conflict over scarce resources and seeking to shrug off evil religious or political structures. However, the real solution to this moral dilemma is to work to *create a virtuous world* where the strong stop even *trying* to prey upon the weak and build an effective society that identifies the inevitable mavericks and *neutralizes* their capacity to do evil.

Sadly, all too often gun ownership *is* a vice, with single individuals e.g. owning ten handguns, all useless for hunting, “for protection” where at least nine of them produce no real marginal benefit in safety. They spend large amounts of money on those guns and all of the ammunition they consume firing them at pseudohuman targets. I gotta say, this money might better be spent on groceries or house repairs or education or opportunities for their children, or even better still used to help out neighbors and people all over the world build a world where guns *are not needed* either for protection or to defend freedom.

the planet, or close to neutral? Do the products of the labor on average hurt people or cause them to lead non-virtuous lives (tempting them to gamble or drink to excess), or do they help people in some way, or are they mostly neutral? ***You cannot lead a virtuous life while working at a non-virtuous job!*** Anywhere in the wide range of nearly neutral is fine – *no* job, *no* action, can be guaranteed to produce no negative “evil” side effects – even farming involves disturbing the soil and displacing the natural wildlife that would otherwise have been there – but the damage done should be at least in reasonable balance with some mix of pragmatic necessity and the greater good.

Right Effort. This is another version or extension of the Right Intention virtue above, of the “duty” axiom and virtue already given, but it addresses a different point in the stack of brains and body parts that is “you”. You might well generate with your intentional, interior monologue driven, rational self a virtuous goal like “I will not eat ice cream except on very rare occasions when it is socially appropriate” as a step towards caring for your coronary arteries and avoiding type 2 diabetes. However, your *stomach*, and *taste buds*, and various other internal sub-systems *crave* the damn stuff, and as you naturally experience hunger those voices get louder and louder until all you can think about is how much you want some ice cream. You start hearing ice cream whisper to you from the freezer (if any is in there uneaten) or find yourself walking down the ice cream aisle even though you know there is nothing on your shopping list that you need to look for there¹⁸.

“Right Effort” requires that the “you” that actually thinks, that actually *decides* things in a *thoughtful* way, ***take charge of all of the rest of you*** so that you are not driven by your appetites, your lusts, your greed for more, more, more – of anything. Money. Power. Sex. Food. Excitement. Possessions. Friends. Accomplishments.

This is not only a virtue, it is one of the *core* virtues, as it demands that you actively try and continually reinforce the *key change in yourself* from the state where you watch yourself act

¹⁸As the author cringes in shame...

badly but somehow cannot stop yourself from doing it to where you don't, where if you choose to act badly, *you quite deliberately choose to do so fully knowing that it is a bad action* – and incidentally, violating your own promise to yourself to try to do *good* (or at least, refrain from doing bad!) things.

This is one of the most difficult requirements for anyone seeking to lead a virtuous life, and the next three “steps” on the Way are instructions for *mental disciplines* to be practiced to help, not virtues per se beyond the implicit “you should perform these practices or all of the Right Intention and Right Effort in the world will fail. As I said, Siddhartha was perhaps the world's first *practicing social psychologist* and these are his prescriptions for *therapy*, motivated (perhaps unfortunately) by a certain amount of the supernaturalism that prevailed in his day.

Right Mindfulness. This is a virtue that pretty much missed getting into either the Greek virtue ethics systems, the British system of ‘virtuous duty’ to the empire, or the Boy Scout system of virtues, although interestingly it *is* in many of the *religious* systems of virtue and ethics. As previously noted, Right Effort is required, but how the hell can you take charge of your appetites? We all too often *do* face Paul's dilemma and do that which we would not and fail to do that which we would do, all the while *watching ourselves do it!* Buddha's practical psychological solution – and, in the form of prayer, that of many religions – is to *actively and regularly practice mindfulness*, usually through some form of **meditation**. Even the Greeks seemed to be trying to identify something *like* meditation as e.g. Socrates considered “the good” to be the actions that naturally flowed from a disciplined, educated mind – “The unexamined life is not worth living”.

