

# Why Does Possibility Exist?

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# Abstract:

Why does possibility exist and where does it come from? These are questions not usually asked because possibility is so deeply woven into the fabric of the universe we take its existence completely for granted. By exploring a well known, but essentially unexamined absolute first principle, we describe why possibility exists, where it comes from and the form it takes in our universe. We describe the fundamental mechanism which enables possibility to exist and to resolve to choice in context, which means we also generate the existence of context and choice. We discuss a number of examples to demonstrate how this mechanism operates and what it means.

In the late 19th Century, paradoxes revealed that no true universal set, no true set of all sets, can exist. Axiomatic set theory was developed as the solution to the problem this impossibility presented and the impossibility was treated as a failure of the naive conception of set theory and was set aside. We do not address set theory except in passing. Set theory assumes possibility exists to describe which sets are possible. We look instead directly at the meaning of the impossibility uncovered by the paradoxes to uncover why possibility itself can exist. This has never been done. We show that deriving without assumptions from this impossibility generates a specific structure which enables the existence of possibility, context and choice.

We begin by explaining the process by which we focused on this impossibility; we describe the process by which we can answer a question so obvious we take it for granted. We then derive the existence of possibility, context and choice and define the inherent structure we call the Choice Mechanism. To use a metaphor from the paper, we describe a box whose sides are absolute impossibility and which can be filled with all the possibility that can exist. By structure, we mean an actual structure in which possibility occurs and through which all resolution of possibility happens.

The rest of the paper consists of five discussion groups. We present in these a number of illustrative examples all of which cannot currently be explained. To be clear, we use the Choice Mechanism to provide the missing "why" for a number of otherwise unexplainable, fundamental phenomena, with each discussion group covering a major aspect of how this underlying structure for possibility appears and operates.

1. The first group explains how the Choice Mechanism calculates: we explain why numbers exist, meaning both Base 2 and Base 10, why the fundamental analytic constant  $e$ , the base of natural logarithms, exists and why functions exist. Again to be clear, we mean we derive the actual existence of numbers, of  $e$  and of function. We show in this and other sections how the universe actually calculates possibilities and how those become results.

2. The second group discusses physical examples which literally manifest the Choice Mechanism context structure; we explain why the logarithmic spiral occurs in nature and how

the context structure of the Choice Mechanism completely explains certain fundamental behaviors of elementary particles.

3. The third group focuses on how the Choice Mechanism context structure operates, specifically on how coherent resolution to choice of context expresses as a force; we explain why natural selection and economic “markets” exist.

4. The fourth discusses fundamental aspects of how the Choice Mechanism acts on persistent structures, meaning how coherence interacts with things that have a past, present and future. This section contains too many examples to list.

5. The fifth discussion group describes how the Choice Mechanism functions at scale, meaning the effects of coherent resolution of context to choice at various scales of existence: we explain why the arrow of time exists and why the subjective experience of time exists. We also explain why and how constants of infinite depth can exist in a universe in which time exists.

Please understand this work completely agrees with established fact and theory, does not in any way rely on "hidden variables" or new particles or forces, and is not in any way mystical. We do not advance any new paradigms. We merely explain what we in essence already know: that possibilities exist and that somehow these come together to make our universe and all that happens in it. We provide the missing “why”. We understand this is difficult to believe. You have to read it. We can't otherwise persuade you.

The material is presented in a non-technical manner. The math is trivial.

No contact information is provided because we prefer to remain unknown.

# What This IS:

## AN INVESTIGATION OF THE OBVIOUS

This is an investigation of the obvious. Something so obvious we take it completely for granted: the existence of possibility. Not probability. Not chance. Not dumb luck. Possibility. The existence of alternatives. What might be or not. What might happen or not. What did or did not happen. What was or was not.

Ask yourself: why does possibility exist? Ask yourself: does that question make sense? Can you imagine yourself without possibility? Think about it. Can you imagine anything happening without possibility? Think about that.

You have a choice. You can decide possibility is a given of our universe, a condition which can't be analyzed, whose existence can't even be questioned. Or you can read on. Two possibilities. You pick.

If you choose the former, good luck and thank you for your time.

If you choose the latter, here is what you will find: we will identify an absolute first principle and will derive from that the absolute minimum structure which generates and shapes the existence of possibility so possibility not only exists but is enabled and resolves to choice within the constraint of contexts. We will then prove we are right by using this structure to explain a wide variety of unsolved fundamental physical and mathematical problems.

If you choose to read on, you will understand why possibility exists and what that means.

Enjoy.

## WHY DOES POSSIBILITY EXIST?

Why does possibility exist? Where does possibility come from? Not how possibilities are counted or how probabilities are figured but the literal, almost child-like questions: why does possibility exist and where does possibility come from? Is possibility a given, an essential piece of our universe that just is, or is there a reason that enables it to exist? If there is a reason, how does that reason show itself in our universe? Where does the actual existence of possibility itself come from?

These questions may seem odd. All our science relies on evaluating possibility. Our lives are journeys through possibility. We take possibility's existence so completely for granted we don't acknowledge its existence as an assumption. Look at books on probability. They don't begin, "Let's first assume possibility," because that assumption is so widely shared it need not be mentioned. Even Kurt Gödel's work on the incompleteness of formal systems, which directly addresses first principles, assumes we can make a list of possible formal statements.

We also take for granted that possibilities somehow manage to combine or calculate and resolve into choices and results. We take for granted that possibilities directly and consistently relate to whatever happens or does not. Even the word "choice" implies more than one choice is "possible." We can imagine nothing happens but only as a possibility versus something else actually happening. When we say, "He has no choice" or "There is no chance" or "This is inevitable," we refer to a set of possibilities for a particular situation, not to a real lack of any possibility at all. These assumptions are so deeply rooted we don't realize they exist.

We all know events come together over time, often in highly predictable ways, sometimes randomly, sometimes inevitably. We measure and predict from the smallest scale to the very large, from tomorrow's weather in your area to national elections years in the future, from who wins today's game to who might win the championship months from now, from what happens in your individual day to local, regional, national and international levels of economic activity. We currently price complicated financial instruments based on expectations about the future. We have immensely detailed tools for modeling the possibilities inherent in both current measurement and potential future outcomes. All these measurements and predictions, every one, share an essential trait: they require that possibility exists and that it is constrained over time into choices we can at least try to measure and rank.

We will explain why possibility exists, the particular character it takes in our universe and the structure possibility inherently describes and takes. We will explain how this structure enables the existence of context and acts as the inherent mechanism through which context constrains possibility into choice. To be absolutely clear, we are not talking about probability, but the fundamental concept of how and why possibility itself exists and how possibility inherently resolves into choices within constraints imposed by contexts. These issues cannot be separated: the structure which enables is also that which constrains.

It is important to note five general points. First, much of the difficulty is contained in formulating the question and identifying how it can be answered. We want to make this completely clear: much of the difficulty in this work is identifying the question and putting it in rigorous terms. The existence of possibility hides in plain sight, using its obviousness to escape notice. We could say this work is an investigation of what may be the most obvious thing in the universe to uncover what that obviousness means.

Second, this work is easily repeatable. When we finally learn to see a thing hiding in plain sight, that thing becomes so obvious we may wonder how it was able to hide so well for so long.

Third, not one thing in this work contradicts in any way the science we already know. This entire endeavor uses well understood, universally accepted fundamentals. It then applies the results. There are no claims of new paradigms, no elevation of speculative fringe theories, no new forces or particles, no extra or hidden variables, no radical over-turning of proven ideas. This work is rooted in very well understood fundamental concepts, not in something claimed to be previously unknown.

Fourth, this work is not a philosophical or spiritual construct. It is in no way an extension of mystical approaches to or definitions of the physical universe. We want to emphasize that point: this is an investigation of specific questions, grounded in absolute fundamentals, and then a series of relatively brief discussions of the meaning of the answer. Because the questions are fundamental, the answers have fundamental implications. To repeat, this work is not rooted in belief or faith.

Fifth, none of the many problems, phenomena and issues discussed in this work can currently be explained. Many are considered unsolvable. Others are taken for granted and, like the existence of possibility, aren't even recognized as questions. Some are treated more as philosophical issues. Please keep in mind each time we ask, "Does this make sense?", the alternative is generally that no other answer exists at all.

A note on style: given the wide variety of topics and the need to be clear about the main ideas, we try to present the material in as non-technical a manner as possible, using simple language and repetition of key concepts. We focus on presenting only the concepts most directly related to why possibility exists and where it comes from. We avoid extended technical discussion.

# Basics:

## 1: HOW TO ANSWER AN OBVIOUS QUESTION

Since much of the difficulty is in formulating the correct question, we begin by discussing how we go about answering questions that hide so well we don't realize they exist. Once we say, "Possibility exists so it must exist for some reason," where do we look for the reason? How does one answer a question too obvious to be seen?

Let's begin with what we know. Remember, we are looking for a reason why something completely obvious exists. We know the answer is not likely to be in any area we have already worked over because odds are we would have seen the issue in clear enough form for it to be recognized. In other words, we can reasonably conclude the answer isn't obvious because it isn't obvious, not because we missed something. We can, of course, overlook questions but these tend to be small, even trivial. Odds are strongly against a reason with such important consequences hiding in an area we understand well.

What are we looking for? We referred above to areas already worked over. Think of these for the moment as plowed fields. We haven't necessarily exhausted the field but the soil has been plowed well enough that we have a good grasp on the problems in it. This suggests we need an unplowed field. Where to look? We can't expect to uncover a new field of inquiry that expresses itself physically in our world, meaning some unobserved physical phenomena. That idea is ridiculous.

We need an unplowed field we somehow can't see. We know we can't see it because it isn't plowed and, being a curious species, we can assume we would have examined it if we could see it. Why would we not see an unplowed field? What could hide it from view? In regular life, we can't see something when something else blocks our view, when a barrier is in the way.

We have moved from identifying an obvious question to looking for a barrier that prevents us from seeing an unplowed field. We normally try to see over or through or around a barrier. We try to knock a hole in it or climb over or dig under it. Any attempt to deal with a barrier means we know a barrier is there. If we know a barrier is there, even if we don't know its size or shape or properties, we try to see what is on the other side. This means the barrier must be in our perceptions, meaning a barrier we don't realize is there, one that blocks what we perceive. It must be a barrier to what we think about, a barrier that prevents us from deciding to look. That would be a reason why we haven't plowed that field.

To keep with the metaphor, we plow fields that look promising. We plow fields we think can be plowed. We don't plow fields we believe are unproductive or which we believe literally can't be plowed. This suggests we look for a field we haven't plowed because we thought there was no reason to do so. Note the wording: odds are we haven't looked in that field by choice, not because

we didn't realize it was there. To be clear, that suggests we found something better to examine, because the alternative is we simply failed to see a potentially productive field. Since odds are we turned away by choice, that implies we saw something, looked at it and that looking led us into another productive field. That next or second field must have been productive because odds are we would at some point have returned to whatever we originally noticed to explore more aspects of it.

We are getting close. If we were choosing between relatively productive fields, we'd at some point investigate both. This means we did not merely find a better field but decided the other was not relatively but absolutely unproductive. If we believe something is absolutely unproductive, that would make the barrier to perception very, very strong, which makes sense because we're discussing something obvious we somehow have not investigated. This implies the barrier is a problem whose solution left something behind which we have had no reason to examine. This problem would need to be substantial, even existential, because whatever the solution left behind includes something hidden that is fundamental. This line of reasoning suggests some inquiry was begun, ran into a problem and the problem was solved in a manner that left something behind. We then wouldn't look at that something because it would appear unproductive, to be nothing more than a problem. It might even seem to be a mistake or a failure in the original direction of the field.

We have narrowed our scope so much only a few examples might fit. Going backward from the present and looking at the most obvious choices, one is the problem of infinities arising when calculating in quantum physics. This was famously addressed by the process of renormalization. Another choice is the axiomization of set theory after George Cantor's original conception of sets — generally known today as a form of naive set theory — ran into paradoxes. These paradoxes mean certain sets are not possible, sometimes called illegal because they can't legally be formed. This problem was solved by developing axioms which define how sets can be formed, meaning the rules by which sets legally exist.

If we look at renormalization, we still have significant questions about why it works and also about what it means. If we know these questions exist, are they barriers to perception? Remember, the thing we're looking for is likely to be quite obvious once seen because possibility itself is obvious in our world. That suggests renormalization doesn't fit: we still look at the issues renormalization left open so we should notice something obvious. The same logic applies to the basic issues of quantum and chance: they are the subject of a vast literature. It would be foolish to imagine we could miss something obvious there.

