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The Practicality of Statistics: Why Money as Expected Value Does Not Make Statistics Practical

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CLAREMONT MCKENNA COLLEGE

The Practicality of Statistics:

Why Money as Expected Value Does Not Make Statistics Practical

SUBMITTED TO

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FOR

Senior Thesis

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Introduction

Uncertainty is an incredibly broad concept that holds clout in the insecurities of both academics and the layman because of its prima facie nature. That is to say that by default, prior to experience, prior to logic, prior to history, some things are necessarily uncertain. Uncertainty can exist on all planes of human understanding. All practices that purport to interact with knowledge have “answers” to uncertainty at various levels. Knowledge serves to supplant uncertainty. The uncertainty of location, the uncertainty of morality, the uncertainty of knowledge are all forms of uncertainty that philosophy as well as other academic subjects try to impose upon. This thesis will mainly explore the uncertainty of empirical prediction.

Predictions are an interesting philosophical concept because their empirical nature makes them difficult to turn into sound arguments. Empirical uncertainty is a deep level of uncertainty. I say “level” because there are many premises that we need to accept before exploring empirical uncertainty becomes worthwhile. If we consider external world skepticism, it becomes asinine to focus on the uncertainty of prediction, since we aren’t “certain” of what is in front of us. However, let us assume that external world skepticism is not a problem. Even if we assume that the external world exists, we can still have uncertainty around our perceptive faculties. Even if we assume that our perceptive faculties are pristine, we can worry that empirical objects that are purported to be related to “one” concept have actually have a relation to that concept. That is to say that one apple shares properties with another “purported” apple. Even when we create empirical models of understanding predictions, there are many assumptions we make in order to make our data practical. Empirical prediction is a bizarre idealism that has various underpinnings that need to be accepted in

order to be useful. But if the importance of a prediction is not in its idealistic “soundness” then perhaps these worries are not incredibly important.

What is a prediction? It is a claim about what an individual believes will happen in the world or within themselves. A man exclaiming that an elephant will fall out of the sky is making a prediction. Predictions may or may not have reasons behind them. Predictions are of particular importance to individuals because they provide a level of stability that makes day-to-day life (conceivably) rational. If we have no faculty of prediction it seems almost impossible for us to justify the rationale behind our actions. Depending on how seriously you take the volitions and desires of individuals, when people do not have what they want, they act in order to attain what they want. However, saying that these actions have a motivation in relation to these desires depends on what you think these actions will accomplish. This only makes sense if they have some conception of how their actions relate to the causal chain that might push them closer to their hopes and desires. If you do not understand what levers move certain objects, life quickly becoming overwhelming. From a philosophical perspective, although the idealism of predictions is murky, predictions have a practical weight that makes them worth looking at.

If we are examining predictions from a “practical” perspective, it becomes worthwhile to talk about how the predictions of individuals interact with people’s notions of “practicality.” Although it is difficult to imagine a person who does not care about prediction, the existence of uncertainty does not necessitate being affected by it. It is not readily obvious that there are appropriate or inappropriate ways of dealing with uncertainty. Some may become mired in uncertainty, unable to muster the confidence to act, in fear of ruining their chances of achieving happiness. Some may want to try and have their predictions consummated into the world. And some may not particularly care about how the causal chain plays out. If all of these people care about their volitions, then how do we explain this third person? It is possible that some will not

particularly care about the workings of the external world and instead prefer to act within it, that is to say some people live in “the moment”, or have faith (with whatever complexities constitute that faith) that their actions will lead to their desired results.

Just because we do not understand the causal chain does not mean we do not act within it. I am careful not to have my argument rely on how people live their lives. However, I believe that these examples help us remove ourselves from the necessary practicality of prediction. This is a rhetorical tactic, in context of the thesis; I believe it is important to understand that there are alternatives to the examined life. If the idealism of prediction is shot, then its rhetorical force might be because of its practical importance in our everyday lives. Even if we abandon the idea that the assumptions we need to accept to speak about predictions undermine sophisticated models of prediction, we can still question the importance of “practicality” in our everyday lives. Although prediction might be necessary in order to live, a “sophisticated” model of prediction is not necessary in order to live. The unexamined life does exist. And if the only reason we believe in sophisticated models of prediction is because of their importance in everyday life, that seems to be the same as an unexamined life. I don’t believe there is anything wrong with that, but perhaps rhetorically, some take more offense to that “unexamined life” than I do.

So what is an action with an incomplete understanding of how it interacts with the causal chain? The answer, of course, is faith. The more secular might (facetiously) call it confidence. Confidence is the sort of euphemism that people use when they want to give off the impression that they correctly valued uncertainty. Ultimately, when it comes to empirical matters, confidence and faith are the same thing.

One might worry that I am stating the obvious. More importantly, one might see an unfair religious connotation to my language. One might respond that the value we put into our predictions isn’t faith based. If you are granting the assumptions of the method of prediction, based on the

model of prediction these are the expected outcomes. That isn't faith, that is merely conducting valid argumentation with uncertain premises.

The reason why prediction is not merely argumentation with uncertain premises is because although we might have a well-reasoned model for valuing uncertainty (which is to say we accept all the premises of our model of valuing uncertainty), the value we place on that uncertainty, i.e. the output of the model, has its *practical value* entirely rooted in faith. Even if we say that the value of our model is in its practical worth, if even the *value* of the *concept* of the output of the model is rooted in faith, then the entire thing is based on faith, even if we take those assumptions.

But let us not start off assuming that the output of the model is based in faith. Let us instead say that confidence comes from a well-reasoned model of the uncertainty that prevents confidence from being certainty. I use this verbose definition because there is something essential to realize about the nature of prediction: it becomes entirely asinine without uncertainty. A prediction without uncertainty is by definition a certainty; it becomes redundant to speak of the obvious, and thus the prediction ceases to be a prediction. Thus, a "well-reasoned" model of prediction cannot eliminate uncertainty, or else it ceases to become a model of prediction, and becomes prophecy. Instead, a "well-reasoned" model of prediction most accurately values uncertainty and allows us to be confident in a reasonable range of outcomes: an interval of confidence, if you will.

The most fundamentally agreed upon model of uncertainty is the concept of statistics. Statistics is fundamentally agreeable because it provides a mathematically derived model to quantitatively value uncertainty. The reason we provide value to these quantitative metrics is because it becomes readily obvious that if we use another concept to value uncertainty, one with qualitative worth, we can see why our model of prediction is biased. This isn't to say it isn't reasoned, there could be a reason. For example: say I saw three doves flying southwest and thus predicted the Superbowl. For whatever reason, this is commonly viewed as "not well reasoned" (at

least on its own). The value of our prediction depends on the connection between doves flying and the outcome of a football game. We don't think that these concepts are empirically related.

Numbers by definition are related to each other, and if we can turn our data into numbers, our data will be related in concept. It is in this calculus that we can derive relationships between data points and hopefully arrive at some idea of what the world around us is like. Since statistics provides these numbers, if we have those numbers all that is left to do is to translate these numbers into predictions.

However, most have long since abandoned the notion that a "reasoned" model of prediction is infallible, that it doesn't have assumptions hidden within it. Instead, the "weak" form that most people take to mean "rationality" or "reason" is synonymous with practicality. That given certain assumptions statistics can tell us not only what we should expect in the world, but also about what it is we consider valuable. And in that sense, it is a well-reasoned practicality.

We can call this well-reasoned practicality, probability. Probability is a human concept that aims to make sense of the concept of uncertainty. It is an uncomfortable concept that tries to remain relevant in the face of uncertainty. It necessitates an uncertainty to be important but also necessitates a certainty so that it is distinct from the general uncertainty that anyone else might encounter in life. Without going too deeply into the content of the thesis, a probability by itself is simply a number. Even if we could somehow derive that an event had an 80% chance of occurring what do we make of this 20% chance of the event not occurring? Without some manner of valuing that uncertainty, interacting it with a practical subject, there is still a chance of your prediction being wrong, and without some way of valuing 20% as being less than 80% it certainly doesn't make a prediction more "rational." Out of 100 tries 80 will have the event occur, but that says nothing of what the result of the next try will be. At best we come up with an expectation.

But just because we have a mathematical model that is unbiased doesn't mean that our expectations describe the real world. Statistics, even if you assume that the assumptions of statistics are right, ultimately cannot say anything about the outside world, because their method of interacting with the outside world, (a probability) ultimately becomes an expected value, not a description of what most likely *should* have happened into the world.

Confidence without reason supporting it is nothing but faith. And that is the ultimate "goal" of the thesis. To show how the foundation of the only prayer of a reasoned model of prediction, i.e. statistics, ultimately relies on faith, and this is a sort of spoiler, this is not the sort of faith that most religions and philosophical arguments rely on, but a deeply traumatic sort of faith, that is, the directionless hope of expected value.

Chapter One: What is Practicality?

I take the term practical to mean "useful", in an unbiased sense, in relation to something an individual cares about in the exterior world.¹ Although individuals have subjective preferences, i.e. what they care about is subjective, for our model of prediction to be practical, in relation to these preferences we must be able to make unbiased inferences about the world. Given that we care about the object in question, our method of prediction gives us unbiased information about it. I assert this two-pronged definition because we have two worries about our model of prediction.

First, we can make unfounded assumptions about any prediction, and consider it unbiased as far as it doesn't relate to objects in the exterior world that we care about. E.g. Premise one, all cats are red; premise two the object is a cat, conclusion the cat is red. This is unbiased if we simply view it as a logical argument, but the moment we consider it a claim on the "exterior" world, i.e. the things we care about in prediction, it becomes an unfounded claim because we don't have the data

¹ I use "exterior" as opposed to "physical" because there are also "mental" predictions, e.g. an epistemic hypotheses.

to support it. This aspect of our definition of practicality ensures that if the model can't say something about the predictions we care about, it isn't "practical." For this definition of practicality, I assume we care about predictions in the exterior world as opposed to wanting a theory of prediction with valid premises that don't relate to the exterior world. This is to ensure that we don't have objections of the sort that "statistics" doesn't claim to be "practical", although that might be valid I am after this definition of practicality as it relates to uncertainty.

Second, if we do care about what our model of prediction is talking about, i.e. it interacts with the exterior world, we have to make sure the inferences we derive from it are "unbiased" otherwise our model of prediction is merely faith based. We can create a valid model of prediction about the things we care about, and it might be valid, but if the value of the output of our prediction is faith based then our model of prediction is faith based. This two-pronged definition introduces what will end up being the main problem with statistics. The moment we talk about something we care about, i.e. the exterior world, all of our statistical models will fail to relate to it, because the outputs of our model are incoherent as they relate to the exterior world.

This subjectivity does introduce a worry about personal versus objective practicality. In short this isn't a concern when discussing the practicality of prediction. In so far as there is some principled reason (not reliant on faith) that a probability gives me some information about the world, it can be viewed as conceivably practical. The thesis does not undermine practicality for "certain pursuits". It wants to show that the entire system of prediction requires faith to be relevant. Whether the output of a statistical model is "objectively" important or "subjectively" important, the practicality will depend on faith. This isn't to say faith claims are unimportant. It simply is inappropriate to call unfounded "guesses" practical because they don't provide use above any other prediction.

I believe it would be most useful to talk about what could make a prediction practical. A prediction is simply a guess (hopefully educated) as to what will occur at a given future moment in time. However a simple guess without any “support” (ultimately a faith claim) simply amounts to a “useless” combination of words. If we forget that these words might provide us comfort, like a prayer, these words bear no “relation” to the world and thus aren’t “practical.” Even if our predictions come from a reasonable model of prediction, for these predictions to be “practical” they have to have some relation to the exterior world. In order to achieve such a relation, we make our predictions about things that individuals conceivably value. If our prediction has some relation to the things we value we can say that the prediction begins to have value. Because our predictions tell us about what it is we desire, our predictions serve as a tool to help us achieve our desires, and as such can be considered “practical.” Statistics, as a method of prediction, is practical because it gives us numerical probabilities that can be interacted with the things we care about.

Even if we assume that statistics provides an un-biased and well-reasoned measure of uncertainty, we still need some manner of making a probability “practical.” It should be noted that practicality can only have worth to an individual who does not yet have what it is he desires. I care about things being practical because they have some relation to what it is I value. If I already have what it is I desire, although a well-reasoned prediction might be about a tool that helps me achieve what I desire, it would no longer be of use to me. We can imagine a sort of intellectual empathy that makes all well-reasoned predictions “practical” to a conceivable person. But that sort of empathy is still imagining that a person cared about the object that the prediction is supposed to be about. Just because something is practical doesn’t mean it is important or even something I prefer. This connection to importance and preference is only possible because there is something about what it is we want that makes a particular prediction practical. In some ways, this is a long-winded way of stating the obvious, what it is that I find valuable is relative to my preferences.

Using our model of statistics, assuming we have the correct data, we can derive many predictions. But, only the ones I care about are the ones that are practical (to me). This introduces into our model of prediction a relativism that might be very uncomfortable for what our model of prediction is trying to be. Luckily, statistics has a set of assumptions that make it so that given certain properties of data our model of prediction will be unbiased, and thus “correctly” values uncertainty. The data we use has some relation to the world around us that helps us understand how uncertainty might manifest itself. Thus, although the importance of statistics is subjective, the relationship between data and the outside world that we care about (under the assumptions of statistics) is not mind dependent.

Although the relationship between data and the real world isn't mind dependent, because personal importance must pass through human subjectivity, we can question how to interpret the predictions statistics gives us. A model of prediction must have uncertainty or else it ceases to become prediction. Thus, these models value uncertainty or provide some prediction upon it. All predictions must have some likelihood that is less than necessarily happening. Even if we somehow arrive at a 99% certainty that an event will occur, that 1% uncertainty leaves open to interpretation how we should value it. (if we forget expected value as to not jump the gun) There is no particular reason why we cannot value that 1% uncertainty as much more dire than the 99% certainty. Even the interpretation of the output of statistics is mind dependent. Even if the output is mind independent, if the output's worth is mind dependent, then statistics has no way of imposing its practicality since we have no real reason why the necessary uncertainty can't undermine the “predictive value”. That is, even if they value what statistics is talking about, if they are too scared of uncertainty statistics might not have value.

For statistics to be practical, it will need some manner of discounting these sorts of personalities. That is to say it needs a way of saying that these are “irrational” individuals who are

not correctly valuing risk. The concept of value is a strange one since it has weird connotations of importance that a theory of prediction cannot have or else it is biased. Thus, by “value” statistics means some manner of quantifying risk through some sort of unbiased estimator, our best guess is some pure quantitative measure that doesn’t rely on the “value” of a concept. A number has the value of the number it is supposed to represent. This is why statistics is a mathematical theory of prediction and not a qualitative one.

But if numbers are just numbers, how could they possibly have any connection to the real world? Just because someone tells you that there is an 80% probability of something occurring doesn’t mean that that is something that can be easily translatable to practicality. The way that the numbers speak about the world is through interacting with objects that we care about. I begin to care about the words 80% because there is an 80% chance that I will get that job I really wanted. Because I care about employment I care about the probability that is related to it.