Neuroscience and behavioral psychology are both actively studying meditation even now today, as it *does* often have a major impact on intentionally directed ethical behavior. New terms have been invented to describe the “unified” state meditation *can* sometimes lead to – “self-actualization”, for example. I've personally found that teaching college students mindfulness practices *can* – I'd even say *more often than not does* – help students

with the *specific* problem of ‘test anxiety’, an instance of the shutting off of the brain as soon as it is presented with a stressful challenge. This happens when brain subsystems evolved to help humans *fight off saber-toothed tigers* kick us into fight or flight mode in an utterly inappropriate environment.

Mindfulness practices *can* help with cravings of all sorts – for tobacco, alcohol, drugs, sex, and *even ice cream*. They can indeed help an individual reduce the voice of all of the “attachments” whose greedy pursuit all too often leads to *suffering*. Buddha got this all quite right, as one can *empirically verify for yourself* as you *should* do before making them a part of *your* personal ethical practice. Note well that he did not assert them on the basis of faith or authority – he simply said try them and see if they help¹⁹. I can do no less.

Still, I cannot quite agree that being mindful per se is in and of itself a *virtue*. I *do* agree that people, especially people who can easily identify their own *failings* at leading a “mindful existence”²⁰ and who would like to do better ought to *try* mindfulness practice to see if it helps. There is actual evidence that if one pursues it *with discipline* and *over a long time* and *with some instruction from somebody that knows what they are doing* (which can easily be obtained for free on the modern internet through e.g. through the numerous youtube videos available featuring Rinpoche²¹ *that it will often help!*

¹⁹Again, he was apparently an *empiricist*, an early *scientist*, and the main reason his philosophy took off and covered a large part of that corner of the world was that *it worked*. Up to a point.

²⁰Crudely defined to be one where their intentional self is *unified* as much as possible with all of those sub-selves (indifferently labelled as things like “the subconscious mind” in western tradition, although there are clearly *many* such minds, often in conflict) and with the frontal lobes and rational thought at least *mostly* in charge.

²¹Wikipedia: http://www.wikipedia.org/wiki/Yongey_Mingyur_Rinpoche. Rinpoche gets *my* red feather as one of the best teachers of meditation practices out there, especially for people with any sort of anxiety related problem that they wish to overcome. Rinpoche himself suffered from an anxiety disorder when he was young, and used meditation to help himself achieve a state where anxiety no longer causes him to suffer or become dysfunctional. Beyond that, he teaches a *positive* approach to Buddhist practice as a path to *personal* contentment and happiness by making content with your own inner self to practice “lovingkindness and compassion” in all of your thoughts and actions while refraining from self-criticism, stress, and suffering, that is very much in line with the virtue ethics I’m – ahem – *preaching* in this work.

With such a glowing endorsement of mindfulness, why then the qualification that “being mindful” through meditation is not itself a virtue? For several reasons. For one thing *it doesn’t always work*. Seriously. In retrospect, that this should be so is obvious. Human brains come in a dazzling range of functionality, or if you prefer, with a dazzling range of possible causes of *dysfunction*. Many of these dysfunctional parts are *purely biological* – imbalances in hormones, neurotransmitter levels, specific protein regeneration pathways, etc. These failures are *way, way too subtle and complicated* to be fixable by a single universal hammer that treats all forms of human suffering caused by the inability of a human to behave in a self-aware, ethical manner as if they are a single, unified nail!

I think even the Buddha recognized this, as he was (reportedly) at first very reluctant to teach his discoveries of the benefits of meditation and mental discipline as a path to a virtuous existence that minimizes suffering. His stated objection, according to the surviving canons (mythical or not) was that the majority of people simply couldn’t, or wouldn’t, be able to learn what he taught and benefit from it. One of his reasons for establishing requirements for his followers to become proper *monks* and follow the practices *with direction* was that it filtered out the common masses to the subset that *might* have a chance at succeeding in his grand prescription of unattached mindfulness leading to exit from the cycle of rebirth etc (with the side-effect of propagating his teachings for 2500-odd years into the present semi-intact subject to the usual drift associated with oral or manuscript-based memetic transference before the printing press was invented).