Moving to the axiomization of set theory, we can see the paradoxes led to the formulation of axioms and how these make set theory work. To oversimplify, the original idea of a set as a collection or group of things was found to have a limit: rather than extending to a set of everything, to a set of all sets, the paradoxes revealed that some sets are literally impossible. The paradoxes mean there is no true set of all sets, what is sometimes called the inability to form a true universal set. We know the consequences: Cantor's naive set theory was supplanted by axiomatic set theory and the discovery of those paradoxes are treated as a failure of his version.



What, if anything, was left behind? The failure of naive set theory due to paradoxes. We know what the lack of a universal set meant for set theory: development of axioms to make set theory work. What does the lack of a universal set mean on its own? What does the failure mean? Does that have any consequences other than the need to axiomize set theory? We will examine these questions in this work.

Before continuing, we need to discuss what we mean in this work by first principles. A first principle is in general just the point from which we begin to argue. We normally pick a first principle and argue from that position, whatever it is. The principle we choose can be partially true, true in only some circumstances, wholly invented or even irrational. We can begin from a known physical law or we can even argue from what we know to be false. In this work, first principle means an absolute principle, not a relative first principle chosen for the sake of argument. Axiomatic set theory, which underlies essentially all our mathematics, was deduced from the lack of a true universal set. We deduced the existence of paradoxes that reveal this impossibility. We discovered what seems to be an absolute impossibility. That is our starting point.

We should also note this absolute impossibility exists in any axiomatic form of set theory. Versions of set theory with a universal set define allowable sets in a manner that generates a specific definition of a universal set. That pushes the impossibility or illegality outside those definitions, but does not eliminate the impossibility if you look past them. When we say “true universal set”, we refer to this absolute impossibility not to any form of any set theory's conception of a universal set. At this point, we also need once again to be very clear: this is not a paper about set theory, whether axiomatic or naive. We will only mention axiomatic set theory in passing from here on.

Let's go over what we've accomplished. To begin to answer a question so obvious we don't realize the question exists, we narrowed our focus until we defined we were looking for a fundamental, even existential problem that arose in a field of inquiry whose solution left something behind which we could not see because the solution set up a barrier to perception. We identified two possible examples and realized one — discovered through paradoxes which led to illegal sets — may fit. We then described how the lack of a true universal set is an absolute first principle.

We will derive the structure that flows from the lack of a true universal set. This has never been done. That makes sense in the process we discussed above: the fundamental, existential problem which arose in naive set theory needed solution and that solution functions admirably well. The success of axiomatic set theory coupled with the failure of naive set theory erected a barrier that prevented us from looking carefully at what the solution left behind. We didn't realize the field — a further investigation into the meaning of the lack of a true universal set — was productive because we saw production in one direction and failure in the other.

We needed to find something obvious and fundamental which was hidden from our view by a perceptual barrier. It is hard to conceive of something more fundamental than absolute impossibility, especially since we are asking why possibility exists. To say impossibility and

possibility relate states the obvious. It is perhaps more than ironic we did not look at the meaning of impossibility because we were trying to understand what is possible.

The next section lays out the basic implications of the inability to form a true universal set. The description is fairly abstract but, for reasons that will become clear in the First Discussion Group, requires no mathematics. If the discussion is too abstract, look for the concrete examples and note we tend to repeat points to make sure we are clear.

## 2: DERIVING FROM ABSOLUTE IMPOSSIBILITY

We start from the first principle of the inability to form a true universal set. This is an absolute impossibility. Let's call that absolute impossibility **IMP**. Putting aside axiomatic set theory, what else might **IMP** mean? One meaning, the most obvious, is **IMP** acts as the ultimate limit of what can be formed: **IMP** is “that which cannot be formed” which means it accompanies “whatever can be formed”. If we lump together as close to everything we can, meaning all possibility we can in any way put together, we still have this absolute impossibility of **IMP**. We must have **IMP** because eliminating it would construct the true universal set and that can't be done. This means we have **IMP** and whatever is “not **IMP**”. Remember, “not **IMP**” in this example is as close to everything as we can get. Let's label “not **IMP**” as **IS** and **IMP** as **NOT**. We have **IS** and **NOT**. As a note, if the labels or ideas confuse you, keep reading because we explain the same points in different ways.

Another essential meaning of **IMP** is it creates the potential for possibility, which means it also defines the other limit, the lower bound of what can be formed. This meaning is less obvious. We may imagine possibility beginning from some source and then rising or increasing to “whatever can be formed” where it runs into the **IMP** wall of “that which cannot be formed”. We might imagine **IMP** only exists at this upper edge of possibility. We see the problem with this idea by reducing **IS**. When **IMP** acts only as the upper limit, if we define **IS** as less than essentially everything and progressively shrink it, then shrinking **IS** would erase the potential for **IS** to exist up to the **IMP** limit. Without potential, we would need to create possibility anew each time we exceed our shrunken **IS**. This would mean we either eliminate **IMP** and create it when needed or leave an unexplainable gap between our shrunken **IS** and the **IMP** upper limit. Neither of these make sense. We would need some way by which possibility could come into existence inside the upper limit of **IMP** without the potential for that possibility existing beforehand. **IMP** acts as the lower limit because **IS** must have the potential to exist to the **IMP** limit. As a note, we will revisit this topic in the First Discussion Group. It is important.

Since we can't eliminate the potential for possibility up to the **IMP** limit, if we begin with essentially everything and shrink that **IS**, we add to **NOT** so it consists of **IMP** plus whatever is “not **IS**”. Keep shrinking **IS**. When **IS** becomes the empty set, meaning nothing but potential in the label **IS** waiting to be filled, **NOT** is nearly everything plus **IMP**. We can't eliminate **IS** entirely because that would again erase the potential for any possibility — or would merely hide **IS** inside **NOT**, which would start the problem over again from the top of this section. We get the same result if we start with **IS** as the empty set and increase it so **NOT** begins as **IMP** plus essentially everything and then shrinks toward **IMP**. The “whatever can not be formed” of **IMP** acts as the upper limit of “whatever can be formed” and the lower limit of “whatever might be formed.” This means any **IS** exists with **NOT**, from when **IS** or **NOT** stands for the empty set to when **IS** or **NOT** represents as close to everything as possible.

When we vary **IS**, we make what we call a Thing. A Thing is any “thing” we imagine existing within the **IMP** limits. The reason why we need to define Thing in addition to **IS** will become

clear in a few paragraphs. While a Thing can be the nothingness of the empty set all the way up to as close to everything we can get, it is simplest to consider a Thing as any Thing within the maximum and minimum limits set by IMP. That means a Thing expresses the potential for possibility between nothing and everything. Consider you. You are a Thing and you exist as IS along with NOT. That NOT then includes everything else we can imagine up to the limit of IMP. The Thing that is you embodies the potential for variance of any Thing: you were once a baby and now you are bigger and older. The Thing that is you changes.

Imagine a box. A box contains space that may be filled and a box may be completely filled until nothing more can fit. IMP defines the biggest box: absolute impossibility describes the sides and the box can be filled with possibility from none to full. This IMP box contains every other box, which means any Thing is essentially a smaller box inside the IMP box. That Thing, that smaller box, exists together with NOT within the IMP box. This relationship holds true for any Thing at any scale up to and including as close to everything as we can get and all the way down to emptiness. Every Thing inherits this characteristic. A fundamental consequence of IMP is that it makes a Thing and attaches NOT to any Thing. As noted above, we will spend more time on these points in the First Discussion Group.

Remember, this work is about why and how possibility exists. Without going further, we can say possibility exists because IMP is “that which cannot be formed” and limits the maximum IS of “whatever can be formed” and the minimal IS of “whatever might be formed”. IS and NOT together form what we describe as the minimal condition of existence: IS always exists along with NOT because we can't eliminate IMP. When we say possibility exists because of IMP, we mean possibility in our universe exists within the box made by IMP, that this absolute box, the one whose sides are defined by absolute impossibility, contains all the possibility that can exist in our universe. This does not mean possibility came into existence after impossibility or even that this form of possibility is the only kind imaginable in some other universe. It means IMP enables the existence of possibility in this universe within a particular limit. As we will see, it means possibility exists within the structure mandated by these limits. It means IMP defines the particular attributes of possibility in our universe. We will discuss the meaning of this general point in more detail in the next section and again toward the end.

To apply these ideas, consider a drinking cup and some water. We typically say a cup may be half-empty or half-full, so we can — just for now — label the emptiness as NOT and the fullness as IS. We could reverse the labels so we focus on the IS of emptiness and how fullness is NOT emptiness. We can drain the cup so not an atom of water remains and then the cup is like an empty set waiting to be filled. IS would be the empty set of what might fill the cup and NOT would be maximized emptiness for that cup. We can of course reverse the labels so IS becomes the maximized emptiness and NOT is the empty set of whatever fills the cup. If we fill the cup so we can't add another molecule of water, we would naturally label that everything as IS but we could also label the empty set of the inability to add more as IS.

Consider the cup again. The labels we assigned are incomplete because NOT is actually much larger than merely half-full or half-empty. The actual NOT of half-full is “NOT half-full”

and the actual NOT of half-empty is “NOT half-empty”. Since IS and NOT, a Thing and NOT, combine to the IMP limits, if IS stands for either half-full or half-empty, NOT includes every other possibility within the IMP limits, from the likely to the absurd. The cup could be on fire. It could be an illusion or might contain poison. Touching the cup might transport you across space. We can apply any label for IS to the cup and NOT will be “NOT that label”. Our first look at the cup reflects how we tend to see “things” in the general idea of “context”, while the second is how a Thing fundamentally exists in the IMP box. When we limit ourselves, we see only the two immediate choices of half-empty and half-full. It is not wrong to link “half-full” and “half-empty” if we set up that choice in that context, but that is not the elemental relationship.

We can now derive the existence of context from IMP: context exists because selection inside the IMP box of any Thing to be IS defines NOT in relation to that IS. We label this relationship of IS and NOT as Minimal Context. It is the absolute minimum context, the fundamental connection between any Thing and that which is NOT that Thing. This relationship holds for any selection of IS; whatever Thing we label IS exists along with the NOT the selected IS defines. Minimal Context is the primal context from which all context flows. As a note, by selection, we mean the potential for labeling a Thing, not a specific act of selecting or creation. Selection is a statement about the nature of the IMP box: if you remember the beginning of this section, the limits of “whatever might be formed” and “whatever can be formed” create potential which IS against those limits as NOT. That is the elemental selection. We will see in the next section how selection becomes choice.

We can now explain why we introduced the term “Thing”. When we select any Thing inside the IMP box, then NOT consists of IMP plus the remaining potential in the IMP box — just as the NOT of “half-full” is “NOT half-full”. Since the remaining potential can be selected as IS, it is a Thing. To make this point clear, we could define part of the IMP box as IS and leave you out of that IS, meaning you are in NOT along with IMP. The selected IS and you are both Things. That is why we use Thing: Minimal Context describes the fundamental relationship of any Thing as IS along with NOT while any number of Things may exist in any combination as IS or NOT. If that is not clear, substitute your family for you so IS or NOT consist of the Thing of your family and the Things of each person. Thing is a flexible label. We can say IS describes a specific instance of Thing.

The selection of any Thing generates a second Thing and that means IS and NOT both represent or contain Things. Since we have 2 Things and any Thing exists in Minimal Context along with NOT, we have 2 Minimal Contexts. We can picture these as IS and NOT, NOT and IS, with the first IS representing the first Thing selected and the second IS representing the one defined by that selection. These 2 Minimal Contexts comprise what we call Immediate Context. Immediate Context describes a Thing in two absolutely minimal perspectives of Minimal Context: one in which we label the original Thing as IS and the other in which we label “everything else” as IS. This is true for any Thing we select first. Imagine you. You exist in Minimal Context with NOT, meaning all that is NOT you. You are IS in that Minimal Context. Immediate Context adds the other Minimal Context, the one in which you are NOT and all that

is NOT you becomes IS. This perspective is not as easy to see: when we select “everything else but you” to be IS, then “everything else but you” is the first Thing and you are the second Thing defined by that selection.

Immediate Context has 4 states of IS and NOT, NOT and IS. This means IMP enables 4 states relating to any Thing. While Minimal Context is the primal context in which IS and NOT always exist together, Immediate Context extends the meaning of context so the original Thing explicitly defines and relates to other Things. Immediate Context represents the fundamental existential statement: you exist versus everything else and everything else is somehow NOT you. Immediate Context describes you in relation to whatever else exists. It includes both these fundamental perspectives. It is you in the universe. It is any Thing in the universe.