Even if our probabilities are related to things we care about, an 80% chance of being employed, that fact alone doesn’t mean they relate to me in any practical sense. Even if we can interpret our probabilities in a manner such as out of 100 tries I will be successful 80 times, that “fact” doesn’t really mean anything to me in this moment. This is because we don’t know which “try” is the one where I will be successful. For 80% to be practical for me, it needs some manner of interacting with either my expectations of what it is I value or it is somehow predictive of what it is should happen. Either way we can begin to understand that a probability is a measure of uncertainty, not of certainty, that is to say that our statistics are really grasping with the concept of risk.

We have established that risk is our measure of uncertainty that we need to quantify in order for our measure of prediction to be unbiased. It should be noted that merely saying that there is a 20% chance that you will fail doesn’t imply a measure of risk. The event might have a 20% chance

of not happening but the effects of that non-event could be catastrophic. Say a bomb has an 80% chance of giving you an ice cream cone and a 20% chance of destroying half of the continental United States. Furthermore we might be worried that my own fears of change might undermine what otherwise might be a “smart” decision. Imagine a 20% chance that I could hurt my parent’s feelings whilst a 80% chance that I find true happiness. In order for risk to be unbiased as well as practical, it will need to be about an object we care about as well as be quantifiable.

Another way to look at a 80% probability is .8. If we have 100 tries at an object we can imagine that applying our probability we can expect 80 of that object. Although our one try doesn’t mean much, we can expect that using 100 tries we can get 80 results that we want. This is where we get our concept of expected value. The next question we can ask is whether this expected value is what the world should look like given our data, or if it is an expectation of what we can predict the world to look like based on our data. Before we can understand how probabilities interact with nature, we need to look at what the nature of things might look at.

Laws of Nature

Before we can discuss the expected value of our predictions, we have to understand what data is supposed to be, or what it is supposed to represent about the world. In order to do this we should look at the underlying assumptions that make a given dataset a reflection of what the world might look like. For statistical analysis to be relevant, data needs to have some connection with what it is trying to represent. There needs to be some form that they represent. Otherwise, all data would be iconoclastic and it would not matter how many data points we collected since they can’t give a coherent hypothesis, because they don’t relate to the same thing. The fundamental property that data must have is that they must somehow relate to a *population* we are trying to analyze. The only way data can have such a relation is if there is some nature, that we are not privy to, that in

some sense determines the data we might find in the future. In order for statistics to be relevant, it must somehow help us understand the given *nature* that determines whether data can connect to other things. I am not privy to any methods of determining nature definitively; so if data does have a particular connection to the nature that is supposed to represent it, finding relevant data would make it more likely that a given hypothesis on this nature is right or wrong. Ultimately, the disconnect between “data” and the nature (nature determining the exterior world) it is supposed to represent, will be a fatal blow to the unbiasedness when we use our statistical model of prediction. This will be more obvious with physical probability but will also be the case with epistemic probability.

What can nature look like? A nature is how things of a given sort appear/are in the world. Things can become easily convoluted if we try and understand questions like what is a man? Instead, let us talk about what nature means in a statistical sense. Since statistics predicates itself on prediction, then it is giving an accurate weighting of the likelihood of an event to occur. The sort of nature we are talking about determines how data appear in the world, and this is a strict determinism. The laws that govern a particular nature are what statistics, in an idealistic sense, strives for.

Our laws of nature need to be idealistic. Otherwise, they do not mean anything. By “idealistic”, I mean that by whatever definition defines them, the objects described by that law must follow that definition perfectly. The law defines some aspect of the object in question. If we understand the law of nature as it relates to a particular object we can predict qualities about that object based on the law of nature. Any perceived ambiguities would arise because we do not understand the “complete” law. I use the word idealistic as opposed to “completely true” because depending on what we imagine a law of nature to be, “completely true” is not powerful enough to describe our laws of nature.

If we posit a “law of nature” that says something like “8 out of 10 cats are red” we can imagine the “law” to be completely true but not idealistic. This “law” may be completely true; out of the 1000 cats ever seen, 800 were red. However, this law of nature is not idealistic because it does not define the object the law is about. If we see one cat, we will not be able to tell if it is red or not based on this “law of nature.” We might try to make the law about one cat by reducing the law to “.8 cats are red.” However, .8 of a cat is not an object that can be described coherently since .8 of a cat cannot exist. This “law” is a description that might be completely true, but cannot be idealistic. Because it cannot tell us what one cat will be it is merely a description of cats.

If we insist that the statement “8 out of 10 cats are red” is a law of nature, the “object” the law is describing is not the “cat” but the “number of cats.” However, the “number of cats” is not a property about cats. The idea that there are 8 cats does not tell us anything about cats. If we hold this law about numbers to be “idealistic”, it can indirectly tell us the color of a cat but not because the law is about the color of cats, but because we know something about the number of cats. For example, because we know that 8 out of 10 cats are red, and we see 9 cats, 7 of which are red, we can infer that the next cat must be red. The number of cats there can be might indirectly tell us about the property of one cat, but it is not directly about the properties of cats. If we interpret the “law of nature” in this manner we are viewing it a statement that defines the “number” of things in the universe. If we insist that we are speaking about the object “cat” itself, 8 out of 10 is an interpretation of the law of nature not the law itself. Although it might be true, our law needs to be more exact, i.e. idealistic.

As it relates to “properties”, A law of nature cannot say the words there is a 30% chance of an object having a “property” because the law is supposed to represent a certainty. To say that there is uncertainty within certainty is meaningless, it reduces to uncertainty. If we say that laws of nature are uncertain then we admit that our statistics cannot be an imposition on what should happen in the

world given data, because the world “should” be uncertain. We would necessarily be saying, based on our data, this is what we expect given some bizarre construct, although we know that the world is uncertain. A “law” of nature, if it exists, does not say there is a 30% chance that each newborn will have an extra ear. That interpretation is only our manifestation of how we deal with the uncertainty that we can never access the true determinism of these laws of nature. In some practical sense, i.e. when we are communicating with others, we pretend that the law of nature says that there is a 30% chance of growing an extra ear. However, we understand that we still need some manner of valuing this 30%. Human minds can interpret that 30% in whatever manner they believe is “practical”. But that “practicality” does not necessarily mimic the laws of nature.

So now that we know that laws of nature need to be idealistic we can see why our data will never mimic this ideology. The true ideology of nature would say something like: the next person that appears will have an extra ear, and then the one after that would have two ears, and it would determine a strict pattern for the extent that the law is supposed to determine (if we can say a law of nature can even have certain tries). Thus we can understand a law of nature as a pattern that would definitively repeat itself given the circumstances that define it, with its “variances” being explained as human ignorance as to the true form of the pattern.

The reason data can’t show us the true laws of nature is because it can’t show us the definitive structure of the pattern it is trying to represent. The main problem with patterns is that from within a pattern it is impossible to know whether our patterns are one 1 iteration of a long pattern or multiple iterations of a shorter pattern. Consider the following: A sequence of blocks denoted by the colors red (R) green (G) and blue (B), we see a sequence, denoted as RGB,RGB,RGB,RGB. We might try and understand the law of nature as RGB for every iteration, thus we might say that the pattern is RGB 4 times. Since we are not privy to the words of the laws of nature we can only know it through experience. Now let us say that we get something like RGB,

RGB,RGB,RGB,BRG. We could say that the pattern is now RGB 4 times and BRG 1 time or we could say that the pattern is RGB three times and then BRG; we could even say that the pattern is RGB,RGB, then RGB, BRG. We can extend the length of the pattern and we can understand how our limited existence does not give us limited data to ever definitively prove a law of nature. The pattern might be so long that given an incredibly long period, for billions of tries, with similar conditions, we won't get a different result. But as long as there is one different outcome at the end of that pattern, our data can't completely mimic this ideology. Because data can never tell us the true idealism of what a law of nature is, and since we only know data, it would be incoherent to speak in certainties. This is a basic argument that elucidates the pattern of induction.

Chapter Two: Epistemic and Physical Probabilities

The uncertainty necessary for relevant prediction undermines the idealism of data's connections to the laws of nature. The laws of nature we are trying to observe need to manifest themselves as patterns. On its own, data is a descriptive device. Statistics allows us to use data to have "informed beliefs." Uncertainty of the true pattern of the laws of nature limits our data. This physical idealism of data is not one that our statistics can hope to achieve. Our hypothesis is a method of valuing how likely it is that our hypothesis emulates true nature. Since this is statistics, we are trying to understand the probability that we are right or wrong. This is merely to say that statistics must have some assumption with how to deal with this uncertainty. We can now denote a difference between the relation between probability and the idealistic laws of nature. One difference can be making it more likely that we know the laws of nature and the other with how data physically represents the laws of nature. There are epistemic probabilities and there are physical probabilities.²

² Physical and Epistemic probabilities are terms commonly used to divide the types of probability. As such, these terms were taken from the Stanford Encyclopedia of Philosophy

A physical probability denotes the likelihood of an event given properties about the physical world.³ How frequently an event will occur based on its physical properties. Based on the properties of an even sided coin we might conclude that a toss of said coin would have a 50/50 chance of landing heads or tails. When we observe a less obvious example, say how often a dog is orange, if our probabilities were physical we would be understanding how often this physical property occurs. Although we can interact this probability to our minds, it does not make it an epistemic probability. Even if we could understand that 80% of dogs are orange and 20% are brown, our knowledge would be limited to that fact alone. Since a physical probability is looking at the frequency of occurrence, new data points add to the likelihood that our proposed frequency is correct. Every brown dog I see adds to the likelihood that my 80/20 split is correct or incorrect. Our hypothesis set is limited by the data we have discovered. Thus, physical probabilities are not immediately predictive claims and as such are not immediately useful since descriptions don't provide "practical" information. Even if we merely want to understand the laws of nature, due to the idealism of the laws of nature, our data wouldn't even be able to do that.

Because we understand that laws of nature need to be idealistic, and our data cannot arrive at said idealism, we can never arrive at the perfect frequency of a given class. If our probabilities are supposed to denote the frequency of events occurring, our analysis will always be flawed. We will at best merely be describing what it is we have already discovered. When we apply this physical probability to decision making we see where it falls apart.

A rational agent who cares about practicality cares about the ability of prediction, and since prediction is a forward thinking vehicle, he/she needs the probability of the events he/she cares about in order for this probability to be useful. Even if we have a perfect dataset it would only give him/her the physical frequencies of a physical event. Confronted with a decision in front of him,

³ Romeijn, Jan-Willem, "Philosophy of Statistics", The Stanford Encyclopedia of Philosophy (Fall 2014 Edition), Edward N. Zalta (ed.), <http://plato.stanford.edu/archives/win2014/entries/statistics/> (accessed November 29, 2014)

he/she would arrive at a number between 0 and 1 of the likelihood of the physical event having said properties. Since he/she thinks probabilities are physical in nature, and probability can only give him probabilities between 0 and 1, applying those to physical things quickly makes the notion of “using physical statistics” incoherent. A physical event either happens or doesn’t happen. A .8 event is incoherent when we imagine a physical event. Even if we are talking about a hypothesis on what will happen next, the frequency of our hypothesis does not give us useful information as to whether or not it is correct. Even if we defined useful as knowing the frequencies of the laws of nature, the same worry would occur if our probabilities were physical. We know that our data cannot perfectly represent the laws of nature, meaning that knowing a frequency does not lend us closer to practicality. Although an individual can use this prediction, because what the prediction yields an incoherent physical event, our second idea of practicality, how an unbiased agent would use it, is not fulfilled.

Epistemic Probability

An epistemic probability would denote what we can “unbiasedly” *believe* from the data that we witness. We develop a hypothesis and use our data to arrive at a conclusion as to whether the hypothesis is right or wrong. In other words, we use our data to help us determine what we can believe about the world. If we are adapting this view towards practicality, it represents what an unbiased person would believe about the world given data. That is what our unbiased measure of uncertainty would be trying to understand. Our hypothesis says something like I believe x to be true based on the data. Although the content of our hypothesis can only be right or wrong, since we are concerned with a belief on how likely it is that we are right, the 0 or 1 nature of this hypothesis does not immediately nullify its usefulness. If what we are looking for is truth or falsity, a likelihood gives us some hope for decision making.

Having said that, it does not become readily apparent how the likelihood of us being right is useful to an individual. If what I care about is a particular event, knowledge of how I might be right about the event is not exactly what I am looking for. Being 80% likely to be right about the treasure being in a particular location does not obviously translate into usefulness. We run into the same problem as physical probability. Without a method to value this certainty or uncertainty, for my next trial, besides a feeling of confidence (which is faith based if 80% doesn't represent the exterior world), the information isn't useful to me. In order to crystalize how we might turn this 80% certainty into useable information, we have to understand what an epistemic probability represents.

If probability is of an epistemic nature, and we are trying to establish its practicality, then it relates to some knowledge about what it is I care about. Thus we might believe that probability has two methods of interacting with our knowledge base. We can imagine doxastic attitudes for our probability. I.e. what an unbiased agent would have as an opinion based on the data presented to him/her.⁴ In this case probability represents an "appropriate" (based on the model of uncertainty) degree of belief. We might also imagine probability having a decision-theoretic influence, given our knowledge base.⁵ This would mean that probability represents a willingness to bet on a certain outcome.⁶

Ultimately, I believe that the view of epistemic probability that has the most hope of being "practical" is a combination of decision theoretic and doxastic probability. If we take a purely doxastic view of probability the "educated" opinion we derive wouldn't be the object of desire we want to consider "practical". The doxastic view might tell us what would be "most" rational to

⁴ Ibid.

⁵ Ibid.

⁶ The terms doxastic and decision theoretic also are common ways of denoting epistemic probabilities and are taken from the Stanford Encyclopedia of Philosophy entry on statistics.

believe but that belief isn't what we want from practicality. Because this view is a level removed from our objects of interest it can't be viewed as purely practical.

A purely decision-theoretic view of probability has too much subjectivity, with its probabilities to call "practical". The reason why this subjectivity undermines "practicality" is because by "practicality" we want to arrive at an idea of what an unbiased agent would find practical. A biased agent making decisions based on "subjective" interpretations of data reduces to an unwarranted confidence, which could be deemed faith. If our measure of practicality rests on biased human preferences, then anything can be practical in so far as it has to do with an individual's preferences. The question of whether statistics is practical becomes asinine, because anything can be practical if we use biased interpretations of our surroundings. Furthermore if our statistics relate to data which relate to laws of nature, if we interpret our data "biasedly" then we will make "wrong" decisions about the situations we care about. Although uncertainty makes it so that we always have a chance of being right, this view of practicality automatically reduces our probabilities to faith. If we don't have this objectivity as to what a "practical" agent would do, then although our system of valuing uncertainty uses numbers, anything can be practical if it helps an individual makes a decision.

If the problem with a purely decision theoretic view of probability is human subjectivity, then combining it with a doxastic view gives us what we want from our idea of practicality. Although human subjectivity might enter this decision-making based on risk preferences, by combining doxastic attitudes with this decision theoretic use of probability we can arrive at what a "rational" agent should bet on a given prediction, given certain data. Although we might make "wrong" decisions based on human subjectivity, our probabilities would represent practicality. Based on the data there is a correct decision that is "most" practical based on what we are given. Our data has a chance of representing what it is we can expect to happen.

So how do we interpret this doxastic/decision theoretic view of probability? I propose that there are two ways to do this. One way would be to have some expected value of an event which would determine how much we should bet on an outcome, given its measures of uncertainty. The decision-theoretic portion would allow us to posit a certain decision that we care about and the doxastic portion would tell us what the consequences (in an numerical sense) are of what we might expect to be given our data. A rational agent could thus use this expected value to make “rational” decisions. I am going to call this the expected value doxastic/decision theoretic view.