So let’s not make this a *requirement* of a virtuous life, as all that will do is make those that try it expecting it to *make* them stop gambling, or feeling depression all of the time, or being able to resist ice-cream seeking behavior – or worse – and *fail, feel like a failure!* Which will both increase their personal suffering and might well make them frustrated enough to say “What the fuck, meditation doesn’t work so I may as well just go ahead and kick this puppy.” Or more horrific, dysfunctional versions of the same thing.

Pirate rules, of course. More like “suggestions”. I’d say by

all means that if you are mentally scattered, if you find yourself watching yourself doing bad things and unable to stop, *by all means, give meditation a try* as a path to mindfulness and self-control, or self-actualization, or whatever other nifty catch phrase you might attach to the simple idea of “being virtuous” in your thoughts and actions. Just don’t consider it the *only* arrow in the bow of modern psychology and medicine.

Every day we learn more about *objective* ways brains malfunction, and we already have *many forms of therapy*, both social psychological as in analysis, counseling, 12 step plans, etc (that *also* only sometimes work, but sometimes is better than never, right?) and chemical – there are numerous treatments for things like depression, bipolar disorder, schizophrenia, attention deficit disorder, and more *that empirically and verifiably work* at the double-blind, placebo controlled gold standard of actual improvement, and it *incredibly silly and wrong* to assert that meditation and mindfulness can somehow replace all of them. It’s the difference between being “religious” in one’s practice of virtue ethics and *pragmatic*, and we’ve agreed – I hope – that pragmatic virtue ethics is the way to go as it can *try many different pathways* in the *search* for a personal system of virtue ethics and practices that works *for you*, and that optimally works for *everybody else* in a reciprocative way.

Right Concentration. This is a very difficult one to interpret, as the words that describe it in the original language don’t have direct equivalent in English, and I’m not quite sure I agree with their stated goal and purpose.

Let’s keep it relatively simple and interpret this in a way that can easily be justified by life experience and observation and that connects this maximally with the Greek tradition as a bonus on the side. There is an interesting phenomenon that is associated with mental effort directed towards solving a problem. It forms a significant part of the teaching practice I use to help my students learn physics. If you work on a problem, then sleep on it, work a bit more, sleep on it, find yourself thinking about it in the middle of the day while you do something else, sleep on it, repeat *ad infinitum*, then there is a significant chance that *one day you will wake up and find the entire solution to the problem, however*

difficult, just appearing to your intentional consciousness. This appearance is also often accompanied by somatic phenomena, things like the impression of a flash of light (seriously!). This phenomenon is common enough that it has a *name*: Insight²².

It is familiar enough to almost all crossword-puzzle solvers – if you are doing one of the nasty Saturday or Sunday New York Times crosswords, with oblique, nonlinear clues and up to 25 (or a bit more with occasional embedded Rebus squares) letters to an answer, and get at most a handful of words crossing the long one, words that themselves might not even be *right*, if you struggle and strain to answer it, you will eventually get to the point where you are making almost no progress. You have literally no idea how to take another step.

When you *put the puzzle down*, to return to it much later (often after a good night’s sleep), you just *look* at the 25 square answer with (say) three of them filled in and **Bam!** There it is! You *all at once* see exactly how to fill it in, and how to fill in a bunch of the crossing words as well.

My favorite question to put to my students (who often have had this, or similar experiences in their own studies) is: ***Who found the answer to that puzzle clue?*** Don’t be too quick to answer! It wasn’t my – or their – *intentional mind*, the one with an interior monologue and algorithms for e.g. permuting letters and guessing possible cross answers to “decode” the answer using *reason*. The answer was there all at once, and I – or my students – *didn’t even think about the puzzle in the meantime!* In fact, *not* thinking about it sometimes *helps* the process occur.