If we look more closely at Immediate Context, we see IMP shifts from accompanying one Thing to the other depending on the choice of Minimal Context. To picture that, look at your hands and pretend they represent the 2 Things minimally generated by the IMP box, meaning they stand for all possibility inside the IMP box. This lets us examine the simplest, most fundamental case in which only 2 Things exist. Pick your left hand to be IS so NOT consists of your right hand plus IMP. Since IMP represents the upper and lower limit of possibility, the potential in the limit attaches to your right hand. If we then switch hands and make your right hand IS, your left hand together with IMP makes NOT and all the potential in IMP attaches to your left hand. Remember, we've artificially limited all possibility — “whatever can be formed” — to your two hands, just like we did with the cup. Even in this minimum case, each NOT is unique because IMP switches with each selection of IS. If we don't artificially limit the universe of possibility, whatever we select as IS defines another Thing that contains the potential for all other Things. The marker for that potential is IMP as part of NOT.

To be complete, we could minimize slightly more by beginning with 1 Thing and defining “everything else” as NOT. Whatever we select as IS defines the second Thing. This is always true when describing the inherent meaning of the IMP box. We could, for example, pick your left hand to be IS. Then NOT would be “everything else” plus IMP, which is the same as if your right hand stands for “everything else”. If we look at the other Minimal Context and switch IS and NOT, your left hand along with IMP makes NOT. We could also start with your right hand as IS because selecting any Thing to be IS defines the other Thing contextually in relation to the original, selected Thing. We could start with any Thing. When we select you or any other Thing as IS, all the potential for possibility exists as NOT along with that selection. IMP generates a single Thing and then a contextually defined second Thing, which generates the 2 Minimal Contexts that comprise Immediate Context. When we include the second Minimal Context, we can then describe you as NOT everything else.

If we look at our hands as the only Things, we tend to assume selecting the left as IS means the right is the only remaining choice, which would suggest we'd only have the 2 Things of left and right. The same tends to be true when we say a cup is “half-full”; we assume the only other answer is “half-empty”. Take away the assumptions. Select the left hand as IS and “NOT the left hand” is the remaining potential in the IMP box. Select the right hand and “NOT the right

hand” is the remaining potential. That is the importance of IMP as the marker for potential: selecting IS defines that Thing as IS and contextually defines a second Thing which is NOT the first Thing within the IMP box. A Thing doesn't know what it is NOT. When we assume “knowledge” of the other choice, that combines both perspectives of Immediate Context into one. We will see a direct physical example of this point in the Second Discussion Group. We will also discuss how Immediate Context generally occurs in the Fourth Discussion Group.

When we attach IMP to a Thing, we attach the limits of the IMP box to that Thing. Potential in the IMP box can only exist if we remove any assumption of “knowledge”. Imagine we select the empty set as IS. If we don't assume “knowledge”, selecting the empty set means only that NOT runs to the limit of IMP. Selection is dumb; it doesn't know what is NOT. Imagine we select “whatever can be formed” as IS. We know the empty set is NOT, but IS only knows “whatever can be formed” has been selected as IS. NOT happens to be all the potential inherent in the empty set, potential that exists because IMP acts as the limit of “what might be formed”.

We spend so much time on this point because we are uncovering and eliminating hidden assumptions. We generate IS and NOT and Thing from the IMP limits. We do not assume any dependency or relation between Things other than that they exist in the IMP box. We don't assume any link that defines NOT or a Thing other than the minimal one of existence in Minimal Context. When we say the IS of a half-full cup is NOT half-full, we expressly avoid assuming any relationship between half-full and any other state. Even when the only choices are your hands, meaning when we restrict “whatever can be formed” to your hands, the first Thing selected is a different Thing when it is the second Thing in NOT because all the potential of IMP shifts to it. That is the fundamental relationship of a Thing and NOT in the IMP box. We do not assume more. We cannot assume more because IMP doesn't generate those assumptions.

To recap, each Minimal Context consists of 2 Things, with the Thing representing NOT defined at the absolute minimum by changing perspective and shifting IMP. This means Immediate Context consists of 4 Things, the 2 we can easily see as IS in each Minimal Context and the 2 contextually defined Things that are NOT in each Minimal Context.

Since any Thing exists in Minimal and Immediate Context, each of the 4 Things in Immediate Context exists in its own Minimal Context and its own Immediate Context. These additional contexts generate another level with 16 Things that relate to the original Thing. We call this level Larger Context. To understand, use your hands and feet to represent the IS and NOT, NOT and IS of Immediate Context. Say one hand and one foot are each IS and, for convenience, say the opposite hand and foot are each NOT. Now choose each hand and foot in turn and look at the others in relation to each choice. We have 16 states in 4 unique arrangements in which each hand and foot becomes IS and defines its specific Immediate Context. Since each state exists uniquely in its contextual arrangement, we have 16 individual Things. Remember, each arrangement at the minimum shifts IMP to make a unique NOT and a new contextually defined Thing. We can not only assign each state its own label, but these labels represent the actual unique existence of that state in a specific context.

What is Larger Context? In Minimal Context, a Thing exists as IS along with NOT. That is the minimal condition, the most basic statement about what IS or is NOT. The 4 states in Immediate Context are defined by the selection of the original Thing, so Immediate Context connects that original Thing to whatever else exists. Larger Context relates the original Thing to any other Thing. In Larger Context, each of the 4 Things in Immediate Context generates its own Immediate Context. The states within the 3 other Immediate Contexts connect to these other 3 Things, to the second IS and each unique NOT. Larger Context contains the minimum number of states in the minimal number of contexts that relate to all 4 Things. This means you not only exist in relation to the universe in general but to any other specific Thing. We will see an example of Larger Context in the Second Discussion Group.

To run through this one more time, IMP generates a Thing and that defines a second Thing within the IMP box limits. Remember, the IMP box embodies the potential for possibility. This generates 2 Minimal Contexts in which these Things are each IS. These 2 Minimal Contexts together make Immediate Context. Because IMP shifts as we select IS, each NOT even in the most minimal case is a unique Thing defined by the context in which it occurs, meaning what we select as IS defines what is NOT and that NOT contains the potential for varying possibility within the IMP limits. This simple arrangement repeats: each Thing exists in Minimal Context and each NOT is uniquely defined so the 4 Things in Immediate Context generates the 16 Things of Larger Context. This means any Thing can fundamentally be described as existing in Larger Context of 16 states that can be broken into 4 Immediate Contexts and 8 Minimal Contexts.

Larger Context completes the description of the original 2 Things inherently generated by IMP. We derived IS and NOT from IMP, described the IMP box and identified the existence of a Thing. We then derived the existence of context, first as the condition of existence of any Thing as IS, then as the relation of any Thing to everything else and finally as the relation of any Thing to any other Thing. That completes the basic description. All larger structures break down to iterations of Minimal, Immediate and Larger Context by varying how we select Thing. The next section begins to explain what this structure means and does.

Before we continue, we should ask: does this make sense? Why does IS exist along with NOT? Why can we attach NOT to a Thing? Why can we label IS and NOT together as Minimal Context? The structure of contexts rests on these simple statements. Consider once again the examples of your hands and a half-filled or half-empty cup. When we say the NOT of half-full is NOT half-full, we mean this is the only result which doesn't require an additional assumption. That is the point: we are deriving from what seems to be an absolute first principle, a discovered absolute impossibility. An assumption, by contrast, is a relative first principle. The process of identifying questions too obvious to be asked requires identifying assumptions. It is one thing to challenge assumptions, another to figure out which assumptions we take for granted. It is then another thing to remove the assumptions. We place IS along with NOT in Minimal Context because we do not assume.





### 3: THE CHOICE MECHANISM

Remember the original questions of this work: why does possibility exist and where does it come from? We have now derived that a single absolute, the lack of a true universal set rendered as IMP, generates 2 states, then 4 states and then 16 states. We took this impossibility and generated the existence of a Thing, then 2 Things, then 4 Things and with Larger Context we have 16 Things. We can now say IMP generates a Thing which exists in Minimal Context of 2 states, which has Immediate Context of 4 states, and which exists in a Larger Context of 16 states. A single Thing exists in relation to 2, 4 and 16 states. This is elemental, fundamental possibility created out of impossibility and existing in contexts.

Possibility exists because of impossibility. That is why it exists. This flows from the absolute form of impossibility we identified in the inability to form a true universal set. This absolute impossibility not only explains the reason why possibility exists but mechanically how it exists: impossibility makes Things possible, accompanies Things with NOT and generates contexts related to a Thing. When we say IMP generates possibility, we mean possibility exists as a series of states that relate to any particular Thing through Minimal Context, Immediate Context and Larger Context. These three contexts not only contain states but describe the fundamental existential relationships of any Thing: as a Thing existing at any moment, as a Thing existing versus the universe, as a Thing existing versus another Thing.

We have now defined what we call the Choice Mechanism. The Choice Mechanism enables possibility to exist and, as will be discussed below, enables resolution to choice within context. The Choice Mechanism is also the "Context Mechanism". To continue, Minimal Context is the fundamental statement of the idea of "context": any Thing must be accompanied by NOT so any IS always relates to a NOT. We use the word "Context" to describe Minimal, Immediate and Larger because those groups or arrangements of states relate specifically and inherently to any Thing and any labeling or selection of a Thing as IS or NOT relates it to the other states in these contexts. This is important: when choice is enabled, it is enabled within these contexts. As noted before, people use the word "context" with a general understanding that "stuff happens in context". We have now derived why and how context exists from absolute first principles. As a side note, we have at times used both names and at one point considered calling it the "C-Mechanism" to cover both. We decided on Choice Mechanism because the word "context" appears in each level of description while the word "choice" would otherwise not appear at all.

To understand, consider a Thing in each context. If we merely describe its existence, we can say it IS along with NOT in Minimal Context. If we look at this Thing compared to whatever else exists without being specific, that is Immediate Context. This is a Thing existing in the IMP box. If we look at this Thing in relation to any other Thing, we describe Larger Context. Any comparison, any selection or choice between Things of any size or scale is enabled by Larger Context. The key word is "enabled". Possibility is enabled by the Choice Mechanism because any Thing generates many states that directly relate to and are defined in relation to that Thing. The Choice Mechanism enables choice because any Thing exists in these contexts and that enables all

these states to resolve to that Thing or NOT. To be clear and perhaps overly repetitive, choice requires the enabling of possibilities within constraining context. This is the elemental choice function which underlies all choosing: the ability to choose from among a group or arrangement of possibilities existing within Minimal, Immediate and Larger Context. We can define any choice function, even random choice, and it must rest on top of this enabling structure of states in contexts relating to a Thing. An example is below and we will discuss how this process works at the most fundamental level in the First Discussion Group.

We have described not only what enables context and choice but also the constraint inherent in both, that possibility resolves to choice within the constraint imposed by context. Enabling choice requires enabling the selection of NOT as well as IS. When we attach NOT to a Thing that allows selecting “NOT that Thing”. In Immediate Context, that means the choice of the Thing or NOT. In Larger Context, it means possibility may resolve instead to one of the other Things. Enabling the selection of NOT is extraordinarily powerful. We will explore the selection of NOT in greater detail in the First and Fourth Discussion Groups.

To apply these ideas, consider a rock. The rock is a Thing we can label as IS or as NOT. A rock mostly lies in one spot not doing much. Possibilities relate to the rock. These possibilities are various states that exist in and are constrained by contexts whose existence depends on the Choice Mechanism. If the rock sits on a hill, it has potential energy that could be unlocked if some force or action knocks it loose. The cause might be an antelope’s foot or erosion by rain or anything one might imagine could happen. We also know the rock has mass and we can in some cases calculate how that mass shapes time and space. The rock may sit there, partially exposed until worn smooth by centuries of weather. Things happen to that rock, some sudden and some imperceptibly gradual. Things also happen inside the rock. It might develop a crack and water might get in, freeze and split the rock, slowly at first and then in one big event. The water might act on the rock’s insides, perhaps dissolving minerals or causing some other reaction. If the rock happens to be radioactive, it will shed particles and we can say the radioactive material has a half-life, even if that half-life is longer than all of recorded history.

All these and countless more intangible possibilities relate to this one tangible rock. Some are closely connected while others are remote, while still others are improbable. These possibilities are states existing in contexts that relate to the Thing of the rock through the Choice Mechanism. Some arise from contexts inside the rock and some from contexts outside the rock. We can measure some of the possibilities and we can more or less predict some outcomes. If the rock is located in an empty lot surrounded by new buildings, odds are decent the rock will be scooped up and hauled away, perhaps to be crushed into gravel and used in a road or garden. If the rock is a hundred feet from a cliff being eroded by the surf, we can predict more or less when it will fall into the sea given measurements of past erosion rates and estimates for the future. We will discuss how these possibilities in all these contexts calculate in the First Discussion Group. We will discuss how this calculation can occur at all in our universe in the Fifth Discussion Group. Please also note the material in the First Discussion Group makes absolutely clear why states in the Choice Mechanism are possibilities.