Another way would be to think that the doxastic portion of our probability would be an opinion on what we can expect about the world, given our data. Based on our data, the world should look like “this”, and because of that, we can make rational decisions about it using our statistical interpretation. Our notion of practicality is not one that depends on the value of our expectations but one that is objective, based on the data. This view says something like: “this is what the world *should* look like”. Let’s call this the expected world doxastic/decision-theoretic view.

The difference between the two is subtle. The expected value doxastic/decision theoretic view gives us a probability based on our data, which we later interact with our decisions to create an expected value. Our expected world doxastic/decision theoretic view gives us a probability based on our data, which represents what we can expect from the world. When we interact this probability with our decisions, we get an objective view of the world regardless of what the worth of our expected value is. The expected world theory would use probabilities that would represent what we can expect about the world, to make decisions that are “rational” in relation to this expectation. This is as opposed to the expected value view of probability which determines rationality and thus practicality in relation to what we posit the value of the outcome to be (in accordance to the expected value theory).

Why the Expected World Theory of Value doesn't Work

Expecting the world is a bizarre thing to say when it comes to probability. As we have already derived, for probabilities to be meaningful, they need to have some relation to idealistic laws of nature. Although epistemic possibilities are not about physical objects, if they relate to physical possibilities we can still relate our knowledge base to the “actualities” of the world around us. If our epistemic theory is meant to give us some knowledge about the world, then when a probability interacts with a particular hypothesis it should come up with a coherent outcome. If I wanted to figure out the likelihood of an earthquake happening, let us give it a probability of 75%, it would not make sense to say that I believe that an earthquake .75 happened. When we interact our expected world doxastic/decision theoretic view to a given hypothesis, we understand that as a piece of knowledge the outcome isn't completely coherent. This information is not sufficient to make a decision. It is not coherent to expect an event to .75 happen.

But surely processes have different stages to their development. So perhaps in some sense an earthquake can .75 happen. Tectonic plates or whatever relevant empirical phenomena cause noticeable earth shivers at a distance of movement of 300 feet. If our probability tells us that the earthquake has a 75% chance of happening perhaps we can interpret that as, we can expect the world to move the tectonic plates such that it corresponds to a “.75” earthquake. Since an “earthquake” occurs at 300 feet of movement, we can expect a world where the plates move 75% of that distance. The earthquake .75 happens in the sense that we can expect the plates to move 225 feet. It certainly seems coherent that since our probability defines an event happening, although that binary event can't .75 happen, the processes that lead up to that binary event can be 75% complete.

Process Objection

The problem with viewing our probability as the likelihood that a process will be complete is that it assumes that the steps of these processes aren't binary events. If we say that the likelihood that an earthquake will happen is 75%; we are saying that the product of the probabilities of each step in the process happening will give us a number that is equal to 75%. This is an important distinction because in actuality, we are imagining the probabilities that each step in the process happens and calculating them. Under this scenario, each event is a binary event of either yes or no that has a probability between 0 and 1 of happening. For the same reason that it is incoherent to imagine an binary object 95% happening each step in the process is incoherent for our mind to process. Even if we sum all of these, because each mechanism is incoherent to expect to 95% happen the "75% of the process" is a construct of the mind that under closer examination doesn't make sense. And although we can use it for decision making it is not unbiased by any stretch of the imagination. So why do processes have to work this way, why can't the whole thing be imagined to happen at once as a 75% object?

This has to do with the assumptions we have made in order for our probabilities to be coherent. We have two scenarios: our probabilities describe events that have deterministic causes or somehow our probabilities measure events spawning from the ether. In the first case, in so far as we have uncertainty, we can imagine a process as a domino effect of causal links. Each domino has a probability of less than 1 of falling. Each domino would cause the next step creating the deterministic links that allow an event to happen. Thus we run into the same problem of imagining a .75 event.

If our processes are simply "links" (each with a probability of less than 1 of occurring) that spawn from the ether, each link still falls under the same problem when we try and conceive of expecting it in the world. If the whole "process" happens at once, with no intermediate steps, then

we have the original problem and we can no longer imagine it being 75% complete. This has ramifications when we imagine more mechanical processes that produce multiple things at once. The likelihood of the process occurring is the sum total of the variances of each cog turning. Cog can be substituted for any link in the process. If one process makes 100 barrels of corn, we cannot take our probability and expect 75 barrels of corn. Any mechanistic event, if it can be understood by one of these two scenarios, still won't allow us to "expect" the world.

Multiple Tries

Another way of trying to salvage the expected world thesis is to take our probability and conduct enough trials that we can start to see a coherent expected world. For example, let us imagine a process that is supposed to produce enough force to break a hole in a wall. Let us imagine that it is made of a piston that has a variety of gears that responds to a press of a button and punches the wall. If we imagine that there is variance within this process we can imagine that there is a likelihood that the wall will not break when the piston hits the wall. Based on our trials, we imagine a probability of .75 for a hole to break through the wall. As we have outlined before: off one trial, it is incoherent within our mind that the wall will .75 break. Even if we imagine it as a process, the wall continually deteriorating, it still isn't a coherent idea, when we reconcile it with how the world works (i.e. how nature performs, how the laws of nature work). But perhaps by conducting our process 100 times when we look at the end result of our trials we can expect 75 walls to be broken. This makes sense, .75 probability by 100 tries, we can expect 75 walls to actually be broken. However, similar to our objection to the process method of understanding the expected world thesis, each of these trials is still a binary event. The likelihood of each wall breaking is 75%. Each wall cannot .75 break. It takes a construct of the mind to meld these 100 trials together into a coherent picture of 75 broken walls. It is still incoherent to imagine a binary event .75 happening.

But there is something to be said for taking our probabilities and interacting them with multiple tries. The concepts that we are playing with seem to logically follow. We can make these interactions make more sense when we imagine them as values as opposed to events. Instead of imagining an epistemic idea of the world, if we imagine an epistemic idea of the value of the world there is no reason why it is incoherent to imagine the value of the earthquake.

While it is incoherent to imagine a binary event .75 happening, the combination of trials can be representative of some idea. What that idea means to me i.e. the value is still open. We can imagine an appropriate idea based on the interaction between probability and reality. If what we mean by epistemic is what a rational person would expect the value to be based on data and statistics, it doesn't matter if the world can't be in such a way; we are only looking for a "reasonable" inference. If what we mean by "epistemic" is the value of the interaction between probability and reality, we still have a hope. This is the expected value doxastic/decision theoretic probability theory.

Chapter Three: Expected Value in Frequentist and Bayesian Statistics

What this ultimately means is that we are trying to rationalize some "impression" from the data. Although the world can't mimic our data, and we can't expect the world to look like the data, if we examine the premises of our statistics we can understand what an expected value is. Ultimately, because this epistemic view takes probability to have a "proper" interpretation, but not one about the exterior object in question but about the belief about that exterior object. This implies that our expected value is a bet of sorts. It is a bet on the likelihood of our belief being correct as well as the value of the decision we make based on it. Our impression from the data is ultimately turned into beliefs about the world. We can call these beliefs hypotheses, and use them in decision making. But should we be using our data to eliminate our hypothesis or should we assume some

likelihood of our hypothesis and see how data changes that likelihood? Ultimately both of these questions are trying to discover the likelihood of our hypotheses, and ultimately under both conceptions, we will need some notion of a value that determines whether our hypotheses are likely or not. There is always a chance that our likelihood is incorrect. Our belief in our likelihood of rejection thus needs a “meta” notion of value that comes from somewhere. “Somewhere” will depend on what it is an individual considers to be a worthy bet. A worthy bet, entirely depends on a subjective notion of what a thing is worth. This will violate our second notion of practicality, the unbiased inferences we can make from our valid model of prediction.

Before we can understand what underlies the expected value of a hypothesis, we should try to understand the different views that hypothesis testing can take. The two most popular views are Frequentist interpretations of statistics and Bayesian interpretations of statistics. Both these interpretations will operate under the assumption of a doxastic-decision theoretic view of probability and will explore what a “hypothesis” means under these interpretations of hypothesis testing.

Frequentist and Bayesian Statistics

Both Frequentist statistics and Bayesian statistics care about the notion of valuing hypotheses. Under the Frequentist framework, sample spaces (data) can be explained by a particular hypothesis. Necessarily the hypothesis cannot explain all of the data or else it would be a certainty. Frequentist statistics calculates how frequently our hypothesis explains the data and assigns some probability to that notion. We thus take our data to be “real”, i.e. have some a-priori worth, and imagine our hypothesis to be conceivably fallible. By contrast, Bayesian frameworks take our hypothesis to have some a-priori worth, and try to test its likelihood by imagining the data as fallible. We thus take our hypothesis to have a-priori worth. The data interacts with our hypothesis in order to make it more or less likely.

Under Frequentist interpretations, variances from expectation occur because we do not have a perfect hypothesis that can explain all the data. Under Bayesian interpretations, variance occurs because we don't have all the relevant data that would make our hypotheses true. As it relates to practicality the Frequentist framework fails because even if we had a hypothesis that explained all the data, we can never acquire enough data to make our hypothesis practically relevant (i.e. can be used again to make predictions). Bayesian statistics fails because our ultimate decision, based on expected value, depends on the value of what we are wagering. Because all data is "fallible" under the Bayesian framework, we can never completely remove a hypothesis' mere possibility. Ultimately, this becomes a bet that our hypothesis is right given the data, and bets depend on subjective value.

Frequentist Statistics' Hypothesis Testing

In order to understand a hypothesis' frequency we need to have some method of testing our hypothesis with our data. We can imagine that a hypothesis has a probability between 0 and 1. I am going to present a function and we will see how it can be interpreted through the Frequentist framework.⁷

$$F(s) = \begin{cases} 1 & \text{if } Ph(s) < r, \\ 0 & \text{otherwise}^8 \end{cases}$$

Since our hypothesis (H) is one that relates to cognitive belief and ultimately decision making, we can use data to value the likelihood that our hypothesis is a "reasonable" cognitive belief. I.e. what is the likelihood of (H) given our sample data. We have sample data, which is necessarily finite, which we can call (s). Under Frequentist frameworks, (H)'s likelihood is an idea

⁷ The following chapter uses commonly accepted formulas, they are taken from the entry on the Philosophy of Statistics in the Stanford Encyclopedia of Philosophy

⁸Romeijn, Jan-Willem, "Philosophy of Statistics", The Stanford Encyclopedia of Philosophy (Fall 2014 Edition), Edward N. Zalta (ed.), <http://plato.stanford.edu/archives/win2014/entries/statistics/> (accessed November 29, 2014)

of how often we can reasonably imagine an event to occur in the world. In that sense given our collecting of a sample from a sample set multiple times, (H) is a hypothesis on the distribution of the data. This is because the Frequentist framework assumes that our data is real and our hypothesis describes the frequency with which it will occur. (H) explains some portion of the data, since it necessarily can't explain all of the data. This "distribution" that explains some portion of the data we can call $P(h)$. We can define a function (F) on the sample space that helps us understand when we might think that our hypothesis (H) is too unlikely, which is to say we reject (R) our hypothesis. If $F(s)$ is 1 then we reject our hypothesis (H) .

Some function that will yield us a 1 (yes) or a 0 (no), values the probability that our hypothesis (H) is true given our sample (s) i.e. $Ph(s) < r$. The probability P (i.e. numerical probability) of our hypothesis (H) being true given our sample (s) i.e. $Ph(s)$. That probability is then compared to an " r " that determines our "criteria" for rejection. If $Ph(s)$ is less than R then the $F(s)$ function will output 1, i.e. reject the hypothesis. If the probability of our hypothesis given our sample i.e. $Ph(s)$ is greater than r then it will output 0 meaning we won't reject it. If the probability of the hypothesis given our data is less than the value we have ascribed to be worthy of rejecting the hypothesis, then we will reject it. Although it might be possible that the hypothesis is right even with $F(s)$ outputting a value of 1, if a rational agent agrees upon a value of r then he "should" reject the hypothesis. This is very obviously dependent on what the value of r is. And that in itself is subjective to a person's risk preferences.

Under Frequentist interpretations, hypotheses are distributions that try and explain the "real" data, thus rationality as it relates to the correct rejection value " r " has to do with the likelihood that a given hypothesis' distribution relates to the data. A hypothesis can't explain all the data available, this forms a distribution of prediction and data that lies outside of that realm of prediction is something that Frequentist statistics will have to account for. We try and find a best fit of a

distribution around the data. Ultimately, our decision making has to do with whether we accept or reject the hypothesis i.e. our “r” value. Because we can’t be certain that our hypothesis is right since we don’t have all the data that will ever be available to us (by definition of uncertainty), we always have the risk of two particular mistakes.

These errors are called Type 1 errors and Type 2 errors.⁹ The Type 1 error is the probability that we rejected the right hypothesis and the Type 2 error is the probability that we accepted the wrong hypothesis.¹⁰ If we are trying to discover rationality we will need to understand the importance behind these two errors, and if we are searching for a quantitative method, we will need the probability of making these errors.

No matter what method we use to try and define the likelihood of a distribution, we still engage with a probability that always has a chance of being wrong. The concepts that make up the likelihood of distributions that we then relate to our hypotheses always have uncertainty tied to it. Since our hypothesis is not assumed to have a-priori worth our hypothesis’ likelihood is merely the likelihood of its distribution. Thus the probability of our hypothesis being right is interacted with the hypothesis itself. Similar to our problems with physical probabilities we will arrive at a fractional hypothesis. For all the reasons stated before this is not a coherent doxastic/decision-theoretic idea that we can deem practical. Since there is no rigorous connection between fractional hypotheses and real hypotheses, any connection we do make is taken on faith, undermining our second idea of practicality.

Although we do not view probabilities as related to the real world and instead view them as epistemic attitudes we know that a .8 hypothesis can’t exist. Saying anything more could always be disputed since under this view the “likelihood” of type 1 and type 2 errors are merely probabilities.

⁹ Type 1 and Type 2 errors are common names for this concept accepted within theories of statistics. Also from Stanford Encyclopedia of Statistics.

¹⁰ Romeijn, Jan-Willem, "Philosophy of Statistics", The Stanford Encyclopedia of Philosophy (Fall 2014 Edition), Edward N. Zalta (ed.), <http://plato.stanford.edu/archives/win2014/entries/statistics/> (accessed November 29, 2014)

Even if the probability is miniscule until we can “value” (not just put a probability to) the type 1 and 2 errors, they don’t relate to practicality. Because fractional hypothesis are not coherent, although we make decisions from them, they cannot be deemed practical since their veracity can be reasonably disputed.

Frequentist statistics might be a perfectly valid philosophy of statistics. By no means am I saying that this is an argument for whether Bayesian or Frequentist frameworks are correct. Because of the reasons I have outlined previously, a Frequentist understanding of statistics does not relate to anything that we can imagine to be “practical”. This doesn’t imply that Frequentist statistics is somehow invalid. Practicality is not necessarily the worth of statistics. If we don’t care about practicality we can just imagine a Frequentist statistics as a framework for understanding probability. The power this would have for us would be personal and not as wide reaching as we would like “practicality” to be. This doesn’t undermine the theory, it just doesn’t relate to a practicality that supersedes faith which is what this thesis is concerned about.