Note that I do not know the answer to this question myself. I have *no idea* where the answers that come from Insight with a capital ‘I’ come from inside the human brain. I merely offer this as evidence that *you are a lot more than your intentional mind and its interior monologue* and that the nonverbal, preverbal structures you can’t intentionally control are capable of *complex thought* that happens while your *conscious* mind is busy watching TV, or sleeping, or doing almost *anything* else but think

²²Wikipedia: <http://www.wikipedia.org/wiki/Insight>. In the specific sense of “epiphany, eureka moment”.

about the problem itself.

This is where I think the practicing social psychologists and therapists of Buddhism are trying to go with Right Concentration. Insight – and let’s think of the target of *Enlightenment* as a *form* of Insight, that is, insight into a very fundamental and common human problem – is something that is likely to happen *only to the prepared mind*, and then only when one is concentrating a lot of your “intention”, or *attention*, on trying to find the solution to some problem up to the point of frustration interspersed with periods of rest and turning one’s attention elsewhere. You have to *concentrate effort*, or *invest time and energy, mental and otherwise* on the problem, and may well have to *build mental tools* or otherwise work *up* to the solution in some way.

For those who watched the original “Karate Kid” movie, this is the *point* of “wax on, wax off”, which has become a metaphor for precisely this kind of directed effort and preparation. Only with the discipline, the concentration, the directed effort, is Enlightenment on *anything*, even in the form of a suddenly appearing solution to a bizarre Crossword Puzzle clue ending in a question mark (so you know the answer is a pun, a joke, or something equally nonlinear), likely to happen.

So I *agree* with the Buddha here. If one is accepting the *duty* of leading a deliberately virtuous life, of disciplining your actions so that they eventually are *automatically* good, *without* the constant need of your toplevel interior monologue driven self acting as a nanny²³ to keep your other deeper selves in line, then you have to, one way or another, *concentrate effort* on arriving at this desirable state of self-awareness and directed action, quite possibly *every day*. At least at first!

Wax on! Wax Off!

Hence, a Virtuous suggestion: Every day, spend a “meditative” moment reviewing your actions over the day. Were they guided by virtue? Were they neutral, but perhaps necessary? Were they non-virtuous? In other words, *did you eat the ice-cream after all* even though you nominally *intended* not to do so?

²³Or “superego” in at least one Western psychological metaphor/model.

Then analyze your actions and the motivations for them. *Why*, exactly, did you eat ice cream, or drink alcohol until you were shitfaced and annoy your friends and sadden your family *again*, or shoplift a tube of lipstick from Wal Mart and risk being arrested and all of the bad things that follow for a trivial reward that could easily have been legitimately obtained?

Do this daily assessment *without judgement!* Guilt, empirically, is a lousy motivator of good actions, for all that many religions rely on it (and look where *that* has gotten us). Inspect your actions as if they were those of somebody else. Inspect the motivations equally impersonally. Then *spend some time concentrating*, not on regret, shame, intention to make amends, but on reinforcing your intention to *recognize the triggers* of your bad actions and *avoid* them, on realizing that the *benefit* to you of committing the bad action – feeling replete with ice cream, alleviating the stress of having to constantly be making reasoned decisions, having *just the right shade* of lipstick without having to pay for it (and besides, Wal Mart can afford it/deserves it, it isn't like *really* stealing from someone with a *soul*, your self-justifying inner person may assert) – is bought only at the expense of your *self-respect*, your *duty to yourself* to behave virtuously instead of *viciously*, and on reinforcing your intention to *not commit the bad action again* while bopping that selfish little narcissist that lives within us all on the head. By all means, remain open to *getting help from others* to help you realize these intentions, if help exists (and it usually does, although there is sadly no Ice Cream Hotline that I know of).