We can see the physical rock at any moment does not completely represent the possibilities which may affect the rock, whether arising from within or imposed from outside the rock. Now somehow take away the physical rock to separate intangible possibility from tangible physical existence. We still have the possibilities arising within the rock and imposing from outside the rock, exactly as described above. These are enabled by and resolve to choice in the Choice Mechanism. The actual rock, maybe one we can pick up and hold or skip across the surface of a pond, represents a partial valuation of the possibilities related to that rock as they have resolved to that moment. In the Choice Mechanism, the Thing of the rock is the representation of the physical rock at any moment, together with the possibility that relates to it from the contexts included within it and the contexts that include it. To be clear, by representation, we mean the physical rock expresses various possibilities in the Choice Mechanism. We are not commenting about the nature of matter.

The Choice Mechanism connects a tangible object to the intangible possibilities that arise from within and which impose from outside. Imagine the rock exists only as a tangible Thing. It would then exist along with an intangible Thing that represents the possibilities which contextually relate to the tangible Thing. The definition of Thing lumps these together because they go together. We could say a tangible Thing is composed of a physical Thing and its attached intangible Thing and the meaning would be the same. Either way, this composite Thing exists along with NOT. This is another main reason why we described NOT as a Thing plus IMP rather than as a Thing. Our rock might be IS or NOT. If it is NOT, we have the composite Thing of the rock together with IMP.

Our rock sits physically alone but its possibility structure, the intangible part of the composite Thing that is the rock, relates to the larger world. Imagine we are choosing rocks and we pick up our rock to see if it meets our needs. We apply criteria, imposing a context that selects this rock or NOT. The rock is a physical object whose selection fits a context in which certain attributes are worth more. We may be searching for gold, a metal whose worth depends on events and meanings far removed from our rock. We may be looking for a rock to fit a slingshot or to skip on the pond mentioned before. We may desperately need something to defend ourselves with against an approaching mountain lion. Choice depends on context, which means valuing not only the physical rock but its intangible possibility structure. Context defines the Things we consider. We normally do this without thinking. The reason why we can is the Choice Mechanism enables the valuation of a Thing when 2 Minimal Contexts combine in Immediate Context and when Larger Context relates 2 Things. We can then see what a Thing IS and what it is NOT, whether one Thing is the choice or NOT, whether the other Thing is the choice or NOT. We can choose the rock or NOT the rock. We can choose this rock over that rock.

The Choice Mechanism is the process by which we identify need and then see what fits or NOT. We need this Thing. We identify that Thing. Context defines a Thing and defines its value for selection. We can now say, for example, that perspective is a choice function which applies context to a Thing; perspective joins the intangible to the tangible within the method that

inherently defines constraint. We can also say random choice is a perspective in which Things have equal contextual value. We will see in the First Discussion Group exactly how that works.

We need to consider one more fundamental implication before shifting focus to discussion. That is scale. The first form of scale is amount, meaning the number of Things. Remember, we used your hands and feet to generate the 16 states of Larger Context, so 4 physical objects make 16 total Things. These 16 Things are also contextually unique, which means each of them is a Thing that exists in Minimal, Immediate and Larger Context, with each Thing in each of those contexts also being contextually unique and so on. From a single Thing, we generate not only an expanding tree-like structure of layers, but also all the potential relations among all Things in and among layers. The amount of possibility enabled inflates explosively. That could not happen without the Choice Mechanism. This needs emphasis: the amount of possibility enabled mushrooms because Things exist in multiple contexts within the Choice Mechanism. As a note, we can see how random selection develops into various choice functions as contextual complexity develops.

The second form of scale is contextual. As 2 Things relate in Larger Context, they connect any number of possibility states “within” the relationship between the original 2 Things. This generates purely contextual scale in which one context is included within another. Inclusion means a context tends to resolve to a choice that is then used in another, not that an included context is somehow smaller in number or deals with littler objects or concerns. That is why “within” was in quotes. Contexts can include contexts and be included in other contexts. We can then connect contextual scale to physical scale through the definition of Thing: tangible Things may be physically larger but contextually “smaller” and so on. Inclusion of context within context enables ordering. Without the Choice Mechanism, we have no primal way to place Things in order.

Does this make sense? On a basic level, we have described what we already know. We know possibility exists and connects tangible “things”. We know in some sense some “things” are “not”, meaning we carry around a basic definition of impossibility. We know choice exists. We know we consciously choose and that the universe chooses for us. We know we pick a “thing” or not. We know everything happens in context. We know some contexts are mountains and some molehills, even when we have trouble telling the difference. We know perspective changes how we view things. We know value depends on context. We have now derived from a single absolute first principle why these fundamentals of our existence exist and the structure they take in our universe. They all relate to possibility so it generally makes sense they would flow from a single source.

Reflect on the beginning of this work. We identified a question we take for granted and discussed how we could begin to answer it. Once we ask the question “why does possibility exist?”, we can no longer take possibility for granted. We have now derived a structure that enables possibility and which enables it to resolve to choice in the constraint of context. No other explanations exist. None. Why does possibility exist? Possibility in our universe exists because absolute impossibility exists. How does it exist? It exists within the framework of the Choice

Mechanism. Where does possibility come from? It is a product of the inherent structure derived from absolute impossibility. This structure, the Choice Mechanism, enables the mechanical operation of choice and the mechanical application of context to various situations.

Reflect finally on the extreme simplicity of the Choice Mechanism. It consists of IMP, NOT, IS and Things. We can list the entire derivation in a handful of steps: IMP invokes IS and NOT, invokes Minimal Context, invokes Thing, invokes 2 Things, invokes Immediate Context, invokes 4 Things, invokes Larger Context. Minimal Context, Immediate Context and Larger Context together make up the Choice Mechanism and describe the absolute minimum meanings of IMP, a Thing and 2 Things. The word “invokes” could also be “requires” because IMP requires IS and NOT and Thing is essentially a more flexible label for IS. The Choice Mechanism is the bare minimum expression of IMP, without extra steps, without extra assumptions. This is as it should be: something fundamental must be simple, not because that appeals to the artistic sense or conceptions of theoretical elegance but because fundamentals are fundamental. In this derivation, we did not assume anything at all: we identified the existence of IMP and then laid out the bare minimum meaning that creates in this universe.

The rest of this work discusses specific applications of the Choice Mechanism. We will discuss extremely well known phenomena and will explain why each one exists. The important point to remember is none of these phenomena can otherwise be explained, not a single one. We want to emphasize that: the Choice Mechanism provides the missing “why” for a large number of unsolved problems and outstanding issues. We will discuss only a small selection specifically chosen to present a reasonably well rounded but certainly incomplete picture of how the Choice Mechanism works and what it means in our universe and in our lives. We first need to discuss how the mechanism operates at the fundamental, essential or minimal level, meaning how it calculates. That is the next section.

# Discussion:

## GROUP 1: CALCULATION AND EVALUATION

We have derived the structure of the Choice Mechanism from the lack of a true universal set. The next step is to derive how this structure works and the first part of that is how it calculates. We can't just say this structure is a mechanism without describing how it must inherently work.

The original question of this was “why does possibility exist?” We know we choose from among possibilities. We know possibilities are enabled by and exist in context. Since we choose between possibilities, we must have a method by which we choose and that means we must have a method by which we are able to choose. These are not necessarily — and indeed aren't — the same thing: the former refers to a method while the latter refers to what enables the method to exist. Again, as a reminder, we are not talking about probability or calculus; those are methods by which we evaluate, but they aren't the method by which we are enabled to evaluate. We know we evaluate choices by valuing one differently from another. To do that, we need numbers. The Choice Mechanism creates numbers and then enables numbers to make fundamental tools for analysis.

The existence of numbers is a gigantic, unsolved question in science and philosophy. Do numbers accurately reflect the underlying reality of the universe? Are numbers constructs we have discovered or even invented? Are numbers truly universal and do our analytic tools apply everywhere? Or in blunt terms and mimicking the original questions of this work: why do numbers exist and where do they come from?

The Choice Mechanism should be able to answer these questions. Think it through: if we can't derive numbers from the Choice Mechanism, we would assume they exist. We would also assume certain methods of evaluation and analysis just plain exist, wrought by a hand we still can't identify. Remember, deriving the Choice Mechanism began with looking at the problem left behind by the axiomization of set theory, at the unexamined part which the assumptions of axiomized set theory solved. What would we be leaving behind if we assume numbers, if we assume methods of analysis? That would mean possibility would come into existence from one source while numbers would come into existence from some other source, apparently one equally or even more fundamental. What would that be? How would these connect? Since sets lie at the heart of all mathematics and numbers are used to measure possibilities, how could numbers not be related to the impossibility solved by axiomatic set theory?

The Choice Mechanism does generate numbers. The first result is Base 2. The lack of a universal set generates IS and NOT. These can be rendered as 1 and 0, yes and no or in any other way one can imagine to describe binary relationships. This is fundamental: there is always IS and NOT, always 1 and 0. Always means always when you're deriving from absolute first

principles. Binary is the most basic embedded structure of our universe. It represents the limit of IMP. It represents the potential contained in the IMP box. We will see how this structure becomes Base 2 in a moment.

The stranger result is Base 10. If you look at the structure of the Choice Mechanism, you see it can be pictured as levels with 1 Thing at the top, then 4 and then 16. There are 20 states or "things" within any 1 Thing and these states consist of a thread of IS which has 10 and a thread of NOT which has 10. Also within that 20 states are 10 states of IS and 10 states of NOT. We're not kidding: this is where Base 10 comes from. We should not expect something more complicated.

To explain, we choose between possibilities because one is different from another. How do they differ? They are in some way different, meaning one is in some way not the same as the other. The structure of the Choice Mechanism compares one choice to another by the differences in the elements within the structure. As an aside, we can treat this structure as the source of the related axioms in set theory. To repeat because this is very important, in the structure that enables possibility, comparison is made through difference at various levels and that means 10 states are embedded in multiple ways in every single comparison made at every scale of existence. This is the essence of such elemental concepts as identity. While the counting of numbers of things or states in the Choice Mechanism may seem childish, there is no deeper explanation possible.

Any choice made, any resolution of possibility at any scale, no matter how simple or complex, involves a comparison, a selection, a choice between at least two possibilities. Take the example of needing a rock. We identify the rock we want and that rock fits the determining context. This is fundamental comparison: the fitting of a Thing to a context. This process is what we call identity, meaning it IS or is NOT. That determination of IS or NOT filters through as many layers as necessary to define the required fit. That is important: fit is defined by context, not as an ideal. As noted above, if you need a rock immediately to throw at a menacing mountain lion, you care less about the rock's specific mineral characteristics than if you are looking for the best rock to polish into the jewelry you sell at art fairs. Mining companies invest huge sums to find diamonds, not just rocks.

The Choice Mechanism enables the existence of possibility. It is multi-layered and repeats at two or three levels, depending on how you count the top level of the single Thing. If we take an IS or NOT thread within the Choice Mechanism, we see the possibility states related to that perspective, with the states in Larger Context resolving to the states in Immediate Context to the statement of existence that is Minimal Context. That explains why we lump the states together: Larger Context ties to Immediate Context and both occur within a Thing. A Thing truly contains 10 states in each thread of IS and NOT. These 2 threads then give full meaning to the Choice Mechanism's inherent manifestation of Base 2.

Base 10 is a product of the Choice Mechanism. While Base 2 is the first product of the lack of a true universal set, Base 10 arises from the derived structure of the Choice Mechanism. Base 2 is 1 and 0 and appears in Minimal Context of IS and NOT, of any single Thing along with any



NOT of 0. That also conveniently and necessarily summarizes all the possibility states contained within the IS and NOT threads. Remember, the 1 of a Thing and 0 of NOT can be anything from essentially everything to essentially nothing, which means binary reflects the essence of existence within the IMP box. Base 10, by contrast, is the inherent structure of the threads of what IS or what is NOT in the Choice Mechanism. It literally means the IS and NOT threads of any Thing have 10 states each. It literally means the labeling, selection and choice of any Thing invokes 10 states that appear in as many levels as one can imagine.

It is important to understand these threads of 10 states apiece exist within any Thing, whether the Thing is simple or complex. The Choice Mechanism embodies the fundamental dichotomy that numbers count and any count exists in relation to what it is not. The Choice Mechanism generates 10 states within a Thing and the “not” inherent in those 10 states, meaning of course the threads of both IS and NOT. We see NOT expresses at every level: when we count, we also count what is NOT. That relates the primal binary statement of IS and NOT to the higher base, so we can say Base 10 is a true expansion of binary, that it flows from the most basic principle and exists in full harmony with that principle. We will return to this point in a later section.