Bayesian Statistics

Bayesian statistics assumes our hypothesis have a-priori worth. This means that when we have data we can make decisions about the world based on our hypotheses since our hypothesis contains within them the concept of determining the world around us. They have a-priori worth meaning our hypotheses have the power to predict already assumed; it is only a matter of whether they are more or less likely. Ultimately, this can only be a bet, since we don’t know all the data that will ever be. Although uncertainty will not leave us with a fractional hypothesis, probability will lead us to uncertainty to the value of our hypothesis.

If our beliefs are derived from data, our beliefs have probabilities, and ultimately are bets on what we think the world will look like. If uncertainty exists in the universe then we might worry

that we might have no principled manner of narrowing our probabilities. However, under the Bayesian method of statistical analysis, we test the likelihood of our hypothesis based on our data. Because we are taking our data as representative of the output of the patterns that make up the world, we don't need to worry about skeptical claims. We don't violate the notion of uncertainty by assuming random hypothesis, Bayesian statistics allows us to test these hypotheses and show whether or not they are likely. In order to see how Bayesian statistics values and disvalues hypothesis it would be worth it to look at its mathematical framework.

Consider the following equation:

$$M = \{h\theta: \theta \in \vartheta\}^{11}$$

Before we get into Bayes' theorem, from which the word Bayesian statistics comes from, we should first understand what it actually means that "data" is not given a-priori worth. This means that the data we gather is merely a sample of the idealized "sample set" that we wish to derive our probabilities from. We can imagine this as a little s and big S . Little s is the sample; Big S is the sample set. We only can ever collect the sample and we use that sample data to arrive at an approximation of our sample set.

Although we only get to interact with little s , our hypothesis is a hypothesis about the sample set that our sample is a part of. For every given sample set, there are multiple hypotheses that could explain it. So in reality our hypothesis ($h\theta$) is an element (\in) of a bigger set of hypothesis (ϑ) that tries to explain the data. The probability that we are considering within our Bayesian framework: (P) is some distribution of data between the hypothesis we are considering ($h\theta$) and the sample sets they relate to (S) i.e.: $M = P \times S$. Our hypothesis' likelihood depends on some a-priori likelihood of our hypothesis' place in its greater hypothesis set and the likelihood of our sample set. We might worry that we won't be able to pick a hypothesis to represent the

¹¹ Romeijn, Jan-Willem, "Philosophy of Statistics", The Stanford Encyclopedia of Philosophy (Fall 2014 Edition), Edward N. Zalta (ed.), <http://plato.stanford.edu/archives/win2014/entries/statistics/> (accessed November 29, 2014)

hypothesis set. There are presumably a large quantity of hypotheses within a given hypothesis set; how can we make a relevant decision if we have many different hypotheses within a hypothesis set?

Allow me to expand up on the worry. A hypothesis set implies that two hypothesis within it relate to the greater set. Let us say we are concerned about cats. The hypothesis set would be comprised of hypotheses about cats. $P(h\theta)$ might say that cats are brown and $P(h\theta')$ might say that cats are red, but both are related to our hypothesis set \mathcal{H} which is about what properties cats have.

Although we are assuming that all of our probabilities within a probability set have a-priori worth, how do we choose between whether a cat is brown or a cat is red? It would seem that prior to information we should assume that all hypothesis related to a hypothesis set are equally likely i.e. $P(h\theta) = P(h\theta')$. If our hypothesis set is the belief we are going to have, then there seem to be an infinite amount of things to believe.

This is where the Bayesian theorem comes in.

$$\text{Bayes Theorem: } P(h\theta | s) = \frac{P(s | h\theta)}{P(s)} P(h\theta)^{12}$$

Both Bayesian and Frequentist statistics care about the likelihood of a hypothesis. The difference is that Bayesians accept the hypothesis $[h(\theta)]$ to be relevant to the likelihood of the sample being correct. Given the data(s), my a-priori belief about the likelihood of cats being brown $[P(h\theta)]$, is relevant to how likely my hypothesis $P(h\theta)$ is. We can read the line “|” as the word “given”. Because the Bayesian framework assumes that hypotheses have a-priori worth, we are trying to discover the probability of my hypothesis being right given the data: $P(h\theta | s)$. The probability of our sample being right given our hypothesis $P(s | h\theta)$ divided by the probability of our sample $P(s)$ is going to affect how much our sample affects (not by addition or subtraction but by multiplication of a number) the likelihood of our original hypothesis $P(h\theta)$.

¹² Romeijn, Jan-Willem, "Philosophy of Statistics", The Stanford Encyclopedia of Philosophy (Fall 2014 Edition), Edward N. Zalta (ed.), <http://plato.stanford.edu/archives/win2014/entries/statistics/> (accessed November 29, 2014)

Because the probability of our hypothesis $P(h\theta)$ is affected by the effect of our sample, every piece of data we encounter affects our probability. That is the true meaning behind $P(h\theta |s)$. And this makes sense, since we are assuming that our hypothesis has some worth, our data makes it more or less likely. We can now begin to choose between alternate hypotheses within a hypothesis set. Let us return to the idea of a hypothesis set. Each hypothesis within a set has a particular probability and is related to the greater set. Because our data affects each individual hypothesis within its hypothesis set, we can begin to distinguish which is the hypothesis we should use to represent our hypothesis set.

Consider two hypotheses within a hypothesis set: $P(h\theta)$ and $P(h\theta')$ we can use posterior information (the sample) to determine the most likely hypothesis given the data ($h\theta$). Because $P(h\theta |s)$ and $P(h\theta' |s)$ have the same sample they are comparable. The more likely hypothesis is the one we should use to represent the set. By definition of the hypothesis set $P(h\theta)$ and $P(h\theta')$ are comparable hypothesis. Thus, although ($h\theta$) itself is an element (\in) of a greater hypothesis set ϑ given our sample (s) there is going to be a particular hypothesis that is most likely given our data. In other words, we are going to pick the hypothesis that is the most likely from our set of hypothesis. Although there might be infinite hypotheses, they are not important because we are only going to use the hypothesis for which $P(h\theta |s)$ is the biggest number. Within the given hypothesis set ϑ I have picked the most “likely” belief. So far, as it relates to practicality, not only do we have a valid framework, within it is contained the power to unbiasedly determine what hypothesis is most likely, and as such more practical, within its hypothesis set. But what does likeliness mean in the Bayesian framework?

How to Value a Bayesian method of Probability

Let us review Bayes’ theory.

$$\text{Bayes Theorem: } P(h\theta |s) = \frac{P(s | h\theta)}{P(s)} P(h\theta)$$

Each of these probabilities represent a likelihood that I am right. But each calculation of $P(H|s)$ depends on $P(S|h)$ which has to be interacted with $P(s)$. Thus we need to understand the probability of $P(s)$. But by definition we are taking our sample to be uncertain. Thus it is a mere probability. So the probability of our belief being correct depends on the probability that our sample is correct given our belief. The effect my sample has on my belief in my hypothesis has a belief about the sample being related to the sample set. This means that when we try to do the move from $P(h\theta')$ to $P(h\theta)$ there is a possibility that we are undervaluing one or the other probabilities. To eliminate $P(h\theta' | s)$ there is always a chance that our sample probability is incorrectly valuing one hypothesis over the other. What this implies is that because the sample's probability isn't fixed, the practicality of our hypothesis is not in one hypothesis being more "right" than the other, but in our expected value. We cannot definitively say that one hypothesis is more "likely" than another hypothesis.

Unlike in the Frequentist framework, a sample's probability is not fixed. Each one is a meta probability. The only way they devalue each other is by using an expected value that is greater than or less than a comparable hypothesis. Unlike in Frequentist statistics, the sample we collect is not taken to be the sample set. Thus, we are merely betting that our sample is the one that best represents our hypothesis set. We do not have complete security in the idea that a sample represents a hypothesis within our greater hypothesis set. Although we can select the "most" likely hypothesis from our hypothesis set to represent the hypothesis set, that in itself contains uncertainty. By accepting the Bayesian framework we admit fallibility in our sample thus we cannot say that a higher probability is the most rational choice. All of our non-zero hypotheses have some probability of being correct. That is to say that there is an argument to be made for their correctness. Ultimately, our confidence in their "rightness" has to do with something outside of their likelihood. Because these probabilities are doxastic they are used for decision making, and since we are

assuming our hypothesis have worth in our “minds” then all non-zero probabilities are possibly correct. Our rationality must come from some interaction of our probability with something of value. The rationality of our decision depends entirely on the value we place on the outcome of our probability.

That is okay, we gave up on fractional hypotheses with the Frequentist framework. Instead we care about the “value” of this hypothesis, but it is important to note the distinction between a hypothesis’ “likelihood” and its “value”. In the strictest sense, we can’t distinguish the more “likely” hypothesis from the hypotheses “cats are red” and “cats are brown.” But it is still coherent to think one hypothesis is “worth” more. Although mathematically, a probability’s likelihood will affect its value under the Bayesian framework, our uncertainty as to the likelihood of a hypothesis doesn’t mean it is incoherent to think one hypothesis is more valuable than another.

Although it is not a concern that our hypothesis cannot definitively be more “likely” than another hypothesis because we only care about the “value” as it relates to decision making, we still need to discuss value. Since we are valuing our hypothesis and not the sample itself, our probability does not need to be a coherent idea. Since we only care about its value as long as the value relates to the exterior world we still have practicality.

Recall that when we are looking for “practicality”, we are not seeking a subjective notion of helpfulness. Although the object of prediction can be of something subjectively practical, we certainly don’t want the value of our prediction to be subjectively practical. We want our output to have a clear decision making capability. That is to say between two outcomes we can compare them and understand what the “rational” decision would be. Bayesian statistics, with its insistence that hypotheses have a-priori worth, has a problem defining what the “value” of the outcome of their predictions would be.

What is the value of our hypothesis? We cannot say that the value of our hypothesis is the thing that the hypothesis tries to make a prediction about. We have run into this problem before, even if we pick the highest probability out of a hypothesis set the probability does not immediately relate to the object in question. We do not arrive at one hypothesis about .8 cats. We arrive at .8 the value of our hypothesis about some prediction about cats being correct. We thus arrive at an expected value. If we were to wager 30 dollars on our hypothesis being correct, we could “expect” 24 dollars. The worth of our hypothesis is not the hypothesis itself; it is what we can expect to gain from it. The Bayesian framework admits that the real world i.e. the sample can be fallible. Its primary concern is not about the hypothesis itself being right since it does not believe that the sample has the definitive power to reject or accept hypotheses. Thus, the probabilities in question are about the likelihood of our hypothesis on our decision-making. The Bayesian framework outputs an expected value for a hypothesis, thus its predictive power only indirectly has to do with the exterior world. The hypothesis’ value as it relates to decision-making and thus prediction is in the decision maker’s interpretation of the “expected value”. Because we have abandoned the physical probability and have gone for a doxastic theory, the practical worth our hypothesis has to do with its ability to help us make decisions. Its ability to help us make decisions can only be defined by how much of “an object of value” is worth to us. If we plug in our numbers we will get to a certain probability which will give us a decimal that we can multiply by this “object of value”. If we imagine it to be “money”, it begins to make sense how one can use our probabilities for practical use. However, this “object of value” that our Bayesian statistics is wagering does not have to be money, and it is important to understand what this might imply.

There is no reason why we cannot be betting pigs and dogs when we try to determine how we should use our Bayesian probability. If we are talking about physical pigs and dogs as wagers, we run into the problem that we cannot have .8 of a pig. But that doesn’t need to be the case. Since

we are talking about doxastic (mind), decision theoretic Bayesian (valuing hypothesis) statistics our .8 of a pig does not need to be a physical thing and thus doesn't have to be a problem. We don't run into the same "you can't have .8 of a pig" objection because we aren't trying to mimic the real world anymore. We are using our probability for decision making. Meaning, if to a sentient individual the idea of .8 of a pig has worth to them, that is entirely coherent. The question then becomes: can we call this inference from .8 of a pig, and whatever it represents "practical"? Recall that by "practical" we are speaking of some "unbiased" criteria that defines the "best" decision between two outcomes of our statistics. These are doxastic, thus they are in the mind. However this "concept" that floats around that we make decisions off of seems to be entirely subjective. These aren't representations of the real world anymore. Their worth seems to be entirely subjective. We would need some objective theory of value to decide that .8 of a pig, which one person can wager based on their data, isn't worth more than .6 of a dog which someone else can wager on their data.

It isn't even perfectly obvious why .8 of a pig is worth more than .6 of a pig because they seem to be qualitatively different ideas. We can imagine that .6 of a pig (however that incoherence is imagined) is more aesthetic than .8 of a pig and as such is worth more. There doesn't seem to be a reason why .6 of a pig couldn't be more "valuable" than .8 of a pig. Even when we come up with examples that are less glib, say lives or objects of real personal importance, unless we have some objective theory of value, they do not seem to be practical to the world around us.

It is possible that there is a clear hierarchy of values that definitively makes wagers based on "x" object of value worth more and thus more worthy of decision than another person's ideas. As to not be presumptuous I will not assume that a theory like this is in place. For now I will operate under the assumption that the objects of value to us are dependent on faith. I might value my family, but the worth of that object seems to be dependent on faith. It does not seem as though I can assert my rationality over someone else's based solely on that object of value, because other people do not

need to value my family. And so we run into this problem. Everyone has their own ideas of what is valuable to them. Under the Bayesian framework, predictions that are practical to individuals have no reason to be considered “practical” in the way we want. That is to say practical in a way that would make it separate from faith.

This was the final hope for statistics’ practicality. Although the Bayesian framework is valid, and has a manner of unbiased inference of what hypotheses are more practical than others (through value as opposed to likelihood), it cannot relate to practicality because the value of the object that we are wagering has uncertain worth. It is uncertain how this “betting piece” relates to “value” in the exterior world, violating the second aspect of our idea of practicality. As such, the decision of what an unbiased person should do is in question, because it is uncertain what a person should value. That is why the next chapter will be discussing value theory, and one possible solution, the value theory of money.

Chapter Four: Hope for our Probabilities, the Value Theory of Money

Under the Frequentist framework the value of our probabilities is a physical impossibility, and thus can’t be used for “practicality”. The Bayesian framework would be “practical”, except the value of our probabilities is something of subjective worth. I will posit a substitute of an object of value that might solve the concern as it relates to Bayesian Statistics. The concept of money is entirely mutable. It is entirely coherent to interact the concept of .8 a probability as a hypothesis to a wager of a dollar. We get 80 cents. If we subdivide this to the smallest possible unit the resultant measure of value still makes sense. Because money represents pure liquidity, .8 of a cent is worth .8 of a cent. Thus if we agree that our wagers are monetary in nature we do not run into the physical subdivision problem. Furthermore, since money represents the idea of value, .8 of our wager is

definitely worth more than .6 of our wager. The idea of 80 dollars is by definition worth more than the idea of 60 dollars. If we can agree that practicality is of monetary worth, then we have hope for a transferable idea of value. One that allows us to say that “because” that hypothesis yields an expected value of 80 dollars, it is more practical to make a decision from that hypothesis than a hypothesis that yields an expected value of 60 dollars.