I lack the space, or the skill, to convey all of the mental practices and therapies and so on that can help you with this process, but this is what Socrates *meant* when he asserted that the unexamined life isn't worth living. Much evil happens because we are simply too caught up in a chain of actions that seem inevitable, one following the other, with no ability to alter them on our own part. Right Concentration, can at least *help* break you out of this chain, by making *peace* with the part of you that “wants” things with no regard to their cost to you or those around you, by opening up this part to the full awareness that ultimately, you really do *hurt yourself* as you give Evil – non-virtuous, self-

defeating, risky behavior that hurts others as well – free reign.

Right View. The final of the duty/intention virtues of Buddhism is to face up to the fact that your body and mind are impermanent. There it is. Sorry, too bad, but one day you will die and your unique mind will more or less totally vanish into entropy, cease to exist as a self- or other-aware entity in the Universe. All of physical science teaches us that this is almost certainly the case, and here Buddha and Buddha’s followers are *just as wrong as the followers of any other religion* when they assert otherwise. If you want to seek any form of capital E Enlightenment, ***stop lying to yourself*** with tails of serial rebirth, perfect cosmic justice, heaven, hell, and all of the other unsupported supernatural nonsense humans have invented because they have a hard time accepting the fact that their life is transient and then they’ll be gone. So no, there is no path “out of this world and into hypothetical afterlives, good or bad”. It is the literal truth that, to the very best of our collective knowledge, *all living beings* have only *one way tickets* for a comparatively brief life on Earth, and when that ticket is punched and that life ends, *the entities themselves are almost certainly just plain gone for good*.

At the same time, Right View *can* be interpreted as the following *probably true* assertion: Actions Have Consequences, and even if death *is* the end of our ability to act, to think, to be, our actions and beliefs *during life* have consequences that will survive our death. This is simply accepting the reality that we live *in*, as a *part of*, an actual, real, external Universe as extensively discussed in the first half of this book.

Humans would like to have a Purpose, but it is pretty clear that we *have no* deontological cosmic Purpose, one imposed on us or invented by some super-powerful being that created us *for* that purpose, or a purpose that the Universe itself holds as a *sentient intention*. That does not prevent us from *choosing our own Purpose*, still with that damned Capital that means that it is something deeper, more powerful, than identifying as our “purpose” our incidental contribution to the rate at which the entropy of the Universe increases, which is our *actual* purpose from the point of view of physics. Life in general, humans in specific, burn through the free energy stores left over from the

Big Bang much faster locally than they would ever be consumed if there were no life at all.

My own strong suggestion, repeated here as the Virtue of Right View, is to adopt as *your* Purpose, and promote as the Purpose of the human species, ***making the world itself the “heaven” that we imagine in our supernatural musings.*** After all, the whole *point* of mythical heaven is that it is a place where only “good” occurs, for *everybody* and *everything*, a place where dropped toast would always land butter side up *if* such a negative thing as dropping toast were even possible and *if* there were actual bacteria or dirt on the self-cleaning floors! Obviously, at some point the myth itself shades over into the ridiculous, but look at what we’ve accomplished so far!

This is more than enough for the *starting point* for a pragmatic virtue based ethos. Note well that it isn’t intended to be particularly complex or to tell you exactly what to do using only reason and logic when confronted by a moral dilemma, even one as modest as deciding to hit the ‘k’ key while typing the word ‘key’. Rather it is intended to be a roadmap for people who *want* to be good – if only they could figure out just what that meant – who are *frustrated* by the almost complete lack of useful guidance from religion, government, philosophy, or nature itself on how to *practically* achieve it. Telling you that killing is “wrong” as a moral principle isn’t very useful in a world where people choose to kill all of the time, including people who are killing others *on your behalf* in countries all over the world whether or not you yourself actually hold a gun. First of all, *it isn’t* a moral principle – it is a judgement that might be the *result* of a moral argument based on more fundamental ideas of what is right or wrong, good or bad, virtuous or vicious – and second of all almost *none of us* really believe it to be unconditionally wrong in the first place *using* whatever we’ve developed so far as a personal ethos²⁴!