If we look at history, we see systems of Base 20 or Base 40 and even other choices. Why is Base 10 the fundamental and not Base 20? Why not Base 40? The reason is shockingly simple: Base 10 is the comparison, the valuing, the discerning within any Thing, while Base 20 invokes either both the IS and NOT of a single Thing or the IS or NOT threads from 2 Things. This introduces ambiguity at the fundamental level. Base 20 would seem to require the universe to be organized as 2 Things because the essential basis for comparison would be between a Thing standing for 2 Things to another Thing standing for 2 Things. Ambiguity aside, Base 20 is clearly more complicated than embedding 10 states in every single Thing at every single scale. We would need a reason why. We can choose Base 20 or Base 40, which we see flows naturally from Base 20 and which could embody Immediate Context, but these are not the count of states of IS or NOT within any Thing. It may not be necessary to say, but Base 21 doesn't evaluate the possibility contained within a single Thing but adds all the states within that Thing to the Thing. As a note, it would make more sense to use Base 64 because that is the largest expansion of the Choice Mechanism which fits within an expansion of 1. Some applications of the Choice Mechanism require 64, but those are not discussed in this work.

To repeat one more time, the Choice Mechanism puts inside any Thing, any 1, any 0, any IS, any NOT, at any scale, threads of 10 states each. This means each Thing has within it 2 threads which compare, which are either the same or different. That means Things can be compared using the states within them. This then means 10 states is the root of all comparison. That is Base 10. Imagine, for example, a big Thing that includes many littler Things: each of these Things compares using the two threads of 10 states and that then makes the big Thing. Base 10 simply and fully summarizes the possibility embedded in all layers of a single Thing. This is how we calculate the odds of finding gold in rocks or when a rock falls into the sea. All the contexts are counts of possibilities.

Does this make sense? There are currently no solid explanations other than observation for how Base 10 exists or why. None. It exists so therefore it exists. The same is true for Base 2. This is one of the largest holes in our understanding. The Choice Mechanism says Base 10 is a result of the inherent structure derived from an absolute first principle. This structure enables and relates states in contexts. The Choice Mechanism says that Base 10 represents the number of possibility states embedded in every single 1 or 0, every single IS or NOT, every single Thing imaginable and in every Thing within every Thing. These possibility states exist in threads of IS and NOT, meaning that within any 1 or 0, within any Thing, Base 10 literally manifests the possibility states which make up the Thing. The Choice Mechanism also manifests the more subtle point that counting or valuing also means NOT counting or valuing. This point needs emphasis: we need the Choice Mechanism to generate the NOT inherent in any selection, counting or evaluation.

As we will discuss further in the Fourth Discussion Group, any selection of IS is also a selection of NOT. Value can be defined by what a Thing is NOT or by what a Thing IS. Remember the rock. When we select a rock to fit a context — when we apply a perspective — we calculate possibility states. This explains why we can be misled; what appears to be the right fit reveals a different value on deeper inspection or vice versa. When we don't know what we want, we have difficulty defining context; we have trouble setting the value we want and that makes it difficult to evaluate what fits. The levels of calculation the Choice Mechanism enables is why, for example, nature develops traits which mislead: the predator can approach unseen, the prey can't be seen against the background because traits rely on limits of calculation. Guess wrong and you are eaten. We now have an actual mechanism by which we can relate value to context. All of this is only possible because a Thing contains Base 10.

We can also derive other fundamentals of the organization of numbers. We often visualize the continuum of the real number line as a line extending from infinity on the right to infinity on the left, which is often shown as negative infinity. If we redraw that picture to reflect the Choice Mechanism, so IMP acts as the upper and lower limit for possibility, the number line extends from nothing to infinity. Since nothing is the absence of counting, which is 0 or NOT, the entire continuum becomes IS, which exactly replicates the very first lesson derived from IMP. This Minimal Context of IS and NOT invokes the other Minimal Context in which the continuum is NOT and nothing or absence becomes IS. We then have the same real number continuum except now it manifests Immediate Context and reflects the existence of possibility within the IMP limits. "Negative" is then appropriately rendered as directional. The same is true if we picture real numbers using a segment or ray; we generate Minimal Context and Immediate Context. We also see the infinity within a line or line segment reflects the existence of layers within the context structure. This carries down to the selection or counting of any number. These are huge, absolutely fascinating subjects we can only mention here.

We have derived the literal foundation of the number system by looking closely at the inherent structure of the Choice Mechanism. We counted, which may seem silly on the surface, but which makes sense when we realize this count places the entire meaning of Base 10 within

each and every Thing and into every resolution to choice in context. Though the meaning of this counting is abstract, the act is relatively obvious and is, of course, easy to do. The next step is more mentally challenging.

The lack of a true universal set generates Minimal Context, the existence of IS and NOT together. We refer to this as the minimal condition. When we look at any IS, at any Thing, we actually see that IS, that Thing and the NOT attached to it. Take any IS. That IS can be any size, any value from everything to nothing. Remember, we can't actually reach everything or nothing because IMP means we always, always have NOT, but we can approach those limits. A small IS has a huge NOT, while a large IS has a small NOT. IS can be any value, any size along this huge spectrum from everything to nothing and as it varies the NOT attached to it varies with it. This simple relationship is true for any IS: IS varies as NOT varies and NOT varies as IS varies.

Here comes the hard part: we can derive the value of this inherent relationship in which IS and NOT vary in Minimal Context. Why we do this will become clear. As the first step, we take the relationship of IS and NOT and translate that into labels or numbers. We assign the value 1 to IS because it is a Thing no matter how it varies: a small Thing is still one Thing, just as a very big Thing is still one Thing. Remember, IMP leads to not one but two Minimal Contexts. This means the IS being labeled could be in either Minimal Context, meaning it would be IS in one and NOT in the other.

As the second step, we value NOT. NOT varies. If IS is huge, NOT is small and vice versa. Remember, NOT is contextually defined by the selection of IS. We can summarize all the ways NOT varies by writing down  $1/n$ , because as  $n$  gets larger and larger, NOT shrinks until it approaches effectively nothing. As  $n$  shrinks, NOT gets larger, so the value of  $1/n$  varies to the limit of 1 and to the limit of 0. Note we aren't saying at this point that the value of  $n$  runs in any particular direction, from big to small or small to big. Also note, we are applying the point made above that Immediate Context represents the real numbers.

We now have values for IS and NOT: 1 and  $1/n$ . As the third step, we need to represent how IS and NOT exist and act in a relationship. This is the most difficult part to explain. The relationship consists of all the possible iterations, all the possible combinations of IS and NOT as they vary, as IS grows to everything, as NOT shrinks to nothing. We value this relationship as it exists in any moment, as a summary of all those iterations and combinations. This means we need to cram all the possible values of IS and NOT into one moment. That will give us the inherent value of Minimal Context, literally the value of the minimal condition of existence. An iteration, a single combination of IS and NOT, is a value of 1 and  $1/n$  for some value of  $n$ . Pick a value for  $n$  and you have a combination of IS and NOT. All the iterations, all the combinations of IS and NOT, are all the values of 1 and  $1/n$  for all values of  $n$ : since each value of  $n$  is an iteration of the combination of IS and NOT, then  $n$  iterations is all iterations. That is the same as 1 and  $1/n$  to the  $n$ th or  $(1 + 1/n)^n$ , which we can summarize as the limit of this equation as  $n$  goes to infinity.

We know the value of the limit of  $(1 + 1/n)^n$ . It is the constant  $e$ , often described as the base

of the natural logarithm or as the base of the exponential series. It is one of the true fundamental constants and forms the basis for mathematical analysis, whether of abstract concepts or real world, physical phenomena. The constant  $e$  has never been derived before from first principles. It has never been explained in fundamental terms before. We can now say the constant  $e$  represents the value of the first consequence of the lack of a universal set. This first consequence is the fundamental condition of existence: IS and NOT together in Minimal Context. The constant  $e$  is thus the fundamental unit value of existence, meaning the value of Minimal Context.

We are not done. As we vary IS and NOT, we describe a Thing along with NOT so the constant  $e$  is also the inherent value of the existence of any Thing at a moment. We can easily derive that meaning of Thing. As we know, a Thing varies from essentially everything until it approaches essentially nothing. We can represent that as  $1/n$ ; as  $n$  goes to infinity the Thing approaches nothing. We again need to cram all the iterations of a Thing into a moment. This means we combine all the values for  $n$  and that means  $1/n!$  represents all the possible values of a Thing in or within a single moment. This equation also generates the constant  $e$ .

We use the constant  $e$  when something changes in proportion to a current value. We've known for centuries our universe has this base for change, for growth, for decay built into its fabric. We've never been able to explain why this base exists or why it takes this specific value other than this is how it is calculated according to this type of equation. We can now say the base exists because the Choice Mechanism imposes this structure for how any Thing, any IS relates to the universe, and the base has this value because that is all the combinations of IS and NOT at any moment, because it is the complete value of a Thing in a moment. In the next section, we will describe why the constant is the base for growth and that will further illuminate why it exists. We will discuss literally how the constant can exist — how a calculation that occurs to such great depth can occur both “inside” a moment and over time — in the Fifth Discussion Group. We have now generated a value for the fundamental condition of any Thing's existence in the universe. We can use this understanding to better understand the deep workings of the universe. We can, for example, illuminate important analytic constructs like the Fourier series.

We now turn to an issue which is in some ways even more fundamental than the constant  $e$ : the concept of a function. When we derived the Choice Mechanism, we took “what cannot be formed” and placed that with the maximum limit of as much possibility as we can imagine and then with the minimum limit of “that which might be formed”. These limits describe the potential of what is possible. Since this potential is any possibility from the limit of IMP up to the limit of IMP, we described the inherent structure of possibility as mandated by and as it exists within the limit of IMP. We defined a Thing as anything we can imagine within that limit.

A function is a process that generates a Thing: any result happens within the limits imposed by IMP, which means it is a possible result. A function operates within the limit of IMP, meaning it generates Things which exist along with NOT. A Thing is a result. So for example, a function that identifies chairs defines the Things that are chairs and the Things that are NOT. As a refresher, remember NOT means more than simply not being a chair; it means all that is NOT. If you remember the discussion of Thing and NOT in the last section, we described how IMP's

absolute limit generates Thing and NOT and the alternative requires establishing relative limits without reason. A function is that reason: a function is a method by which we impose limits within NOT. A function is a method by which we establish relative impossibility within the limit of IMP's absolute impossibility. If you again imagine a box, a function generates Things within the box defined by IMP. These Things are relative boxes within the absolute box.

The primal function is IMP acting as a limit, particularly the expression of IMP as the lower limit for possibility. This limit embodies the potential for possibility to exist from the nothingness of the empty set waiting to be filled to the upper limit of essentially everything. Without potential, there would be no function, no relative Thing, no relative box, no relative impossibility. This is a major reason why we discussed that issue in the last section; we were defining the elemental function. We saw this elemental function at work in Immediate Context: when IMP shifts to make a unique NOT, that NOT is a Thing because it contains the potential inherent in the IMP limits. This is the literal process by which NOT enables function.

We can go a little further without becoming too deeply involved: the Choice Mechanism expresses the possibility built into any function so it resolves to the choices which fit the function. This means IMP enables both relative impossibility and the methods used to draw those relative limits. This is true for both complex thermal calculations and simple addition because any operation involves choice and the resolution of possibility. This is a very complex topic, but consider a very simple example: take 2 plus 2. When we add, we apply a definition of addition which is necessarily a resolution of the possible ways we can add: 2 plus 2 can be 1 or 2 or 3 or a number of other meanings we ignore in favor of the accepted choice of 4. Why do we count the 1's and not the spaces between them? Would there be 2 spaces, 1 between each group of 1's, or 2 groups of 3 spaces? A function embodies various possible meanings so each step as well as the entire function takes a specific form. That form is a Thing.

What if there were no limit of IMP? We touched on this question when we derived the Choice Mechanism and we will run into it again later. IMP and the attachment of NOT to any Thing divides the universe into what is relatively possible and relatively impossible. We can now say this expresses itself in such a strikingly elemental concept as function, both in its existence and its operation. Functions represent choices made in context: any choice of operation defines the context which applies to possibility and also expresses the resolving of possibility within that context. Function embodies the operation of the Choice Mechanism.

The unification of numbers with context in the Choice Mechanism generates the fundamental potential for ordering. Function manifests this, from counting to the most complex algorithms imaginable. We will discuss examples of ordering specifically enabled by the Choice Mechanism in later sections. These topics are tremendous fun.