Agreeing on this principle might be less subjective than we think. Money is a concept that is supposed to represent a store of value. The concept of money is an agreed upon store of value that allows people to exchange their subjective ideas of value for other people’s subjective ideas of value. Although currencies do change, it certainly seems plausible to say that the concept of money allows things to be valued. Whether a thing is worth 20 dollars one day or 30 euros the next, there is an idea of value that the concept of money is trying to strive towards. In an idealistic sense, money derives its value by compiling the subjective idea of value of all those that believe in it. The price of money that a human interacts with changes every day; however, it can be argued that money is supposed to represent the “actual” value of an object outside of what an individual “might think”. Although I might consider horses to be the only thing that is valuable in the universe, the “market” (which consists of everyone else’s idea of value) decides that it is worth 20,000 dollars. Although a horse is the only thing important in my life and I would clearly trade more than 20,000 dollars for one, in an idealistic sense it can be argued that the horse has a value of 20,000 dollars. Money is the ultimate liquid device. Even output can be monetized i.e. 30 bars of gold equals 30,000 dollars. Thus, it can be argued that money has a mind-dependent and a mind-independent component. Just like our definition of practicality, the concept of money is about things we care about because what gives money its instrumental value is the things we care about; and about something mind independent, because the collective preferences of man define what the “true monetary value” of an

object is. Because of these two components, as well as its divisibility, it can be argued that when we speak of “value”, money is exactly what we mean when we speak of “practicality”.

This chapter will argue for four ideas about money that will allow us to use it as a “practical” weight for the value of our predictions.

1. Money is a means of communication, and communication is only necessary if we don't have what we want.
2. The “face” of money and the “true” value of money are different and both change based on what preferences exist in the world.
3. Finding the “true value of money” can be said to be the purpose of statistics and science.
4. The only way to value money “intrinsically” and still view it as “money” is to value its potential.

Money represents a means of communication. Why is that important? I am going to begin with the metaphysical premise that the things people want exist outside of them. We can doubt this premise, but at that point, predictions about the exterior world cannot be “practical” because the exterior world was an integral part of our definition of “practicality”. This is because what we would care about would exist within us and as such predictions about the exterior world wouldn't be about things we care about. If we take this premise, for people to get what they want, they need to interact with the world outside of them. There seem to be two ways individuals can “get” what they want from exterior agents: through power and through communication. I am not going to talk about power because that only indirectly has to do with prediction.¹³ Assuming people have to convince other people to give them what they want, or even if they need a bartering chip to buy tools to “earn” what they want, money represents the way individuals can civilly exchange objects of value. People value different things and money seems to be the panacea for sorting that

¹³ Power is a way we can move external agents and it might affect one's economic dealing. I am simply outlining money as a value theory as it pertains to practicality and expected value. I don't claim that what I am presenting is a complete value theory.

inconvenience out. This is because money is an instrument to many different conceptions of value. For my purposes, money represents the means of communication that allows me to interact with another person's idea of value.

Imagine the following basic economic scenario. Imagine two individuals A and B, with very strong preferences. A has chickens B has cows. A only wants cows and B only wants horses. There is literally nothing else in the world that they find value in. They are nihilistic towards the idea of other objects in the universe having value. Furthermore, this is a system of value where multiple cows are not worth more than a single cow. The agents are indifferent to having more than one of this object of value but they value having one more than having none. So, from A's perspective he would clearly give up all the chickens in the universe for a single cow. His chickens are worthless to him, and a cow represents the only thing of value in his preferential system. If we imagine A proposing to offer all of his chickens for one of B's cows what would B say?

From B's perspective A's chickens are worthless. Utter worthlessness is hard to imagine. We can say that B would be indifferent and might on a whim decide to give A a cow considering that B only values horses. While this is a valid worry, let us say that this benevolence is not something on B's mind, after all A is not a horse so we have no reason to believe that B would show compassion. To B, the idea that someone could value chickens is foreign. He has no system of values to understand what is important to A. Whatever tactics A might use to convince B to give him chickens is not of any value to B. This isn't a nihilism of language; he simply has no reason to find A's arguments convincing. Exchanging objects of value doesn't make sense because these individuals have incompatible systems of value.

Let us introduce money into this thought experiment. Imagine some economic system with stable enough prices that has allowed it to reach equilibrium. Let us say by whatever basis is appropriate for determining "market" price horses are worth 20 dollars, chickens are worth 25

dollars, and cows are worth 30. We can now ask the question: what is the worth of cows to agent A and what is the worth of horses to agent B? We might be inclined to say that the answer is the market price, but that is certainly not the case. To these agents the money is entirely arbitrary and these are objects of transcendent worth. I use the word transcendent because the value they place on these objects not only transcends any economic system but also any other system that places value on other objects.

By transcendent worth I mean the value is not expressible in monetary terms, it transcends economic expression. They would give up all the money in the world because money is not in their system of values. Money is the instrument through which they acquire this object. For that very reason, the price of chickens or cows is unimportant to these economic agents. Money is entirely of arbitrary worth to both Agent A and B because money is only an instrument to value, the instrument is of no worth. Thus the price of chicken and cows is irrelevant to the Agent A or B who is going to use “money” to buy a chicken or cow. These economic agents could not care less about the “market” value of cows and horses because they are of transcendent worth.

Furthermore, in a world with unlimited resources, the economic agents will do anything in their power, pay whatever price and use whatever methods necessary to acquire what they want. These methods have no positive or negative value and as such they will perform whatever is necessary. Even time is worthless to these individuals as they will eventually get what they desire and are indifferent to the “time” wasted. Time isn’t a cow or a chicken so they have no reason to care. The only reason they bother with money is because other people care about it. In a world where everyone eventually gets what they want, the value of the “money” necessary to communicate with others in order to attain objects of desire is utterly irrelevant.

The only reason person A or person B care about money is because they are insecure. Even in an instrumental sense, money only has value if we are insecure about the prospect of getting what

we want. If person A had unlimited time and was confident that he/she would get a chicken magically without communication, they would not need the concept of money. The chicken would eventually fall out of the sky and person A would be fulfilled.

Misers who might value money intrinsically, value it more as an object than the concept it is supposed to represent. They value money's beauty. Perhaps as a pretty object but they don't value it because of its instrumental value. Although money represents the ideal concept for instrumental worth, valuing money's instrumental worth is not valuing money itself. It is valuing money's potential, which is a form of insecurity, because potential only matters if I don't have what I want. Going back to misers, these people they would give up all the resources in the world not because eventually they will trade the money for something of transcendental value but because money *is* what is of transcendental value. We can imagine a "backwardation" of currency where what are intuitively considered objects to most are currency to the miser. To them money doesn't have instrumental value like it does to us, so it isn't what we would consider money.

If we do not assume insecurity about getting, what we want the only way we would care about the "price" of cattle is through a theory of value that has an implicit assumption that more cows are better than less cows. We would begin to care about the "price" of cows only because limited resources make it so that if you gave up infinite resources you might not achieve your goals. Goals of course would have to be enumerated by some system of cows, i.e. more than 1 cow. But this counter example does not value a *single* cow and foregoes the transcendental worth of cattle for a bizarre system of cattle constrained by the insecurity that we wouldn't be able to get what we want. If we had no insecurity about being able to get our "multiple" cattle, each cow is worth a transcendent (which can be imagined to be near infinite) number of anything else. Money, only has value to us on the conditional basis that we are insecure about the things we desire.

There is something odd about valuing more than one cow. The moment you value more than one cow it seems as though you are trying to construct a currency of cows. A cow is of transcendent worth. Their value can't be divisible by other notions of value. So it might be better to imagine these two cows as *one* object of desire. We can continue this exercise until we imagine the correct amount of cows that would satiate our desires. Ultimately, the amount of cows that creates our "object" of desire has to be finite. If an individual values an infinite number of cows, then he commoditizes them, creating a currency of cows. Each cow fails to be transcendent since there is no "ideal" amount of cows. Furthermore, by creating an impossible life's mission his purpose becomes one of maximizing cows. This individual would think in terms of what decisions they can make to maximize their number of cows. Unlike in our cows representing transcendent worth example, this agent does care if they have more than one cow. .8 of a cow is worth more than .6 of a cow and so it becomes a currency. We see this empirically, people used to trade off gold, silver, and conceivably cows. There are economic theories that define why a cow can't be a useful currency (not easily divisible) but if we could imagine that sections of cows could be divided and that people valued more cows than less cows, there is no reason to think it couldn't be a currency.

Since each cow is "valueless" except as part of the whole, the worth of outside activities can be measured by how many present and future cows they can provide. Valuing infinite cattle suddenly gives other pursuits in life a hopeless purpose; the purpose being measured in the amount of cows each action can produce. This is in stark contrast with our examples with a limited number of cows, assuming unlimited resources (although in some weird sense we could value each action by the potential cows it produced), it was very obvious that a cow had transcendent worth. This brings up the point: the moment you value a pointless thing, usually by valuing an infinite number of it, it becomes a currency. And so anything can become a currency, but for whatever reason

people don't trade in terms of cows. And it probably has to do with the idea that most people don't value cows, which is itself an empirical thesis.

Why do I make this point? I foresee a concern with money as practicality. If we are using this concept for decision-making and we don't even know what constitutes "real" currency how can we get unbiased inferences per our idea of practicality? There is a subjective component to money: the idea that people agree on it as instrumental value. This is going to depend on "how" they agree on money; which would be an economic/empirical theory. But the "how" only determines the "face" of money (gold/silver/cows). The face of money is unimportant, as long as the thing has instrumental value it can be considered money. I only care about the why, and why people agree on money is because they are insecure and need a means of communication.

Money is a means of communication, which unlike other means of communication only has value if people don't have what they want. This isn't to undermine the concept of money, because most people don't have what they want, but it is important to understand what money means to accomplish. Between individuals who do not have what they value and need to get it from outside sources, money can help them achieve an equilibrium of value that lets them achieve their goals.

Why the "Face" of Money is Unimportant

We might believe that if the "face" of money is unimportant that somehow undermines what money as the way to "understand" value is supposed to represent. When we strove for practicality we were looking for a measure that is "objective" in the sense that its "practicality" isn't entirely mind dependent. Figuring out that physical statistics had holes in practicality, we strove for an epistemic view. The epistemic view relies on what individual agents find valuable. We might think that this necessary subjectivity undermines the "worth" of statistics. It means that unless we have a theory of value already in place we will be at an impasse for "practicality". However, money is

useful in the sense that it changes constantly based on what people value, it is representative of their objects of desires. In that sense it represents a fluctuating subjective moniker that in aggregate represents the subjective numerical preferences of all those who find things valuable. If our definition of practicality wants to bring in other people's preferences to validate itself, money seems like the best concept to fill in this gap.

So how might money value people's preferences? Science might predict events and their importance to us, and as such events can be given a value. Imagine the idea of the sun rising tomorrow, even it can be said to have some monetary value. The sun rising allows certain biological processes to take place that allow certain functions in our human society to prosper. It is not out of the realm of imagination to conceive of some monetary worth of the sun going out for one second. Even if that results in the death of all life on earth, we can imagine some alien life being angry at not being able to harvest human potential and thus lose x amount of "currency". Although it might be strange to imagine, there is an idealized form of money that is tied to whatever notion of potential we consider important. Potential that represents the value of things. Money represents a store of value that allows us to communicate with other beings that don't necessarily value the same things we do.

I am not positing an economic theory that will allow us to understand what the true "monetary" value of an event is, but I will argue that the "monetary" value of an event is entirely different from the "face" of money. The "value" of an event is a result of inductive methods that give us an output for a particular event. This output's value is then affected by the probability of it happening, that is what a likelihood between 0-1 does. The point of this section will be to show that although we don't have the theory that defines the true "subjective value" output that money is supposed to represent, it doesn't mean that using money as a way to understand expected value is any less valid. This is ultimately because money is simply a means of communication; people's

subjective preferences form what money means to them, meaning that they don't care about the "market's" method of valuing objects in the universe. The "words" that make up communication are not what is valuable to these individuals. In that sense, being worried about the economic theory that might define what a "dollar" represents in terms of "value" to an individual is merely concerning itself with the "face" of money.

If we have two hypotheses: one that has an expected value of 30 dollars, and another with one of 20 euros, the expected value of the hypothesis is actually made up of two component parts: the "output of the event", and the "face of money". Although there is general uncertainty around the probability itself, pushing that point would be disagreeing with the formulation of our statistical method or the "value" of our variables. If we are simply looking for the "value" of our hypothesis for decision making, errors in the face of money will affect all of our hypotheses. Recall, the data gathering process and the statistical methods we deem appropriate to evaluate them are supposed to measure the effect of the "true" prediction. The "face", 40 euros or 50 dollars, is simply a number/name we attach to our hypothesis to make it coherent in a doxastic decision theoretic manner. It is an arbitrary amalgamation of "value" that doesn't affect the true empirical "output" of our hypothesis. 6 million dollars versus 3 euros is the name we give to the "true" value of our money.

Money deals with uncertainty, the uncertainty of future price fluctuations is hidden in its "true value", "true value" representing the appropriate value relative to relevant preferences to attach to the "output" of a hypothesis. For the same reason that (for our purposes) uncertainty doesn't make the notion of statistics irrelevant, the "true value" is supposed to track this uncertainty. Although an economic agent cannot "know" the "true" level of money, "rational" decisions still exist. Since we are looking for practicality as it relates to decision making, although the "face" level of the monetary effect of our decisions might be uncertain, there is still a standard that represents

practicality. The data and all of its connections is believed to have to explain predictions in the empirical world, representing what is practical.

We assume this power to be relevant in order for our entire discussion of statistics not to devolve into a general argument about the problem of induction. Even if we cannot know for certain the true value that the “face” of our money is supposed to represent, it doesn’t preclude the existence of “practical decisions”. The true “weight” underneath our “expected” values is in the power of prediction. Ultimately, “money” is supposed to represent a monetary measure of preferences for an aggregate. Any economist will tell you that this aggregate of people’s preferences is difficult to capture. However, the entirety of science, as it relates to economic theory, aims to define and quantify preferences for empirical objects. If these preferences can be quantified it can always be understood as some currency. To deny that production and preferences can be amalgamated and liquidated is to deal a serious blow to the power of science. It does seem weird to think that scientific/statistical theory can determine objects but not preferences. The question becomes, why do the sciences and the statistics that are the underpinning of them, have to have some definitive method to value people’s preferences?

The Hope of Science/Statistics being the Understanding of the True Value of Money

The hope of science is that preferences can somehow be predicted. Based on some data we can understand that on average people like x y or z . This is “hopefully” the true underpinning of our money. Even if people’s preferences are affected by “cultural” understandings, science can hopefully predict that as well. The purpose of data gathering is to make those sorts of predictions. That rigidity obviously assumes a sort of determinism of the laws of nature. However, as we noted in the beginning, if we give up on this idea that the laws of nature can determine outcomes; the whole talk of statistics being practical goes out the window.

Money in its “unbiased” sense represents the “true” future value of all output, and what that output is worth to us, the collective us, as in all economic agents; however, just because the personal value of money depends on our subjective notions of value doesn’t mean that its “unbiased” sense doesn’t track real world output. Misestimating value might lead us to make the wrong decision, but the idea of value gives us hope for “practicality”. Although understanding the output of the world is difficult, ultimately that is the point of science, and consequently the point of statistics. The subjective value of this output is something that money controls for, because ultimately individuals do not care about money except as a tool. Our definition for practicality does care about everyone’s preferences in its quest for “objectivity”. The hope that we can understand what people will value and thus can communicate with them is what money represents (this is where the idea of a store of value comes from).