²⁴There *may* be exceptions, of course – but it is never clear whether or not those who claim to have these sentiments as an absolute ethical axiom would survive the challenge of being faced with a choice between killing and not only being killed *themselves*, but having their children killed, their neighbors killed, having *everything they view as the good* killed along with them, as was often the real choice being made in the historical past and is all too often the real choice being made in global conflicts today. Nor is it – in my opinion – *right*, or *virtuous*, that they should stand by and not fight to defend what is right, not fight to make the world a better place, even if it requires killing of those who are perfectly happy killing *you* to *prevent* it and *preserve* their personal power, wealth, control in a unjust society.

Having the Right View the idea that our pragmatic system of virtues has a *long term goal*, one that we can easily imagine persisting as “a good” even *after* we ourselves are dead, a goal that makes it *worth it* to sacrifice the blind pursuit of our own immediate short term appetites and interests to the exclusion of all harm that sort of pursuit does to everyone and everything that is *not* ourselves, is absolutely key. Making that goal the lofty one of making not just the world, but the Universe itself “heaven” to the extent our intelligently directed ability permits it is literally the best that we can do by any sensible definition of the term “good”.

All world religions make supernatural claims for “holy” people doing things like healing the sick, casting out “devils”, making cripples stand up and walk by just concentrating awesome religious magical intention on them, no actual work or understanding of the *causes* of disease, madness, or being crippled needed. Yet our secular scientific world has advanced *through* understanding to where these “miracles” are literally everyday events. Every day medical science and bioengineering makes blind humans see, helps people with *amputated* limbs walk (something *no* religion has the temerity to claim), or even run, again, or treats some of the root causes of “madness”, which has absolutely nothing to do with “devils” in any case. We have advanced the world from one where starvation was a *Universal* risk from which *no one* was completely safe to one where – if we could just get our global ethical act together – *no one would need to go to bed hungry at night, ever again*. There is plenty of objective production, but we have plenty of leftover *political, social, and economic* problems in distribution and access to achieve the goal of ending world hunger even as we have made *enormous* strides in this direction over the last century and a half.

We have made enormous *ethical* strides as well. Clearly there could be no slavery in any imagined heaven, and recognizing this, we invented the ethical principle that *slavery was wrong* even though *almost all* of the prevailing world religions explicitly stated otherwise, even though it was a common, nearly universal, practice at the beginning. We no longer burn old women on the claim that they are “witches”. We are *working* on the ethics of *minding our own damn business* and leaving individuals *free* to choose their own gender identity within reason-directed bounds instead of, say, executing them for being gay (as still happens in far too many countries in the world, following an obscene and evil religious law).

What we lack, globally, is Right View. Directed intention to *build a better world* as our purpose by *planning*, by *using the insight that our scientific knowledge has given us* to better predict possible futures and *choose the paths most*

likely to lead to the best ones instead of just bumbling along pursuing short-term political and personal interests, unequally providing the benefits of civilization to those with the most *money*, the most *political power*, the one with the most *supporters deluded by their supernatural religious beliefs*. The impersonal Universe may not “care” about the human species or Planet Earth itself, as the entire planet is metaphorically equivalent to a *single atom* in the vast expanses of “stuff that really exists” out there, but ***I care***. Don’t ***you care?*** Wouldn’t you really, all things being equal, prefer to live in a world where things ***get better over time***, not just for the few, but for everybody, *including* yourself, *including* your family, your friends, your offspring, your neighbors, your country, all of the people in all of the countries of the world, and really, the *entire biosphere of the Earth itself*?

Right View is the *long* view, the one that does, in fact, transcend your lifetime. This has always been so. Who *do* we revere? Those that made contributions that *made life better for everybody that followed*, even after the contributor was gone, or even gone and forgotten. I can revere the inventor of fire, the inventor of the wheel, without even knowing their name, as I have benefited enormously from both.