This ends the first section of discussion of the Choice Mechanism. We derived the method by which the Choice Mechanism enables calculation and then how that generates the essential means of comparison and calculation. We then derived an elemental method by which the Choice Mechanism calculates at a complex level. While Base 10 is within any IS, any 1 or any Thing, the inherent value of any IS, any 1 or any Thing in its surroundings is the main basis for

analysis. The structure that enables the existence of possibility also enables counting and calculation. We have intertwined two of the fundamental aspects of calculation and existence together: what is within any Thing and then how that Thing inherently relates to the world in which it exists.

## GROUP 2: MANIFESTATIONS OF CONTEXT STRUCTURE

In the last section, we saw how basic methods of calculation derive from the Choice Mechanism, moving from the very basis of the numbers system to one of the most indispensable fundamental constants. In this section, we see how the mechanism shapes certain physical phenomena. We will focus on examples in which the Choice Mechanism literally appears in nature and particularly on examples which reveal different views or aspects of the Choice Mechanism's structure.

Since we derived the constant  $e$  in the last section, it makes sense to begin here with the blunt physical representations of the constant, the logarithmic spiral. We note they occur all over nature and, most importantly, at vastly differing physical scales and in the actions of both living and inanimate objects. To pick a fairly standard list, consider the flight of an insect or the approach of a hawk to its prey, the shape of many hurricanes or of some beaches, the shape of many galaxies, including our own, some patterns within our own bodies and, very famously, the shape of certain shells.

We can now, at a minimum, explain why all these occur. Not how, but why. That distinction is important: a hawk soars and flies through air while a beach is made of bits of sand moved in water. We are, in general, able to figure out the physical processes that occur in each example to generate the spiral form. Hot, humid air over certain temperature water as the earth spins relates specifically to hurricane shapes, not so directly to the shape of a shell. We are not arguing with what we know but are adding explanation.

When a hawk approaches its prey, they both interact with a complex system of weather and air and relative speeds and many more factors. Same for a hurricane, though the factors are obviously different. Same for our galaxy, though the factors are different again. All these examples involve things combining in some complexity that occurs both at any instant and over time, sometimes over great amounts of time, and across small spaces to the vastest spaces imaginable. Here is a version of the same question we asked at the very beginning: how is this possible? We know it happens because we literally see it and we can measure it. We know this happens on every scale, that it affects you and me and rocks and stars. It is obviously a condition of the universe itself. We know how to measure it — using the constant  $e$ , for example — but why does it happen and where does it come from?

Let's go back to what we know. We begin with a snapshot of a Thing existing in Minimal Context. As the possibilities related to this Thing and the other Things in the context expand, contract and resolve, the Thing we are looking at draws a line, meaning it moves from spot to spot to spot. This line encloses possibility, so when a hawk spirals in toward its prey, the line of approach encloses certain possibility and excludes other possibility. We then see possibility resolve to a point and the hawk gets dinner. As the line draws, we can take a snapshot anywhere and see the Thing we're following as it exists from moment to moment in Minimal Context. The line the Thing draws can be described as a series of snapshots of Minimal Context. This means the line consists of iterations of Minimal Context — as increased or decreased of course by the specific

factors involved. Each snapshot can be represented by the value of Minimal Context, meaning the constant  $e$ . The line both roots in and embodies Minimal Context.

The “naturalness” of the spiral turns out to be due to the inherent process of a Thing existing, with its existence making over time a line that is really a moving picture of Minimal Context. This is, again, extremely simple: a Thing exists in Minimal Context in a moment and then again in the next moment and then again in the next and so on. These moments of existence each have a value rooted directly in the constant  $e$ , so the entire line manifests the constant, arising out of it as base and growing or contracting in relation to that value. If conditions remain stable, if the context continues, we are able in specific cases able to see this relationship rendered physically in the logarithmic spiral.

The constant  $e$  shapes how a vast number of possibilities are not only enabled to exist but become choices which link together over time and space. A beach is built grain by grain, just as a hawk flies meter by meter, just as a hurricane gathers strength, just as a galaxy takes shape. All those grains become that beach in the form of a spiral and the hawk's flight ends with a kill and the hurricane hits the coast because the constant representing the value of Minimal Context — and the value of a Thing — shapes what happens.

We ask from time to time: “Does this make sense?” We already know the mathematics. The Choice Mechanism's contribution is to explain why the constant exists and then why it defines so many natural structures at so many scales of existence. We saw the constant is an extremely basic expression of the Choice Mechanism, being the value of Minimal Context and of a Thing, and now we see this natural change and these natural structures directly reflect the simplest application of that basic notion: take the value of a Thing in Minimal Context and extend it from moment to moment to moment. We will discuss the “moment to moment” aspect in the Fifth Discussion Group. We will address an even deeper related question at the end of this work: why does the universe generate the constant  $e$ ?

We will now move to the next set of examples because they apply this simplicity even more directly, by literally expressing the context structure of the Choice Mechanism in physical events. What follows is extremely well known but very, very complicated so we've reduced description to the minimum necessary. We apologize for the reduction.

In the famous double-slit experiment, we shoot particles — usually particles of light called photons but also electrons and some other very small things — through two tiny slits at a screen which records where they hit. If we put detectors at both slits and shoot photons at the slits, we count the particles which go through each slit and we get a pattern on the screen. If we uncover both slits and shoot particles at them, so we don't know if a particle goes through either or both slits, a different pattern appears on the screen, one typically described as an interference pattern of waves. This pattern has a central area on the screen whose intensity is about 4 times greater, meaning about 4 times as many photons hit that part of the screen.

The double-slit experiment raises at least two fundamental issues we can address here. These are aspects of what is known as the wave-particle duality, meaning that matter has qualities of



both a particle and a wave. First, if we shoot single particles one by one with both slits open, the pattern builds on the screen over time. Each particle hits the screen randomly within the wave interference pattern we see emerge. Each particle somehow fits to this wave pattern. How do particles know where to go? Second, we wipe out the wave interference pattern if we cover one slit or put a detector to monitor that slit or pretty much try in any way to look at what happens at either of the slits. Looking changes the result; as soon as we look at a slit, we see no longer see the interference pattern. The choice of how we decide to perceive changes what actually happens and that is apparently true even if we choose to look after the particle has passed through the slits but before it hits the screen. How is that possible?

We have no problem understanding that a grain of sand is part of a system which generates a beach in a specific shape. We use the constant  $e$  in those calculations and we now know that constant is the valuation of IS and NOT in Minimal Context. These complex systems shape themselves according to a structure in the Choice Mechanism. When we push down to the level of light, how do we connect one particle's action to another over time? They don't talk to each other in any known or imaginable way.

Imagine a structure which imposes a pattern on events. This structure could then allow individual particles to act randomly but within the constraint imposed by the structure. If the structure has more than one level, each level could perhaps act as a view so the selection of perspective would affect what is seen, meaning the possible result might change depending on which view we select. We know that in regular life we can choose to see individual raindrops or the rainfall, a tree or the forest, a face or the crowd, and so on. For this kind of selection of view to apply to particles, it would need to be embodied in a structure that somehow imposes itself on the actions of fundamental particles.

We have that structure. Before continuing, it's important to note again that any proposed solution to these mysteries has to meet certain requirements. The first is that any solution must fit absolutely with what we know works and the methods we use to calculate results. The second is we assume no additional or hidden variables. This means we can't add any as yet undetected means by which particles communicate or by which looking makes an actual physical change or somehow otherwise interposes a physical reason. To do that would require creating that method, that physical thing, that physical interaction, and that would require reasons and a model, let alone an explanation for why we've never before managed to see it in action.

The Choice Mechanism derives from the lack of a universal set. As we've noted, this means at the very top level, we have something we can't fully comprehend, the impossibility of IMP. This impossibility defines the limit of what is possible: every possibility, every form possibility takes, is included in the system defined by that top tier NOT. It is the ultimate impossibility. The structure derived from IMP is the Choice Mechanism, with Minimal, Immediate and Larger Contexts. This structure isn't a hidden variable; it's a structure in our universe that enables possibility to exist and resolve. The structure shapes the possibility of physical interactions occurring. The structure appears in physical objects but it isn't a physical thing, just as a

possibility is an abstraction which may relate to an actual thing held in your hand. Whatever physical interactions may possibly occur happen in this structure.

This structure fits the wave-particle duality, the double-slit results, the way that individual photons form patterns over time. It explains all of the problem without in any way contradicting what we know is true. It actually illuminates the methods used to calculate but that is a topic for another time. Just as importantly, the structure explains the problem in a manner completely consistent with what we know about the rest of our world, linking these fundamental behaviors to much larger ones within the same model.

Let's go through this more carefully. The Choice Mechanism describes a structure in possibility that shapes actions over time. A structure in possibility is not like the shape of a room or the objects in it but the inherent structure in which possibility is enabled to exist in this universe and by which it resolves into choices within contexts. That is the entire point of this work: to describe why and how possibility exists. What are individual particles doing when shot at two slits? They somehow go through and then hit somewhere on the recording detector, not anywhere, just in the pattern where they possibly can hit. They don't hit where they can't but where they can. They don't know where to go any more than a grain of sand knows that it's becoming part of a beach. The particles are constrained by the purest form of the Choice Mechanism we can identify.

To explain further, we first need to consider another example: the partial reflection of light by two surfaces. If we shoot light at a block of glass — meaning light of one color at nicely pure glass — a certain percentage of the light is reflected and some passes through. As the glass gets thicker the amount of light reflected or passing through changes; it increases and decreases, increases and decreases. To be clear, “two surfaces” refers to the front and back of the glass, meaning it refers to a discrete amount of glass, glass with a beginning and an end. We can calculate how this happens but, as with the wave-particle issue, we have no explanation why.

In the Choice Mechanism, this kind of partial reflection is a direct example of Larger Context. Since the light either goes through or reflects, two Things exist in relation to each other. One is the amount of light that passes through and the other is the amount reflected. This is crucial: each of these Things stands as an independent IS. The NOT for the IS of reflection is that which is NOT reflected while the NOT for the IS of transmission is that which is NOT transmitted. If you connect the two, you assume light knows what happens, that light knows not being reflected means it is being transmitted. Light is dumb. It has no idea whether the glass is ending or continuing. It has no idea what fate holds for it.

The next part is somewhat difficult. At the scale of our regular lives, we see events happening around us as possibilities become real. We choose at any moment whether to look at this process or at any particular piece in the flow, just as we look at a face or the crowd, the tree or the forest. We switch between close focus on a Thing of some sort and seeing the flow of Things as they move past and with us. To look at any Thing is to see a value for that Thing at that moment. If we look at the flow, we see the value of the flow of Things changing as we watch. We rarely have control in regular life over when a context exactly starts and when it exactly ends. We have

trouble even identifying in regular life when a context exactly starts or what the context exactly is. With partial reflection of light by glass, we establish the context. We set up the apparatus and decide how much glass we'll use. We choose when the context ends by cutting off the glass.

When we measure the amount of light reflected or transmitted, we look at possibilities changing and shifting in Larger Context as the two Things relate over the context's existence. Whatever physically happens in the glass to reflect light occurs over the length of the glass. The context exists for the length of the glass, so we see Larger Context appear in the glass or, perhaps more accurately, in the light reflected and transmitted by the glass. We see the value of interaction between the IS of reflection and the IS of transmission, both at any specific point and as it varies. Since light has no mind and doesn't know when this context ends, it can't fit itself to the length of the glass so it can't start reflecting a little, then a bit more, then a bit more until it reaches a maximum when the glass ends. It doesn't know how long the glass will be. It repeats its fundamental structure, over and over, without any awareness until we choose to end the context.

Larger Context enables 16 possibility states to exist in any interaction between two Things. These 16 possibilities are Things themselves. We see in partial reflection of light by two surfaces a repeating cycle in which the amount of light reflected varies continuously from 0% to 16% to 0% to 16%, over and over. The length of the cycle, meaning how much glass it takes to repeat the pattern, relates to the type of light, which means the length of the structure is not an absolute, that light resolves possibilities according to its own internal contextual constraints. The structure of the pattern is pure but the exact length of the pattern depends on something physical.

The Choice Mechanism supplies the missing “why” for partial reflection. This why is wholly consistent with the existing way we calculate the results. To repeat, we establish a Larger Context with two Things, the IS of light reflected and the IS of light transmitted. We control the existence of this context. When we look at the amount of light reflected, we look at the flow of Things, of possibilities within the context. We see this captured in glass. We repeatedly use the word “look” because in this example we are choosing to look at Larger Context as it occurs. We can look at it over a length of glass and see a cycle of values or we can look at a moment of a length of glass and see a value for that length.