The “true value” of money can track things that are surprisingly “meaningful”, by whatever metrics define that. For example, there seems no reason to imagine that happiness couldn’t be a currency. Things could be valued based on how much present or future happiness they can be expected to bring. A thing’s three “dollaredness” is some quantity of happiness that is worth three dollars. Science hopefully can help us understand how a thing’s physical being, or the output it creates definitively translates into happiness. Assuming that we can’t turn happiness into a commoditized form, we could create a currency that is simply supposed to represent units of happiness. In reality, we are trading the potential for future happiness. Again, if happiness is some transcendental goal, then some quantity will satiate us. If it isn’t then we don’t really value happiness itself as each unit of happiness doesn’t add to anything transcendental. It simply becomes a currency, a means of communication. Although there might be variances in the exact levels of happiness an object brings different humans, we can communicate with others by exclaiming how happy things make us. Presumably that is a means of coherent communication. The “true value”

that money represents doesn't have to be happiness, the value of our money can be expressed as a means to whatever end we want. As long as human beings are insecure about not having whatever constitutes the "true value" that money represents, people will care about money.

If money is supposed to be a notion of value that serves as defining practicality, practicality understood as how an unbiased agent should use data for decision making, what about the concept makes money a worthy concept? Although money is supposed to represent a scientific preference theory, it still ultimately relies on an economic agent's preferences. The question then becomes why should I care about the market value of a given object? Is it fair to call an individual irrational if he/she doesn't accept the price of certain objects? An individual can clearly doubt the inferences of events no matter how many times they are studied. They aren't irrational in that sense. If our agents make decisions that are "impractical" where does their irrationality come from?

The market method of valuing money is supposed to be something we believe in. It seems too self-aggrandizing to think that your idea of value is worth more than everyone else's. Or in less colloquial senses why should I think my personal preferences undermine the idea of human nature? If I think a chair is worth 300 dollars, and the "market" thinks it is worth 10, what does my disagreement represent?

There are two context clues hidden. One, that I think this object has *monetary* worth and two, that the market has "decided" on some value. Let us start with the first, as outlined when we built our currency, if we actually care about the price of an object it doesn't represent the transcendental worth of our true objects of desire. If I think a chair is worth 300 dollars as opposed to "it's worth the world to me" it represents that I still view the chair as a means to some end. So what does this imply? For me to still care about "means" to ends, i.e. instrumental goods, I must not have what it is I desire. There is insecurity about the prospect that I will attain the objects that will fulfill me. If this is the case, it implies that the things I want are outside of my reach, not completely

in my control. That is why I want money in the first place, to barter my way up to fulfillment. This implies that I need to interact with others in order to get what I desire. Since I don't care about the chair itself except as a means to my ends, and these ends are in the hands of the outside world, I need some manner to communicate in order to get them. In this scenario it seems illogical for me to expect other people to think the chair that I have is worth what I want it to be worth. What gives me the right? I could be right, there is uncertainty after all, but it demonstrates a bizarre self-confidence to honestly believe that my chair is worth something outside of the market price. Furthermore, since I am trying to communicate with others, and that is my desire (albeit instrumentally), it seems practical for me to survey the prices people believe in and act off of that information. I certainly don't have the "faith" necessary to think this chair has transcendental worth, so why would I think it's worth something other than the market price? By admitting that I care about money, I admit that I care about others, and it seems logically inconsistent to deny their preferences just so I can sell my chair at a higher price.

But perhaps I am missing something. What does it mean that the chair itself has a market price? Recall, in the purest of senses, the true value of our chair is supposed to be its "output" in terms of preference, however, that may be defined. But as we have defined there is always uncertainty. Just because a scientist says something doesn't mean it's true. What that sentence means is that perhaps they misinterpreted data or there is some error in our inferences. Even if both me and the market agree that "dollars" is the correct way to think about the value of this chair, perhaps the market has incorrect assumptions for how they derive this value. Therefore, an individual still has a case that their idea of what the chair is worth is correct.

To make this clearer let us imagine the chair as a financial asset. The chair's cash flows are being valued at a terminal value of 10 dollars. I believe that the chair has a terminal value of 300 dollars. Perhaps the chair's "revenue" growth is assumed by the market to be 10% year over year

and I think the chair's revenue growth is worth 3000%. Because there is uncertainty even with the same amount of data, if I believe that I understand better the factors that the "market" and I believe constitute value, perhaps my idea of value correct.

Let us pretend that this isn't a financial asset. The chair has an output, and different scientists might disagree about what that output is in the future. Although money tracks the collective unconscious opinions on the importance of this output, science can still be unsure about the output. Thus, scientists can disagree about the value of something even if it can be monetized. But this leads back to something I said before, this does not imply that there isn't a true value of this chair in terms of dollars. My disagreement with its true value can stem from "relevant" reasons that might still be open for discussion. Even then, I am agreeing about the ultimate method of communication. Science is supposed to help us understand the true output of things and money as a concept the idea that we can take into account everyone's preferences. Even if we can't understand money or how it can monetize what is valuable about certain objects, it doesn't mean that we can't use it as a suitable way to understand expected value.

Now that we have the basics of this concept of money, let us make it more plausible and relate it to statistics in order to understand its rhetorical force. Science hopes to help us understand the output of the world, statistics being the manner in which it creates hypotheses. It can do this because of the determinism it needs in order to be relevant. Let us say the world determines a tree. This is the output, our preferences will define what this output means to us. There are a variety of reasons why this tree might be "valuable" to an economic agent. Perhaps I value the tree because it will make a good chair. Someone else values it because it they can make paper out of it. The "true monetary value" of this tree is some amalgamation of our ideas of value, one that under perfect conditions, (including a lack of bias) allows the "trade" to happen. If "trade" is an idea of

amalgamating human preferences into a “fair” price, the amalgamation of our preferences seems to be the true worth of objects.

We might believe that perfect conditions are implausible, that it is impossible to determine who is biased and who is not; that we might need a theory of value in order to understand someone’s “bias” in valuing an object. But if money as measure of value is conditional on people’s preferences, and preferences can be understood (maybe empirically), although we don’t know *why* people value x y or z (i.e. a theory of value), we would understand that they do in fact have a “true” value relative to people’s subjective preferences.

Some people believe that science can determine preferences. This would be because although preferences are mental attitudes, the components that make up preferences are physical in nature. In ideal senses given enough data it is conceivable that we can nearly perfectly predict people’s preferences. Under materialist conceptions of the world, preferences are made of physical objects that science can predict.

Science/Statistics hopes to understand the connections between physical objects, as it relates to preferences, to arrive at a prediction of how the average person values *any given object*, and given enough data what a specific human will want. This is presumably because the physical objects would also determine the ether of preferences that make up any given object’s market price. In an ideal sense, science/statistics hopes to make it plausible that it can discover what people’s true preferences are. Since that is the case, if we adopt this scientific framework, we can *hope* to understand the value of money.

Although many people might value a chair for a variety of reasons, science by understanding preferences might be able to understand how it is “most” valuable. If in our definition of practicality we care about what is “most” valuable then our decision-making hypothesis have direction.

For example, this chair is “most” valuable is as a beacon of happiness for all to admire and be inspired to make more output. This is worth 300 dollars. Although the paper miller can make 20 dollars from the tree and the woodcrafter 40 dollars, the “true” value of the tree is one that gives people inspiration to continue their work. When we make decisions about the tree, in regards to our hypotheses, we understand that the tree is worth 300 dollars. A malicious woodpecker threatens to harm the aesthetics of the tree. I have two competing hypotheses: one that pouring acid water on the woodpecker will produce the most units of output. The second that letting the woodpecker survive will produce the most units of output. Both of these beliefs could be right, and as doxastic-decision theoretic attitudes, I wish to understand their worth. I run my calculations taking into account all the previous data of my aiming and unintended consequences, and determine that the expected value of my attack is 200 dollars. The second determines that the damage the woodpecker might do combined with a woodpecker’s tendency for boredom determines an expected value of 250 dollars. Because our agents value money, it seems that we have a pragmatic decision. Furthermore, if our decision makers do not value money because money takes into account other people’s preferences, it seems as though their decisions aren’t pragmatic in the sense that they don’t relate to the rest of the world. The rest of the world is the sort of setting we wanted our predictions to be understood in when we first set out in our definition of practicality.

Even more powerfully, if science can understand some “truth” to human preference it will become very difficult to deny the rationality that statistics can give us. We can deny that science has a hope of human understanding but it would be prudent to understand what this means. First, we should understand that just because science can predict what it is humans value, it doesn’t imply that that prediction is an explanation of the matter. The prediction simply follows from the idea that humans seem to have empirical components and as such might be subject to the empirical determinism of the laws of nature. Thus, even if science cannot explain why most humans would

value “x” it does not mean that science is incomplete. More importantly, to say that human behavior can’t be predicted is to say that our preferences are iconoclastic. And if the most important parts of us (from the perspective of our own minds) can’t be predicted, then it implies that every human interaction is unique to the point of “randomness”. Under this view, we would have no real reason to think that a person’s previous words or actions or feelings would determine their next state (words feelings and actions conceivably coming from factors that have empirical determinants). This uncertainty renders money a completely arbitrary concept, which is fine, but it also renders science useless to explaining human beings. If each human being is purely individual, communication is a crapshoot, and we can only hope we don’t harm others. Now none of this makes money more legitimate as a concept, but it does show how powerful the idea of denying scientific discovery prediction actually is. The “nature” that science tries to discover, whatever its object of interest may be, is a unifying force. That unifying force provides a common pool of understanding that lends itself to communication. These scientific discoveries represent a purer form of communication and as such a closer ideal of “human understanding” (i.e. the point of science). As long as we want to communicate with others, it will become more and more difficult to dispute the “value” of objects as the value approaches “true” value and the value becomes more and more apparent to us based on science’s progress.

I wish to make a quick aside, one that defends my idea of money as communication from a semantic point of view. “Language” is a means of communication and it does not seem to be “money”. However, I would argue that language also carries many of the same properties we have enumerated above. If we are using language to communicate with people, when we throw words into the ether, we are making predictions that other people will understand them. In that sense, we have to believe that others will value these sounds. People will only value the sounds of others if they feel as though they need to understand other people’s words. Few people really care about

words themselves. They value them more because they represent a series of concepts that others have agreed have “meaning” because we wish to communicate with others. If we didn’t need to communicate with others, we could (theoretically) use our own proprietary language and fester on our thoughts in whatever manner we wanted to. If we value words for their sounds as well as the concepts they represent, they don’t really represent language but a purpose that language is supposed to help us achieve. Language is an economy that has an arbitrary currency that differs from place to place and if our only purpose for using our language is to communicate concepts that we believe have value, it would serve us well to learn the languages of those we wish to communicate to. We care about developing our language and teaching people to use it because it represents the building blocks for the types of connections between concepts that we place value in. All of these parallels exist because money is a means of communicating value. I make this aside for three reasons. One to defend my semantic term, two, to wrap up the point that the “face” of our means of communication isn’t important, and three to show another property that money has: potential.

Money as Potential

People tailor their words and collect money because both concepts represent means of potential that can move others. It seems unreasonable for people to think that they always know what is of transcendental worth to them. Perhaps money has a value outside of its instrumental worth. It is representative of a store of value. It seems as though things fall in and out of love. Even if there is something I *currently* value in the universe, I might fall out of love with it. This happens with children all the time; they value some trading card, using their parent’s money to buy the latest set. Even adults occasionally fall in love with objects that turn out not to be fulfilling. It does not even need to be an object, we can imagine an adult investing his/her time, wanting to save the

children in a foreign country, and after fulfilling his mission discovering that the mission wasn't personally valuable; that he/she could have found happiness spending their time acquiring frivolous yachts and condominiums. Just because an individual gets what they "want", i.e. the thing they will use their money for, it does not imply that doing so will actually leave them fulfilled.

If this is the case, then perhaps money has a deeper value because it has so much potential. Perhaps it is always prudent to hold money just in case our latest ventures don't go as planned. By storing the store of value, we give ourselves potential to all sorts of future actions. If we give money this sort of true value, outside of its instrumentality, then we admit that we don't have faith in some aspect of our desires.

It could be argued that hedging our bets, just in case those things don't give us ultimate fulfillment doesn't preclude faith in the value of the object of value. It seems very difficult to imagine a person who has that sort of complete faith in the things they claim to desire; it might always be a good idea to keep some money just in case things don't work out. Furthermore, it seems as though money is a good thing to keep simply as a means of communication. When others value their hypotheses to make decisions in the world, having the idea of money in the mind in order to relate to them might be useful.

Admittedly, this argument only makes sense if we assume that a human being will remain insecure. Even if this behavior is a "calculated uncertainty", hedging is still only a result of insecurity no matter how "reasonable" it may be. It is entirely possible that the ultimate end they use their money for does give them true fulfillment. It is entirely possible that a human being doesn't need to communicate with others.

Even if a person has an idea of what represents transcendent worth to him/her, they could still value money because of the potential it has to maintain this object of value. This is especially the case for individuals whose objects of "transcendent worth" are sentient beings. Although these

individuals have full faith and as such, no insecurity in what is important to them, maintaining these “objects” might require money. If we imagine exterior threats to these objects, individuals might need money in order to “communicate” with the exterior world. Say, money to maintain a flower garden, or money to fulfill the needs of a child.

We can imagine a person with a family who cares about money because their family wants certain things in the world. Although the person would obviously give up any amount of money to help fulfill their family, the outside world doesn't need to feel the same way. Although to the person, a car is a valueless thing compared to their son's happiness, a person can't appeal to a car dealership and say, “it's for my kid's 16th birthday, don't you want my kid to be happy”? This might be convincing, but it seems more likely that to the car dealer a teenager's happiness is not worth the 40,000 dollar sticker price. The car dealer might not understand why the pubescent is worth anything, but money is a language he might be able to understand. In this sense although money is not worth anything “intrinsically” to the person who cares about their family, because other people have what his/her family might desire, and might do so perpetually, money is valuable to him as the potential to help him/her communicate with others. Even so, this “value” for money still assumes that the son is insecure and needs things in the world.

But what if we value money's potential without an object of transcendental worth in mind, recognizing it as a store of value and valuing it because of what it represents. The people who do care want the money because it represents potential. However, it only represents potential because everyone else cares about it. Potential is pointless, it can become anything. However, potential eventually has to be liquidated into something that humans can value. The man who only values money simply has nothing to love. However, this isn't to berate the man. Why should he think anything is worth anything? People value their families but why do I invest in that, what about that concept is worth anything? Why shouldn't I hold money until I one day find something of value to

spend it on? Some people find faith in their ideas of value, but it seems bizarre to value that faith by its own belief, so why not use money instead? Until we have a theory of value, these questions seem to be open.

Money represents communication, value, and potential, and all of those things give it a flexibility that makes it suitable as a quantitative measure suitable to be the underpinning of our Bayesian statistics. Money comes from an idea of humbleness and insecurity, and it doesn't seem as though we have a reason to believe that our personal standards of value make our epistemic beliefs "rational". Money takes into account people's preferences, has the flexibility that makes it difficult to deny as important, and for people who don't understand others' particular value systems gives us a standard to trade off of. Furthermore, the hope of scientific understanding is that it can show us what we care about, what output is "valuable" to humans, even if it can't tell us why. Science tries to explain culture, circumstance, and the very code of human beings, and if science serves something we care about it will serve our preferences. The true value of money hopes to incorporate all value systems into a coherent economy of trade. For people with no faith in any particular value system, money is the hope of human understanding.