Fill up whatever is left of that Pit of Existential Despair that you started with with this, then. A ***Purpose*** of dedicating yourself to ***living a virtuous life***, and devoting what you can willingly spare of your time and resources to ***making the Earth itself the “heaven”*** we can only dimly and imperfectly see through the *myths* of the species. Give up on “religious” certainty, and treat the problem as a *pragmatic optimization problem*, not as something to be solved by shouting ever more loudly for some political creed or supposedly “perfect” economic system or the adoption of some non-existent system of “Christian Ethics”, or “Muslim Ethics”, or “Hindu Ethics” – non-existent because *not even the promoters* of such systems can agree on what should really be there, especially when things that *are* there are instantly offensive and evil by the pragmatic ethical standards outlined above.

Part VI

Conclusion: A Global Worldview

This is really quite enough for now. In this work I've tried to provide two things: A fundamental, mathematically and axiomatically defensible definition of *what it is best to believe* about the real Universe we live on based on the totality of our life experience and the interlocking network of evidence supported, reasonably consistent, best beliefs. From this point of view, our pursuit of knowledge is never perfect or complete, but is an ongoing *process* that doesn't lead us to "Truth" with the Capital T, but simply truth, redefined to be something that is overwhelmingly the *most likely* thing to be true, given the evidence and what we 'know' in the same sense of the word so far. This epistemology and ontology is usually referred to as "the scientific worldview" and has become increasingly dominant from its invention a few hundred years ago to the present, even though the formal and mathematical underpinnings of this philosophy have somewhat *lagged* the reality.

The second purpose of my writing is that which I have just presented in considerable detail. The scientific worldview is open to the question of the existence of God or Gods (in principle it is open to *any* clearly stated hypothesis) but *we lack anything like reliable evidence* that any of the proposed deities of the world religions exist and hence they are, simply put, not best belief, even *less* worthy of belief than "believing" in the reality of magnetic monopoles, hidden dimensions, or tachyons in physics (where at least those hypotheses usually have some explicit explanatory power or follow from an actual mathematically consistent argument).

I went further and provide that the Standard Model God, an omniscient and omnipotent creator of the Universe, is *literally impossible* as the hypothesis violates principles of information theory and encoding that transcend the particular nature of the structure within which information is encoded. No being can know its own mind while *being* that mind in anything but the trivial sense of rock-knowledge. I also went beyond that and offered up a number of other, usually related, arguments against the possibility of Standard Model God, and believe that in toto, they simply close the issue as far as *reasonable* discourse is concerned, however certain that I am that they will not put an end to the *unreasonable and unsupportable* claims otherwise.

I did leave open the sole possibility that the Universe itself is "God", omniscient/omnipotent in at least the rock sense but *still* not *meaningfully*, sentiently, omniscient – making Pandeism of one flavor or another the only option for those that wish to continue to believing in a supernatural superbeing in the absence of evidence or a convincing, consistent, model.

Finally, I have offered up a short (probably inadequate) *critique* of existing ethical systems, rejecting categorically the ones broadly labelled “deontology” or “consequentialism” while leaving open the further development of virtue ethics. I then spent a fair bit of time arguing in favor of *pragmatic virtue ethics* as being the most natural epistemological equivalent of the scientific worldview. This is not ethical relativism, or utilitarianism, deontologism, or consequentialism, but is something *distinct*, something that explicitly *connects up with the science* of our decisioning process and our establishment of de facto “ethical” systems in the form of economies, social and biological science discoveries, evolutionary anthropology studies. Indeed, I have argued, it was *never possible* to construct a useful philosophy of ethics *without* those inputs from the real Universe itself, any more than philosophy managed to generate a useful philosophy of the real Universe on the basis of authority-based Ideals. The standard for “truth” I’ve established, after all, is *empirical congruence with observed reality*, not *imagined* towers of abstract argumentation carried out in a near-vacuum relative to our knowledge of, for example, how the brain actually works, “ideal” ethics expressed in high-level human language be damned!

I concluded by offering up, as a core component of pragmatic ethics, a long term, self-invented Purpose for human existence that goes beyond the minimal purpose we inherit from evolution, to seek food, shelter, sex, and a warm rock to lie on and watch out for predators (or prey!). This Purpose is congruent with and capable of taking the place of the asserted Supernatural purposes alleged without evidence or reason by the various world religions – to work in the long run towards *making the Universe a better, more hospitable place for everybody*.