This explanation applies to the “looking” issue in the double-slit experiment. In partial reflection, we can choose to end the context's existence by cutting off the glass. In the double-slit, we are able to look either at the individual Thing or at the context structure of the Choice Mechanism. The structure we see is Immediate Context because the choice of either slit is the choice of that slit versus “NOT that slit”. This choice is exactly like the glass half empty, glass half full example: a choice of half full stands against “NOT half full” instead of the obvious other choice of half empty. We tend in that example to see the choice between half-full and half-empty when the actual NOT of half-empty is NOT half-empty. The double-slit experiment is a pure representation of Immediate Context: when we don't look at the slits, we see the pure choice of a slit versus the NOT of whatever else exists, of NOT that slit. The measured results match the count of possibilities enabled within Immediate Context: the peak of the wave is essentially 4 times higher.

The Immediate Context of the double-slit experiment continues until we destroy the context, which means until we look. When we look, the particle obviously still decides which slit to use, but the Thing we see becomes the particle and its history. The point is subtle until you understand it. When we look at the slits, we see the particles themselves as Things and the choice made to go through that slit is included within the Thing of the particle as part of its history. Whatever choice the particle makes is already made when we look, when we detect it. Even if we look after the particle has passed through and before it hits the recording screen, we switch from looking at Immediate Context and reveal the choice the particle already made. We are able to see this already made choice because that context view remains possible until the the particle hits the screen. This description is entirely consistent with the mainstream interpretations of this problem and quantum mechanics generally. It is shockingly simple: looking at the slit changes our view of the underlying Choice Mechanism structure. We see Immediate Context or we see the Thing itself in Minimal Context.

Does all this make sense? Remember, this section is a very short summary of an extremely detailed, very well studied set of problems. It is a good example why this paper is an introduction to a larger work; the issues raised in merely trying to describe the Choice Mechanism tie to entire fields of study. But to return to the question: does this make sense? We see an explanation that puts both these behaviors of light into the same explanatory structure. If we look at the problems — at the double-slit experiment, at partial reflection by two surfaces — we see an explanation that fits with the state of existing knowledge and not only agrees with our methods of calculation but validates them with the missing “why”. We can now say calculations using probabilities and amplitudes are not only correct but accurately implement the underlying context structure of the Choice Mechanism. The Choice Mechanism organizes possibility. The bands where the particles hit are the possible places they can go and the bands where they don't hit are the places they can't possibly hit. The interactions of light with glass must generate a certain amount of reflection.

Think about why we have waves. When we say matter is a wave, when we observe that tiny scales and large scales can be described using wave analysis, where does that come from? A wave is the organization of possibilities for whatever makes up the wave. We can see how waves occur in normal life and at most scales other than the very small: some physical action generates a set of physical responses and all the possibilities of things affected combine to involve them in a wave. An earthquake generates a tsunami that sweeps huge ships and houses away. A flock of birds takes off almost as one mass when disturbed. Traffic forms knots on roads. The wind passes over the trees. Each of these embodies possibilities. The radiation from the sun on the land generates thermal currents that start to move, a hawk soars aloft, the hot air moves over colder air, and then you feel the breeze.

Everything we experience, everything in our universe, occurs because it is possible. Those possibilities must somehow come into existence and they must somehow resolve into the things we experience and the reality that surrounds us. A wave expresses the resolution of possibility. That resolution is a consequence of the lack of a true universal set and it happens in the structure of the Choice Mechanism. We will discuss this topic in somewhat more detail in the

Fourth Discussion Group. Now consider this: if indeed the Choice Mechanism enables possibility through a structure of contexts, then shouldn't we see the clearest, cleanest representation of that structure at the most fundamental levels? We see the pattern of the Choice Mechanism in the double-slit experiment, in the wave-particle duality, in partial reflection of two surfaces because fundamental particles express the inherent pattern without layers of complexity obscuring the view. It would be a concern if we couldn't see the pattern of the Choice Mechanism structure here.

As a short summary of this section, we shifted from deriving direct mathematical implications of the Choice Mechanism to describing how the mechanism's fundamental structure directly expresses itself in nature. We explained why the logarithmic spiral exists: it shapes the possibilities of natural growth by relating change to the essential value of IS and NOT in Minimal Context. We can now say logarithms work because they actually do use a true natural base, one that represents the possibilities inherent in a moment of existence of any Thing. We then showed the two basic views of the Choice Mechanism's larger structure — Immediate and Larger Context — explain the wave-particle duality, the double-slit experiment and partial reflection by two surfaces. This explanation fits — and indeed reinforces the truth behind — our existing understanding and methods of calculation. None of these has been explained before. All have been great mysteries. The explanation has extensive application beyond these limited examples — and beyond the scope of this paper. Such is the power of working from actual first principles.

## GROUP 3: COHERENCE

We examined in the last section physical examples that express the literal form of the Choice Mechanism's structure. We shift in this section to focus on how the Choice Mechanism context structure inherently operates. We avoid examples that require physical interaction, like particle exchange, and those we measure with physical constants. We begin with natural selection.

If you look up natural selection in scientific sources, you will usually find a general statement that natural selection is a process, as in “evolution by natural selection”. You will find a descriptive statement to the effect that natural selection determines survival over time, as in natural selection favors certain forms while disfavoring others. You may find an argument among scientists about how natural selection exactly operates on organisms, whether it operates at the gene or some other level. You will not find an explanation of why natural selection exists or where it comes from. There has been none available.

For reasons we hope will become clear, we will first discuss natural selection by considering objections to it. If we put aside outright distortions of scientific fact and evidence, these objections are mostly rooted in odds, in the belief that various processes and structures in life and in what we are, are not only improbable but so unlikely that at least some essential pieces must have been put in place by some unspecified determining force. The argument takes many forms — such as that certain universal constants are so precise they must have been fitted to the task or that some combination of proteins is improbable — but all rely on a degree of unlikeliness that becomes a form of impossibility.

If we take these arguments apart, we see the objections rest on two basic issues: the vast amount of calculation required and the method by which this calculation extends across time and space at many different scales. These objections to natural selection are, in essence, attempts to define limits for what the universe can do or calculate on its own. Is there a scale at which the universe doesn't or can't figure things out? Is there an end to the precision it generates? The various objections regarding odds, improbability or unlikelihood express an idea that somewhere and somehow there are boundaries to what the universe does on its own. These ideas express both doubt about what the universe does or is and belief about what that means.

The answer to these doubts has three main parts. First, implicit in any approach, scientific or otherwise, is the universe somehow calculates “stuff” on its own. Without this ability to calculate, we couldn't speak of odds at all. We can now describe the essential mechanism by which this happens: the Choice Mechanism describes how possibility is enabled to exist in this universe, the structure in which it exists, and how possibility resolves to choices in contexts. It generates the structure of numbers and the methods by which value arises and compares. It generates the fundamental constant  $e$ . It expresses itself in the structures of natural growth.

The second part is context. The Choice Mechanism is also the “Context Mechanism” because the mechanism not only enables choice to happen but for choice to happen in context. The “Context Mechanism” enables possibility and also constrains it. As noted before, we have always used and accepted the existence of context — to the point where it is taken for granted —

but we've never derived it from absolute first principles until now. Calculation occurs in the universe as possibility resolves into choice within context. Possibility resolves within constraints imposed by context. This occurs at every scale. We have repeated that enough.

The third part is the IMP box. As made clear in the concept of function, the Choice Mechanism enables the existence of relative boxes within the limits defined by the absolute box. It not only enables these relative boxes but also sets the rules by which they exist in contexts. All function occurs because IMP's limits act as the primal function. Including contexts impose resolution on included contexts as included contexts arise or combine to make including contexts. All the relative boxes and all their contexts fit together because one limit is at the very top, at the level of the ultimate NOT, while the other is the nothingness of the empty set. All possibility is enabled by and resolves to choice in context according to the Choice Mechanism.

Put these three points together: the universe calculates, it calculates in contexts and the entire contextual structure is defined by the box that defines possibility as it exists in our universe. This means our universe is “coherent”: it resolves each and every moment at every scale without gaps. IMP is the ultimate NOT and sets the maximum and minimum limit of possibility. IMP attaches NOT to every Thing. The universe calculates everything, all the time, at every scale within the IMP box. It must. The point is not particularly subtle: all possibility within the limit imposed by IMP exists and resolves as described by the Choice Mechanism. All means all.

The Choice Mechanism generates and mandates what we call “coherence”. Any structure is a Thing whose existence embodies possibility resolving to become that structure and which fits in larger contexts of possibility. To be repetitive, this possibility is enabled by and resolves within the Choice Mechanism. All functions occur within the IMP box. All Things take form in this universe within the limits described by the IMP box. The structure which enables possibility to exist and resolve to choice within contexts is the Choice Mechanism. The Choice Mechanism generates numbers, meaning Base 2 and Base 10. The potential within the IMP box must express itself as possibility using numbers and within the structure of contexts of the Choice Mechanism.

It is impossible for a structure or “thing” to have been “created” on its own while somehow bypassing the Choice Mechanism. This other “thing” could neither contain possibility nor fit into larger possibility structures because potential within the IMP box can only become possibility within the Choice Mechanism. This other “thing” could not relate to Things inside the IMP box, meaning within our universe, because every relation invokes possibility and that invokes the Choice Mechanism. If you could somehow carve that other kind of “space” out of the IMP box, that “space” no longer exists in the box, which means it is not in our universe.

The amount of calculation required to fit all the contexts together to make each moment utterly dwarfs our imagination. Look at the constant  $e$ . Look at the vast amounts of calculation required to generate it: every possible value of Minimal Context — or of a Thing — reduced to a single value. Look at the limitless depth in layer after layer after layer in the endless count of decimal places, each representing layers of possibility calculating to a value. Any moment at any level of existence requires more calculation than can be imagined. That point can't be over-

emphasized: the calculation required to make any moment, to put you in your chair, to put all things in all their places all over the universe, cannot be put in words.

Remember the discussion of perspective as an example of an elemental choice function, that context determines what fits. Consider a constant. It relates contexts that fit together so predictably we say the relationship is constant. The value must be as precise as required by the contexts it relates — and sometimes as the context demands when examined to a great depth, which is an interesting topic of its own. These contexts fit the constant as the constant fits the contexts it relates. Constants require and reflect coherence. It must be this way within the IMP box. We will discuss this topic further in the Fifth Discussion Group.

Arguments based on versions of unlikeliness are bluntly wrong: all possibilities are enabled and resolve in this universe according to the Choice Mechanism. Within the absolute box defined by IMP, we only have relative impossibility. Without intending to be trite, whatever happens only happens because the Choice Mechanism enables and allows it to happen. A remote possibility is still a possibility. A very remote possibility is still a possibility. If we could somehow step outside of the limitations of context, we'd see every event or result or process is such a tiny piece of any moment's calculation we couldn't even name odds for it happening. The point is not probability or improbability for a result or process. That needs to be emphasized. Chance takes meaning from context because odds are only meaningful in context and that requires the Choice Mechanism to generate context. To be clear, any “unlikeliness” argument invokes chance without understanding that chance only occurs in contexts enabled by the Choice Mechanism. If a result occurs, it happens in the structure enabled by the Choice Mechanism.

The various forms of “unlikeliness” arguments are “incoherent” in the sense they conflict with the coherence inherently imposed within the IMP box. We can't negate coherence. That is important: if we bring anything into the IMP box, then it has the NOT term and that makes it subject to the Choice Mechanism. This degree of absoluteness flows from first principles, from the limit imposed by absolute impossibility. We can't bring another mechanism, one that acts according other rules, into the IMP box. We can't bring “things” into the IMP box without those “things” fitting into the structure of Things existing in context that fill the box. Imagine an object. If that object doesn't have the NOT term attached, it can't appear in the box. It isn't in our universe. It would not be rooted in Base 2 and Base 10. If it does have NOT attached, then it must fit into the structure of Choice Mechanism contexts and Things. Cross the line into the box and that is what happens. The same is true if you reduce the amount of possibility to some level within the IMP box and imagine some “thing” occupying all or part of the leftover space. That other “thing” is in the IMP box so it must fit into the Choice Mechanism. We apologize for the repetition but whatever is in the IMP box has the label NOT attached. It must be a Thing and can only interact with Things through the Choice Mechanism.

Remember the Choice Mechanism flows directly from the inability to form a true universal set, meaning a true set of all sets, a set of everything we can construct. That is the limit. We've identified it and the structure it generates. We can put that limit in words: the imposition of the NOT term by IMP. Then realize this limit is a reduction, a shrinking or decrease created by



adding this NOT of impossibility to our universe. If we go beyond this limit, we alter the definition of NOT to remove at least part of this impossibility. We can comprehend a limit derived from impossibility, but beyond that limit things become “incomprehensible”, an issue we'll discuss in more detail later. Within the limits of IMP, all possibility is enabled and resolves to choice in contexts within the Choice Mechanism. That is coherence.