Chapter Five: Why Money is not a Rational Interpreter of Value and a Review of Concepts

Money is ultimately of instrumental value. Unless we posit a theory of value, it will take faith for us to find it important. The importance that money plays in the lives of individuals is based on their insecurity. Insecurity that they will not get what they want and insecurity that they need to communicate with other people. These are all reasonable insecurities and it seems difficult to imagine a person without them. Still, these deep-seated insecurities that lead us to invent the concept of money aren't universal. We can imagine a human being with pure faith in an object of value, so much so that money is worthless to them. There can be an individual who does not place

any value in other people's objects of value. In less personal senses, the purpose of money is to represent a store of value of an object of transcendental worth. If we believe a thing has transcendental worth, that belief immediately becomes "more" rational than any monetary theory, because money is supposed to represent this belief.

We are speaking of doxastic-decision theoretic attitudes as it pertains to the value of a hypothesis, meaning, we are determine the worth of our hypothesis based on the hypothesis' value to us. To an economic agent, money is a placeholder for a thing of ultimate value. If the value of a hypothesis is measured in terms of that thing of ultimate value, it is immediately worth more than money. In economic senses, 10 million dollars cannot compare to an object of transcendental worth, even if that object has a .0001% chance of happening. Because practicality in our sense only has to do with appropriate decision-making, the worth of decision-making is only in its expected value; .0001% of a thing of beyond infinite worth (expressed in monetary terms) is worth more than an infinite sum of money. Because these objects of value by definition are worth more than money, if we are judging our hypotheses worth by its "expected value" as long as we have faith that this object is worth more than money, the non-zero possibility makes the hypothesis worth more than a hypothesis valued in monetary terms.

This holds true even in the face of other people's monetary hypotheses. When we set out our definition of practicality, we sought one that helped us make "rational" decisions beyond one individual's subjective understandings of value. This definition of practicality, for it to be meaningful, necessitates us to compare the value of different hypotheses. If I can't say that my hypothesis is worth more than any other hypothesis by *any* metric, practicality is a bunk concept because the value of the "value of the hypothesis" will be entirely subjective. The concept of money was supposed to help us compare the value of hypotheses. Money only has value because it relates to i.e. is an instrument to, these objects of transcendental worth. If there can be no connection,

money is by definition worthless. Thus, in so far as we think of money as this communicative concept between objects of instrumental value, it can be compared to objects of transcendental worth. Since we have not posited a theory of value, if an individual does believe an object has transcendental worth, it is because of faith. Because we don't have a theory of value, between two faith-based hypotheses, we can't determine which one is more practical. Money, if it can be "valued, by definition, is supposed to be related to any conceivable object of transcendental worth. Thus, we can compare any faith-based hypothesis with any monetary hypothesis: even without a theory of value. Moreover, since they can be compared, we can determine the relative practicality of any faith valued hypothesis to any monetarily valued hypothesis. Since all instances of monetary hypothesis are worth less than monetary hypotheses, we can be unbiased in our comparisons as the comparisons are not conditional and thus can be universalized. Because one faith based hypothesis is worth more than all monetarily valued hypothesis, any faith-based hypothesis is worth more than any monetarily based hypothesis.

Under our definition of practicality, the power of *any* faith-valued hypothesis, by definition, is worth more than all hypotheses in the world that are based on money. If money is valued instrumentally, it is by definition worth less than our objects of transcendental value, meaning all hypotheses valued in a faith-based manner are worth more than those valued monetarily. If money is valued as potential, it does not matter how many people believe in it, those who do, cannot recognize *an* object of transcendental worth. Anyone who recognizes money as a concept and thinks it has worth because of its potential, necessarily thinks that if an object had transcendental worth it would be worth more than potential. Otherwise, they think their money has intrinsic worth, i.e. misers. Thus, if we are holding constant the idea that we have two comparable hypotheses, one valued with money and the other valued with faith, we can easily see how in a decision making

framework, the practical value is worth more in the faith based context than the monetary based one.

We should note that faith is not a concept that gives a hypothesis transcendental value, faith is the concept persons use in order to *believe* that an object has transcendental value. It is not the case that we need some agent to decide that something is a faith-valued hypothesis. Faith is a belief. As long as we want to believe or in other words, want to argue, that a hypothesis has value outside of a monetary sense (for whatever hypothetical purposes) it is a faith-valued hypothesis. A faith-based hypothesis is any hypothesis that we hypothetically want to compare to a monetary based hypothesis, what gives it “faith” is the idea that we are arguing for it as a more practical hypothesis than a monetary one.

For our purposes as long as it is open that this object of value has transcendental worth, i.e. that faith in it could be correct; the faith is immediately more rational than any theory of money. Based on the doxastic-decision theoretic theory the rationality of a hypothesis is its potential worth to us, and a thing that we actually value is worth more than all the money in the world. As long as it is open that an object is worthy of transcendental faith, money cannot be a more rational theory of value than belief in that object. As was previously derived, prior to a theory of value, all value-based hypotheses are faith based. Money was supposed to be our way out of that conclusion.

Compared to faith, not only is money comparatively worth less, if money is valued (i.e. as potential) it is a faith-based hypothesis. The notion that faith valued hypotheses are more practical than money based ones isn't telling us new information; because money based hypotheses were always faith based. Thus, the notion of statistics being practical beyond faith is in serious trouble, because you are always comparing faith-based notions of value. However, it is a very different sort of faith, because the faith in the idea that money has potential is a faith without an object of value.

It is for that reason that money has a rhetorical force that I think is worth discussing. In rhetorical senses, money is a social construct and it depends on the faith that other people are also insecure and will value the same things that the pricing of money says they will value. Even if we value money as a means of communication, we need faith in order to believe that other people will continue to value that money. Individual people only value money if the objects of their desire are not in their grasp. If we want to vouch for money's worth as a faith-based concept, we have to admit that it depends on other people's insecurities. Thus, in order for an individual to think his/her money will help them get what it is they desire, they also have to believe that other people do not have what they desire. It is a convoluted circle that allows a monetary system to make sense. Not only is any reasoning that we have faith in more valuable than the concept of "money", even the idea that money can be valuable as potential, as communication, as a store of value, depends on the idea of faith.

Review of Concepts Up to this Point

Before we review exactly what about money makes this true, we should see what this implies in less abstract terms. Individuals have objects of worth based on their subjective preferences. Decisions can be said to be practical if they relate to these objects of preference. In a world with no data, we have trouble with prediction because we have no way to understand trends. Thus, it becomes equally practical that a guess about the future will have a desired result, since we have no data to base our predictions off. If there is always uncertainty, we wish to know if it is possible that some manners of prediction are more "practical" or more "reasonable", and are more worthy than "guesses". By "practicality", we want a concept of prediction that relates to objects in the exterior world that we care about and that allows us to make unbiased inferences.

Assuming a piece of data can in fact give us insight into the nature that represents the data, we can extrapolate some prediction from it. However, this prediction necessarily has a probability

less than one since we don't have true access to the laws of nature. When we consider a physicalist probability, we understand that we cannot have a fractional binary event, i.e. .8 of a sun; thus, our prediction cannot be more practical than a guess (in that sense), since the rigorous method of statistics yields, something we know is an impossibility. As such, it violates the unbiased inference we want from practicality.

An epistemic probability still yields us with the same result, since we know through imagination that .8 of a sun can't be possible. If we consider our epistemic probabilities doxastic and decision theoretic they relate to how likely a hypothesis will lead me to a practical decision; in that sense a variety of "incoherent" concepts can help me make a decision, and as such as long as we can "value" the "output" of the decision in some manner our statistics have coherence. The Frequentist understanding of hypothesis testing does not make sense since the hypothesis is valued based on the data. The data is considered "real" and falls to the same .8 of a binary event problem. Bayesian statistics is more plausible since it considers that hypotheses have value in an a-priori sense, i.e. they are all possible and then data reduces likelihood. Ultimately, because data isn't "fixed" hypotheses cannot be definitively removed, meaning that we can only consider likelihood in terms of bets. Bets that one hypothesis is more likely than another. This leads us to expected value. The rationality/practicality of a bet is based on the value of what we are betting with. However, the value of a thing we are betting with clearly has to do with faith and even if it didn't falls under the same .8 of a binary event problem as before. Wanting a theory of value that could be practical in terms of both preferences and unbiased inference we turned to money.

Money is less valuable than objects of transcendent worth. If we are judging rationality based on value, then as long as you believe in something of transcendent worth, it is more "practical" than any decision valued in terms of money. A person comes up with a hypothesis that says that drinking liquefied poison toads will help them find God. Our data scientists tell us that

drinking poison toads will result in an expected value, expressed in dollar terms of negative 30 dollars, based on loss of life. When comparing these two hypotheses the person making the decision would choose to drink the poison toad for a chance at transcendent worth. This is a perfectly rational decision because one God is worth at least a transcendent amount of money. Because money is supposed to represent a store of instrumental value, and not value itself; as long as a person believes in his/her self, believes that they are valuing their chance at God, their decision is perfectly rational in expected value senses.

In a more intuitive sense, because there is a chance no matter how tiny, that drinking poison toads will bring transcendent value, that transcendent value multiplied by as tiny a decimal as possible will still be worth more than all the money in the world. And this isn't because the concept of God can't be interacted with probability. .01 of a God might be an incoherent concept, but because practicality is only defined as the value from an idea, as long as we have faith in the idea, it is worth more than the faithlessness that money (as a strict instrumental concept) is supposed to represent. Money represents faithlessness, at best, it is the hope that we can one day find something worth spending money on. Even if other people will never understand why we drank those poison toads, as long as it is open that we could have been right, our actions and our beliefs are practical.

We can be agnostic about practicality as a concept. We can insist that money is worth the same as objects of transcendent value, because we are talking about hypotheses not money. But then we give up on the whole purpose of the exercise to find an unbiased model of prediction. We would simply be comparing two faith-based hypotheses. Moreover, the "scientific" evidence that leads us to one of those faith-based hypotheses would just be rigorous guesses founded on faith, because we gave up on unbiased empirical prediction, i.e. statistics.

The only other option is to hold onto our concept of statistics, hold onto expected value, and simply have faith in money. Faith that money is of instrumental value, that it has potential, that

insecurities are well founded. However, the insecurity that money represents is at least partly at odds with the concept of faith. Therefore, the faith in transcendental value and the faith in money are different kinds of faith because of the insecurity that money necessitates.

The person who has no object/idea of transcendent worth to work towards personally finds his/her actions to be pointless. Perhaps they care about money because it represents potential, a store of value and communication. This person almost by definition seems lacking in faith, considering they have no object of transcendent worth to believe in. If we have a hypothesis this person is trying to give weight to, they will obviously not value it by using measures with personal worth, because they have no such concept. Thus, they will use this “placeholder” called money. However, all of money’s properties, its potential, its store of value, and its means of communication depend on the value systems of other people. Things outside of the agent’s control. When they are trying to make a decision based on two hypothesis having differing expected values, for the money that gives those expected values weight to even have meaning they need to have faith in the concept that other people value their money. All of money’s worth is priced on insecurity, and even the idea that people will remain insecure requires faith.

Chapter Six: Potential Counter Arguments, Faith and Insecurity

In this chapter, we will explore certain counterarguments to the claim that faith makes expected value irrelevant.

It seems as though we can value money while still valuing objects of transcendent worth. We might say that money’s ability as a store of potential means you can still value it even though you have objects of transcendent worth. We can recall the example with the family person and their car dealership. It is important to note that the car isn’t worth anything to them; the car isn’t actually worth the 40,000 dollar sticker price. Presumably, because the car can be thought of as the

teenager's happiness, if this happiness is of transcendental worth to the family person, the money is of instrumental worth. Economic decisions can be complicated; perhaps the family person thinks that the teenager can live without a car and that spending that money will make it so that the teenager will die of malnutrition. They could also think that spending money on a frivolous object will impede the child's development and thus the car might have a "monetary" value that is less than transcendent. In both of these senses, the money isn't worth infinite dollars. Ultimately, all of these examples presume an insecurity that makes the money valuable. Money is only valuable as potential if we are insecure that we won't get what we want. In the case of the family man, there is absolutely no reason not to blow his life savings on the car if he has faith that anything else his family might desire will be fulfilled. We can certainly argue that this is incredibly unrealistic, why would we ever think that things would work out? Why would he ever have faith? That is an important question; first, we should address other objections.

A second objection might be that having an idea of transcendent worth is an incredibly high hurdle to believe in. However, I want to reiterate that a thing with transcendent worth is something that is worth more than money. Under certain theories about decision-making, we can say that anything you would trade money for has "transcendent worth." If we truly had objects of equal value we would not make a trade, or at best be indifferent to the prospect. Thus if we ever actually trade our money for an object the object is implicitly worth more than the money. This object of transcendent worth doesn't necessarily need to define us, and if we imagine these "micro" transactions, anything an individual wants has transcendent worth. If you give up 100 dollars for water then water is worth more to you than those 100 dollars. You don't keep your money because you found something you want to spend money on. Transcendent worth isn't a high hurdle because transcendent worth simply means worth more than money.

Perhaps the objection is trying to target a different intuition. Can we ever really let go of money? Yes, I want that water, but that water isn't actually that important to me, I can swallow my thirst if I can save that money to get something that is more important to me. We can worry that everything has a specific economic value to an agent for this very reason, and that we shouldn't pay more for it. Basically, no matter how much we want a particular thing in the back of our minds we will always value it in terms of "money".

In response to this, I can only say that this idea that money ultimately drives all transactions has its roots in deep-seated insecurity. This isn't to say that the insecurity isn't warranted. However, it would not be charitable to say that it is inconceivable to imagine a person without insecurities that has a thing they value more than money. As long as we have a single thing that is worth more than all the money in the world, money is worth less than that object. Admittedly that is hard to imagine so we posit the idea of God, and usually people use faith to believe in god. In fact, without a definitive proof, it is faith. Just because we can't imagine a thing worth all the money in the world doesn't mean other people don't have that concept.

Money can represent communication, and depending on how seriously you take the metaphor, even language can be described as currency, as such, if we abandon money we abandon communication. We can even refine the intuition behind this objection: under some understandings of the human will, if you are alive it implies that you want to interact with others. If humans truly only lived for themselves, the outside world would be of no value, and as such they would have no reason to live. Therefore, as long as you are alive, it implies that you wish to communicate with others, and as such, money should be considered of doxastic-decision theoretic value to all living agents.

The problem with this objection is that it forgets that there are many ways that humans try to communicate with each other, and not all of them are rigorous. A naïve teenager can shoot bashful

glances at the women of his dreams and hope that she will somehow find that attractive, and consequently understand his feelings. It certainly is possible that the woman will understand these awkward signs and fall in love. I wouldn't bet on it, I might believe it is more reasonable that if he speaks to the woman using his words that would yield him a better result.¹⁴ If the teenager's romanticism is of transcendental worth to him, and believing in the monetary hypothesis would compromise that romanticism, the value of that romanticism is worth more than any monetary hypothesis. His means of communication is worth more than the monetary hypothesis because his means of communication is of worth to him.