In sound bite form, we all have some sort of *vision* of heaven, for better or worse. World myths and actual *stories* and our own human *experiences* teach us to avoid pain, seek love, pleasure and some deeper form of contentment, realized as a mythical place where *there is no suffering*, only the perpetual experiencing of the *highest* forms of contentment, satisfaction and pleasure. In the myths themselves, ‘heaven’ is used as a memetic “reward” granted only to believers in the “right” religion who have allowed themselves to be horrifically exploited economically, socially, politically, and scientifically by the individuals who nominally run it. Those same individuals and foundational holy scriptures usually also provide the threat of *infinite* suffering and *no pleasure at all*, to last for *eternity* as the supposedly *just* reward of those that merely *fail to believe the right thing* in the absense of evidence, consistency, and mere common sense.

We can leave the system of religious carrots and sticks in the well-deserved dust of our primitive past *at any time*, while keeping the *polarity* of the system

they invented as components of our own self-chosen Purpose – to make the one life, the one world, the one Universe that we will experience *the best one we possibly can* by our actions and choices, while *leaving it in the improved state* for our descendants. We won't be around to enjoy it, of course – we'll be dead and gone – but this goal is *ultimately consistent* with our natural inclinations as established by evolution and hence is a pretty minimal appeal to “altruism”, one that does not mandate or minimize the importance of individual struggles to live a better life *personally*, while at the same time rationally recognizing that this chance is inevitably the greatest it will ever be in a just, ethical civilization, one where *everybody* practices the self-assumed duty of living according to a reasonably common set of established *virtues* that provide guidance on how to discriminate actions on the basis of the standards of virtue, and more importantly, how to *succeed* in applying those standards in a positive way and thereby *succeed* in living a virtuous life, one leading to a minimization of personal suffering and maximization of one's potential for contentment.

Have I convinced you? Will this work actually succeed in either enabling you to change at least one component of your previous worldview – the (meta)physical, religious, or ethical – in the slightest way? Has it been, at least, entertaining and instructive for you even if it did not motivate any change per se? Only time will tell.

Time that is running out. Over the years I've been working on this book, the world's ethical basis *took giant steps backwards* as global oligarchies solidified their grip on and corrupted even the world's most successful democracies. We are actually moving *backwards* in the direction of neo-feudalism, and ancient conflicts that threatened the entire world with annihilation in my youth are springing up from their ashes to threaten us all anew. Religious extremism has reached new levels of insanity in countries all over the world, as world religions respond to the “threat” offered by secular atheism and non-toxic religious variants like the Quakers or Unitarianism as an alternative to believing the unbelievable.

Our great hope is pinned on technology, as our knowledge *continues* to advance and provide solutions for scarcity and other problems considered *impossible* to solve by the short-sighted decades or centuries ago, but technology doesn't address the *ethical* problem, nor does it convince religious people to abandon their core beliefs even when they are directly contradicted by the very science that is the basis of the technologies that they use every day. Technology builds us super-plowshares, but it also builds us super-swords – it provides no guidance regarding whether or not to modify the ongoing allocation of our enormous creative energy and access to resources to generally concentrate as much as pragmatically

possible on the *virtuous alternatives* instead of the vicious ones. This is of course particularly difficult in a world where much of the *profit* realized by the de-facto ruling oligarchy comes from the sale of *weapons* and the inflammation of antique tribal antagonisms to perpetuate their wealth, power, and and influence, entirely disproportionate to their representation as a fraction of the world's population.

Whether or not you buy my arguments, accept the axioms I propose and the worldview I endorse, please, remain aware of this problem. ***Even if*** you stubbornly choose to continue to believe in the God or Gods your parents taught you were real when you lacked the judgement to critically evaluate *all* world religions and philosophical systems on their own merits, most of those religions *do* preach one overarching ethical principle:

Peace On Earth

Let's hear a resounding Amen, at least to that.

After all, what *would* Jesus, Allah, Krishna, do?

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