Perhaps I am misunderstanding the scenario. Our eager romantic doesn't care about how he gets his feelings across to the woman in question. Any method will do as long as she understands that he loves her. The communication is a means to an end. Any method will do and the method itself has no value to him, thus he might as well pick the hypothesis that relates to the highest expected monetary value. However, even in this scenario, where he has abandoned the importance of all epistemic beliefs in order to acquire the object of worth, he has a problem when he tries to compare meaningless hypotheses. Even if the subtle and bashful method only had an expected value of 20 dollars, whilst the direct method one of 40 dollars, the idea that 40 dollars is worth more than 20 dollars depends on the idea that money is worth anything at all. And in order for money to be worth something, it depends on the belief that not only you, but other people, consider objects of value to be pointless, because the moment a person has their object of worth, money is worthless to them. Thus, it takes faith to believe that money is worth something. Not everything needs to be understood in terms of money, and the moment we care about a particular belief, money becomes worthless, and even if we are indifferent to beliefs, money itself requires faith.

¹⁴ But then again, what is the value of what I am betting?

I do think it is worthwhile to reiterate that faith based predictions aren't a relic of an archaic generation. I am going to reference a cliché because I do not know how else to convince someone that we can believe in forms of communications that might not be “monetarily” rational. I don't believe we say the words “I love you” when we are positive that another person will understand those words. To sound stupidly romantic, some people think that love is a leap into an unknown. People can say one thing and mean another, some people are mean to the people they like, these are all forms of communication. When we say the words “I love you” and hope to have them reciprocated, we can't always make a clear ledger of actions our object of interest has done in order to calculate the likelihood that they will reciprocate. The point is, when we say the words “I love you” (assuming that we mean them), it seems that by definition we care about who/what we are speaking to.¹⁵ If that is the case, all love-based communications defy the concept of money; we do make cognitively faith-based predictions in our regular lives.¹⁶

There are forms of communication that might be unprecedented even if they are hard to imagine. If we imagine an artist writing a book, it is at least conceivable that certain aspects of their writing relies on a faith-based communication beyond everyday language, specifically in metaphor and reference. We can find awe in unintuitive configurations of language that convey meaning beyond what the words themselves “mean”. That seems to be what certain forms of poetry represent. As a response, we can say that all the “quirky” methods of communication we come up with can be determined by science and can be given some monetary weight. This might imply that humans can't operate on true faith based modus operandi of communication. When a person touches their earlobe three times that means they like you. There is nothing incredulous about

¹⁵ Whether we want to be cynical and say we value them as an object as opposed to a person, is of no importance, we care about some aspect about them.

¹⁶ Hilariously, it seems to be that those who think love isn't a faith based “leap into the unknown” are those who believe in empirical prediction a little bit too strongly, as to make cynical the concept of love. But that is probably an unfounded empirical prediction, not that empirical predictions necessarily mean anything.

thinking that those patterns exist. However, believing in these patterns does rely on faith and faith in money relies on insecurity. However, I do think there is something deeper here, and it ties into an earlier objection: why would we ever have faith and why would it ever help me not feel insecure?

Faith and Insecurity

I think this perspective relies on a severe misunderstanding on what the concept of faith is supposed to represent. People who have faith presumably are insecure, otherwise they wouldn't have faith, they would be "certain". Their faith is supposed to represent a belief in the face of insecurity that exists because of uncertainty. Of course if a person has too much doubt then they wouldn't have faith anymore. It seems as though faith is some sort of delicate balance between insecurity and belief. I don't posit the levels that make an epistemic attitude have "faith" or not, nor is it of importance for my purposes. I think one avenue of attack might be pushing this insecurity point in order to showcase that individuals can rarely let go of enough insecurity to ever not value money.

Faith in money obviously relies on insecurity, and so it is reasonable to ask if we can ever defeat insecurity. A person can always have doubt. Even when a person makes a decision based on an epistemic belief, they ultimately have a predetermined insecurity that can always be expressed in monetary expected value. That is the hope of science, even if we can't perfectly approximate the laws of nature, they might still be what we expect; and our best attempts at the laws of nature are representations of what will truly occur.

Before I said that the hope of science was that we could garner some empirical understanding of subjective preferences, so perhaps money still has a shot. However, this hypothesis is itself based on empirical data making its worth only understandable through money. If we want to understand these statistics in a non-Bayesian framework, we understand that they are epistemic impossibilities (i.e. a fractional binary event). Furthermore, even if we could agree on an

object of worth, money would be supplanted by this “actual” idea of value. However, this would again be a binary object that cannot be understood as a number other than 0 or 1, meaning that our expected value, which necessarily has to be less than 1, will make it an epistemic incoherence. Because science is tied to uncertainty, no matter how much it progresses the predictions themselves will still need faith. Again, there is something more intuitive to this line of argument.

When an individual thinks they do something for a transcendental idea of value, they can obtain that object and find out it wasn't worth anything to them. Even if these are epistemic attitudes, perhaps this belief doesn't provide the transcendental value they believe in. I certainly haven't postulated how believing in a thing of transcendental value actually makes a difference in someone's life. In the case of a person who cares only about saving their own life and foregoes the scientific method for a less “rigorous” method, there is still the possibility that they made the wrong decision, even if they are “rational” in their decision making process. We might say, “You make that decision but you will soon regret it, because science predicts that it is more likely that that potion of toad will harm you.” Thus, we have the intuitive argument that relies on the idea that science has held onto the thread of hope that aligns with the laws of nature. Because ultimately it is hard to escape the feeling that what is rational is ultimately what gets results. Science is a collection of relevant human experiences, why shouldn't I think that those experiences would get me the best results.

Belief in money is different from valuing other ideas of value, because it resigns the believer to a state of pointlessness that can only validate itself by propagating insecurity. Money's value is contingent on the continued insecurity of not only an individual but also those around the individual who consent to the currency. If money has worth as a means of exchange, if other people don't believe in it my money is worthless. If I am a person who thinks money has true value because of its instrumentality, I have by definition given up on the idea of transcendent worth. If I believe that

money is valuable, since I can't believe it has transcendental worth, otherwise defeating the purpose of money, my faith in money implies that other people's insecurities make my money worth something. My best interests are aligned with the accumulation of money and the continued idea that other people will value their personal insecurity as well. Whether or not I act upon this incentive, in order for the only thing I value to be worth something, other people need to value their insecurity and believe in this currency. It is in my best interest to propagate and effectively, feed on their insecurity.

Perhaps that isn't as malicious as it sounds. Our family member is in the hospital and we need to decide what the best course of action is. Generations of our ancestors say that our proprietary potion will cure their ailment. Multiple scientific studies say that other treatment methods would be better. Nevertheless, it's important to us that our ancestor's traditions be upheld, but we also care about our family member. We ultimately pick the ancestral potion. What if we are wrong? That is insecurity. We are ultimately saying that the opinions of human experience, the data around us, are worth more than our beliefs. That the support system of belief of data around us is worth more than the personal faith systems of whatever led us to have our beliefs. However, thinking that the repeated experiences of those around us are more valid than our limited experience is still a leap of faith. The reason the leap of faith makes "intuitive" sense is because the insecurity that makes money valuable also makes it so that we value other people's opinions. Ultimately, insecurity is that we care about the stimuli of the things around us, that things outside of our control might conspire against what it is we value. But, if this is the only way science is intuitive, then it's a self-perpetuating bully that can't even promise us salvation. The insecurity that I need an object of instrumental worth without the hope of an object of transcendent value.

What does it mean to be secure with one's beliefs as it relates to value? It is to believe that ultimately our methods of interacting with the world will lead us to our desired outcomes. That the

things we value will fulfill us in some deep sense. It is to have faith in your epistemic attitudes. That is a very powerful claim, as we have no certain reason to think things will work out in our favor. Why would we think that things would bend to our will now and in the future? That is a lot of power for one person. And that is why it is at least conceivable that many people posit a God that has this sort of power. That it would make sense could make everything work out in the end. That even if you don't get the objects of value somehow the God's power will provide some alleviation. Somewhere in there is some idea of security. I am not willing to say that you can only have security if you believe in God but it does seem difficult to imagine a concept powerful enough to provide that sort of security that isn't god if you don't believe in human experience. If god is a provider of security then presumably an individual will value his/her belief in God. If God is something of worth, the believer's actions will align with God's missions in some way or another.

Thus, we can imagine the person who believes in practicality in so far as it relates to some notion of god and the person who believes in statistics/sciences because they have no preference to epistemic attitudes. Statistics and science represent money, which represents the hope that people's collective insecurities can create a shared notion of value that is coherent. Besides being pessimistic of love the scientific method tries to represent security without value, the sort of security that the God in the believer's system provides. But money can't provide security, because its entire value is based on insecurity. Science has never had complete certainty in discoveries of laws of nature.

The God believer's entire system of value depends on something they have decided is important. A person who values money can't say that their system of value depends on something important; otherwise, they wouldn't be representing money anymore. What they consider "valuable" they cannot personally consider important. In their personal framework, not only have they given up on importance but also have admitted to a perpetual uncertainty on value. The moment someone gives money importance it ceases to be tradable, meaning that it ceases to be

money. The “God” believer’s faith is an uncertainty as well but at least it represents something that matters, and something with the ability to provide security, even if it is only through faith and devotion. I am trying to make the case that on an intuitive level, faith-based predictions need not be stigmatized for their lack of reasoning because at the very least they provide a hope of security.

Perhaps there is something wrong with being “intuitively” valuable because of a sense of security a security that admittedly could be false. Perhaps selling “security” is worse than peddling insecurity, because insecurity is a reality that we live in, because we live in uncertainty. We could say that it doesn’t matter that science/statistics doesn’t provide a sense of security because it provides a guide. Religion provides a guide as well, but its extra sense of security could be deemed as coercive because it isn’t concrete and definitive. People’s insecurities lead them to suffer, and both science and religion leverage insecurities in order to help people make decisions. God provides believers a sense of security that could be coercive because it could be false. Science/statistics does not make that claim, it admits its fallibility and thus isn’t coercive.

God/ Objects of transcendental value dictate what an individual should do, in a way that money cannot. The sense of security that “god” or objects of transcendental value provide is a sense of purpose. Science and the statistical inferences it uses, cannot tell you what it is you should love, while transcendental value/religion/god does try to tell you what it is you should love. So to think that religion is coercive we have to think that following what it is you love without certainty is dishonest. But that seems like a surprisingly defeatist view on love and suffering. It implies that falling in love without being certain of the value in the object is undesirable or even coercive.

There is nothing inherently wrong with that intuition, but it contradicts with the sort of perspective necessary for money to be worth anything; specifically, the perspective that communication with the exterior world is valuable. If you think the idea of uncertain senses of purpose is damaging because you could be wrong, then it would seem as though the sort of faith

necessary to make human contact worthwhile would also be damaging. The intuition that gives insecurity its power seems to be contradictory, because if trying to find security is damaging in some way, then why would you ever want to communicate with others? Money represents uncertainty, uncertainty that there are things of value, but it also represents an interest in commerce. If you are so risk averse that the idea of investing in something of value that could backfire is coercive, then why would you collect money? If the risk of falling into a false love is too great, where does the confidence that one day your money will buy you something valuable come from? If money can never buy you something valuable, it is utterly worthless. Both religion and science (presumably) have their uncertainties but the uncertainty that science peddles is not only pointless but needs to further insecurity to be relevant. It does not represent the hope of transcendental value. But usually, people don't think in these terms, they view money as an instrument to value or they simply take it on faith that science is worth something. Ultimately, even believing in money is a faith-based claim, so perhaps the question of "why would you collect money" can't be aimed at anyone in particular.

Conclusion

In some sense, the purpose of the thesis was to try and make what was originally intuitive, intuitive again, in some rigorous sense. I think the majority of this thesis can be summed up with clichés, figures of speech, and idioms. "The only thing that is certain is that things are uncertain." "Those who care about money are insecure." "Money is power." "Money is a means to an end." "Believe in yourself because that is all you have." "You might be right but I wouldn't bet on it." The practical worth of science's predictive power and the hope that statistics was supposed to provide was probably going to be dubious.

I wouldn't say that there is an appropriate intuition in regards to predictions. I do see how the rhetorical points about money can be convincing. But that is ultimately because of insecurity.

And it isn't a "logical" or "rational" belief. Money is the easiest way to understand scientific/statistical prediction and it is probably the closest thing we will ever get to coherent. But it still is faith based. And I believe it is important to keep that in mind. We don't have more of a right to prediction than those who simply "believe themselves" or "believe in god". All we can say is I would not bet money on it. But money is a social construct that is priced on insecurity. Even in intuitive senses, it would be ironic to try and think our insecurity is worth more than anyone's chance at fulfillment. These are just everyday ironies. But it doesn't mean our predictions are going to be wrong just because they are scientifically based, it's just the basic problem of induction, and we can combat that however we want. But it certainly isn't "practical" and it's probably not "rational".

And so we return to the intuitions from the introduction, I find it hard to believe that anyone in their heart of hearts doesn't find the general problem of induction daunting. That our empirical predictions were ever going to be anything other than faith based. But I think the concepts of expected value and money as ways of understanding insecurities are helpful. Money represents communication, it represents self-feeding insecurity, but it isn't "evil", and we can sometimes have faith in money. People are insecure, and so when we don't have an answer to a particular ailment of the soul, money is helpful as an intuitive panacea, but money isn't what they are looking for ultimately, and I believe that that is also intuitive.

It is also intuitive that it is difficult to deal with other people's opinions and predictions, especially when they contradict what we consider to be right. Therefore, running behind the collective experience of man through the concept of money is something that will probably always continue. And if we recognized our faith based predictions as "merely" faith based equally to everyone else's it seems difficult to muster the drive to act upon your predictions. Science/Statistics will probably be here to stay because that is the only thing you can reasonably bet money on. Even

if this thesis successfully undermined the idea of “probably” “bet” and “money”, it is difficult to act without thinking something is more likely than something else. I don’t think there is an appropriate median that can reasonably weigh monetary concerns and all the communicative abilities money is supposed to represent, with the idea that these are all faith-based methods of prediction. In intuitive senses those intuitions seem to preclude each other. It might just be an animal instinct to say: “if it works it works.”

I will end with musings that in philosophical writings, that empirically have been found to have the risk to be understood as trite and unfounded, because I have spent many pages trying to make the unempirical intuitively plausible. Ultimately, if people can’t have shared predictions through money, then how are agreements supposed to be completed, how are economic systems to be formed? How is the potential of the people to be invested in? It just doesn’t seem practical. And maybe it is a shame that money requires and begets insecurity, and that the pointlessness of that potential might be necessary to create a functioning ecosystem. But, I guess those are the expected values.

Bibliography

Works Cited:

Romeijn, Jan-Willem, "Philosophy of Statistics", The Stanford Encyclopedia of Philosophy (Fall 2014 Edition), Edward N. Zalta (ed.), <http://plato.stanford.edu/archives/win2014/entries/statistics/> (accessed November 29, 2014)

Works Referenced:

Berger, James. "The case for objective Bayesian analysis." *Bayesian Analysis* 1.3 (2006): (385-402)

Casella, George, and Roger L. Berger. "Reconciling Bayesian and frequentist evidence in the one-sided testing problem." *Journal of the American Statistical Association* 82.397 (1987): 106-111.