What is natural selection? Natural selection is the Choice Mechanism operating on life. We will provide a more rigorous definition below. The Choice Mechanism says natural selection is context applied to and working on Things. Context may be extremely widespread or limited. It may extend over vast stretches of time or may be immediate. Context enables both survival after cataclysms and local adaptation. Context allows a certain set of possibilities to flourish while cutting off others. Context enables structures to develop, eliminating some, favoring others. This happens at every scale. A population left alone has a context. A population under pressure, such as an increase in predators or a change in habitat, is in a context. Contexts enable expansion of possibility, allowing multiple forms to flourish, and contexts close off possibility, allowing only some forms to survive.

We have explained why possibility exists and how it fundamentally comes into existence. Natural selection focuses us on how possibility comes into existence for the special case of living Things: that is, why does variation occur? Without variation, we have no evolution. We do not mean how variation flows from a physical process like mutation, but rather the underlying method by which the possibility for variation can exist for all life. Remember IMP generates both fundamental context structure and elemental possibility. Possibility always generates into constraining context and context always enables and constrains possibility. We can't separate the existence of one from the other: IS and NOT describe Minimal Context and Minimal Context is composed of IS and NOT. When we see variation, we see possibilities whose existence has been enabled by context. How does that happen?

If we look closely at the concept of variation, it requires that potential for variation exists — and therefore continues to exist — and a method exists by which potential repeatedly becomes possibility. Remember, a Thing exists in including and included contexts that continue as possibilities resolve to choice for that Thing. We first brought up continuing context when we used a rock to demonstrate the Choice Mechanism. As we will discuss in detail in the Fourth Discussion Group, actions in the present relate the possibility structure of a Thing as it has developed over time to what might happen in the future. This means the past carries into the moment through the persistence of a Thing's possibility structure and extends into the future as continuing context enables dependent chains of “what if” possibility. The Choice Mechanism's context structure coherently enables and constrains these chains from past to present to future.

Continuing context for any Thing reduces to the moment because that is necessary to maintain coherence across scales within the IMP box. Note we said “reduces”, not resolves. Context resolves to choice to make a moment for each Thing while continuing context reduces to the moment. We've described how at any moment for any Thing some contexts resolve to choice while others continue into the future. We've noted these contexts may be including, like the

weather, or included, like the progression of your heart disease. We know all contexts follow the structure of the Choice Mechanism, which means continuing contexts evaluate using Base 2 and Base 10. When we say continuing context reduces to a moment for a Thing, we mean coherence requires the “what if” dependent chains of possibility extending into the future to fit together as each moment occurs for each and every Thing. They reduce to a value in the moment — another expression of the mind boggling calculation the universe performs. The value may be negligible or, in statistical terms, far out on the tail of a distribution.

The alternative to coherent resolution of continuing context would not be unlikely events but impossibilities. Remember, unlikely results are still results within the Choice Mechanism; only our hubris places limits on calculation within the IMP box. As we noted in the First Discussion Group, the Choice Mechanism creates relative impossibility from the absolute impossibility of IMP and that not only allows but mandates ordering. Coherence expresses this ordering for contexts. An impossibility might be that you occupy the same physical space at the same time as another person or a tree or that you take a step off the curb and find yourself 10 meters to the side or even on a different street on a different day and that the consequences would be noticed. Threads exist which violate relative impossibility but coherence prevents those threads from resolving to choice at the contextual level that includes physical reality. That we can imagine these impossibilities reflects their existence in the non-physical realm. Coherence means they can only render in our physical world as stories, as beliefs or as art. We visit this issue again in the Fifth Discussion Group when we describe how the Choice Mechanism generates time.

Any moment for any Thing combines what has happened with what coherent resolution of continuing context enables. The point may be subtle: possibility exists for any Thing at any moment essentially because the future allows it. The potential of the IMP box translates into possibility as the past existence of a Thing interacts with the Thing's future in continuing context to define those possibilities which can become real. That which is must have been and is enabled by what is to be. A Thing that currently exists must have existed in some form moment by moment back in time until it was only unrealized potential, until it was only a possible future. We want to emphasize this point: the continuing existence of a Thing constrains the potential for possibility inherent in continuing context so the possibilities which actually come into existence fit the Thing. This is how the Choice Mechanism reduces the uncountable potential of the IMP box to possibility related to a Thing. In it we see the double-edged sword of the Choice Mechanism, enabling possibilities for a Thing and constraining them at the same time. These constraints come both from a Thing's past and from its possible future as reduced to the moment. As noted, we will discuss how coherence operates on Things in the next Discussion Group. We will, for example, explain why a specific evolutionary result occurs and will discuss in some further detail what the relationship of Things to continuing context means.

Coherence in the Choice Mechanism generates both the structure that makes possibility and how it becomes real. For any Thing, the structure of continuing context reduces IMP box potential to possibility related in some way to that Thing, while each resolution to choice organizes that possibility in relation to that moment. We can say continuing context translates

absolute potential into potential related to a Thing: of all that might be possible, continuing context for a Thing contains what might be possible for that Thing.

For natural selection and evolution, the concepts of random mutation and genetic drift embody the potential of continuing context. A Thing can mutate randomly because the possibility for that is enabled to exist in continuing context. This is true in general and for each specific variation.

Coherence also describes how the potential of continuing context becomes real. Possibilities that can become real are those which fit a Thing as continuing context reduces to the moment. This reduction is how the Choice Mechanism constrains variation: potential exists for spontaneous formation of a person in the middle of the street or for any absurd occurrence but coherent resolution of continuing context does not allow that to happen. In the Choice Mechanism, physical existence is a context, a topic we will discuss further in the following sections. We can imagine absurd things and can render them in words and images. We can share and appreciate them. They can greatly influence us. While we can make absurdity and can place absurd things into our world, we can't violate coherent resolution of the Thing of our shared context of physical existence. Continuing context constrains all levels of Things, from the largest aggregate Thing to you and to each Thing within you.

Context resolving to choice not only allows or disallows specific variation but also determines survival in context. Random mutation, for example, will generate variations for a Thing that can't survive well moment to moment. That is the same as saying those variations have enough value in continuing context to come into existence but not enough to survive. At the limit, a variation with effectively no value in continuing context may be described as potential that can't be realized. Value into continuing context applies to all aspects of continuing existence, not merely to a mutation or other realization of a variation out of potential. An example is terminal illness: the possibilities reduce for the Thing until there is no value in continuing context for its being alive. The value of the possibility for recovery reduces as life ebbs until it becomes only potential that cannot become real.

The Choice Mechanism illuminates why natural selection acts on the individual but affects groups with shared traits. Remember the elemental description of a complex, physical Thing is a tangible Thing with an attached intangible possibility structure. A biological trait is a physical Thing that relates to a possibility structure. A trait shared by a population attaches each individual, physical Thing to a shared possibility structure. Natural selection acts on each individual physical Thing through the favoring of shared possibility structures. "Favoring" a shared possibility structure means continuing context enables the possibilities embodied in that structure. Note the attachment of physical Things to a shared possibility structure is not only why they can share traits but why we are able to aggregate Things in general. The Choice Mechanism acts on a group of physical Things at the scale of the individual physical Thing and at the scale of a shared intangible possibility structure for the group. Though we can lump individual physical Things together to make an aggregate Thing, context operates on and selects each individual, not a group of similar physical Things. To be absolutely clear, the Choice Mechanism

resolves coherently for each Thing, so there is no group selection of physical Things of the same type or kind.

Coherent resolution for individual Things extends to the limit; it is true for any Thing, even if it is part of a larger physical Thing. While a Thing can be an aggregate — and of course almost always is — resolution coherently occurs at each scale for each Thing in the aggregate Thing. You are a complex, aggregate Thing. Possibility is enabled and resolves to choice for any Thing within the overall Thing of you. All the physical Things within the physical Thing of you share a possibility structure. When you die, the possibility structure of you the physical Thing resolves for all the physical Things in you and you physically cease to be alive. Your hair may continue to grow but not for long. This is why it makes sense to speak of selection at the genetic level. Though the Thing is an aggregate of many Things, genes are the encoded physical manifestation of the possibility structure that makes the aggregate Thing. We will discuss in the next section how the Choice Mechanism generates this kind of persistent structure.

Consider a virulent disease that kills at a very high rate. The Choice Mechanism explains why such a disease tends to moderate over time. Remember, we are using the Choice Mechanism to explain why carefully observed and described phenomena occur and that none of this material is otherwise new. Each moment's coherent resolution generates a value for a Thing in continuing context and this value manifests as current possibility for that Thing. Since disease occurs in an individual Thing in a population of Things, its ability to spread within the population depends on its value in the populations' shared possibility structures. A disease or trait may have high value in an individual Thing's continuing context but low value in the shared possibility structure of one or more larger Thing's continuing contexts. Applying the variability built into the definition of Thing, we see a deadly disease tends to spread better into and will tend to kill those Things with more similar possibility structures. The shared possibility structures may be as basic as proximity: kill too many in too small an area and you have no one to infect. Don't kill as fast or as much and the Thing of the disease may infect a larger shared possibility structure.

We understand continuing context can be difficult. To go over it again, a Thing exists in including and included continuing contexts which coherently reduce to a present value for that Thing at each moment. Possibility must exist in the constraint of context just as context must enable and constrain possibility. Context must reduce to value because the Choice Mechanism operates coherently inside the IMP box and a moment relates the past to the present to the future through possibility structures and dependent chains of “what if” outcomes. Mutation occurs because context fundamentally enables that chance, meaning potential exists over time which can become real for that Thing. A mutation survives because coherent resolution enables that actual possibility to exist within those particular contexts for that Thing; the mutation has value in the possibility structure of continuing context. It is not that the future knows a tiny structure will become an eye. It is rather that coherent resolution of continuing context enables that tiny structure now and at each moment as the structure develops. That possibility exists in context does not imply it has greater meaning than that it exists in context. Do not confuse any path we can draw from the past to now with a plan that carries into the future as predestination. As

discussed above, the resolution of possibility to any moment for any Thing requires unimaginably vast calculation. We can not in any way discern a plan except by calling whatever happens the plan.

We can now more rigorously state that natural selection is the coherent operation of the Choice Mechanism enabling possibility into continuing context from moment to moment. Natural selection is the name for the Choice Mechanism selecting a Thing to exist or NOT in continuing context. This process embodies two elements: the potential for variation and the survival of variation from moment to moment in context. Evolution as a whole combines selection with the Choice Mechanism's enabling of possibility, uniting that which generates from within with that which imposes down, all through the same Choice Mechanism process. Evolution reflects the continuing existence of a Thing in context; as it changes over time, the Thing continues to exist or NOT as continuing context resolves to choice. Remember, this entire evaluation process roots in Base 2 and Base 10, which is why we can apply statistical analysis in biological science.

Does this make sense? First, we are in no way describing something new but are providing the “why” behind what we already know extremely well. We know alleles that represent successful variations tend to become more numerous in populations over time. The Choice Mechanism is why: these variations have sufficient value in the shared possibility structure of continuing context so individual Things with those variations tend to survive. This process occurs because coherent resolution of including and included contexts within the IMP box generates a possibility structure for any Thing which in any moment relates that Thing's past to the possibilities enabled for it into the future. Here we see a perfect example of the definition of Thing expressing variance within the IMP box; a Thing can be a physical individual Thing or can be a group which shares a possibility structure.

Does it make sense to speak of shared possibility structures? How else would we see the logarithmic spiral at scales from beaches to galaxies? How else would all the possibilities organize for such extraordinary numbers of elements? It may seem strange to offer questions as a response, but remember there is no other explanation at all. To be more specific, we will as mentioned above address a fundamental aspect of this topic in the Fifth Discussion Group when we discuss how fundamental constants calculate to great depths but are used in daily life. That is, a constant calculates to essentially infinite depths and yet this form of infinity somehow fits within our physical world and within time. To answer the question with respect to natural selection, since we can't place limits on the calculation ability of the Choice Mechanism within the IMP box, if the possibility structures of Things are entirely separate, they generate repetitively so we can speak of them as shared. The Choice Mechanism enables highly similar physical objects to exist and the same actions to occur repeatedly and allows us to treat these objects and actions as groups and as individual Things. All trees are trees but each tree is unique. If at some hidden level, what we see as “all trees” is something else, that “something else” expresses in our universe as a shared possibility structure we can label “all trees”. We could not group objects, could not construct a taxonomy, without the Choice Mechanism.

Second, try to imagine how the possibility of variation could exist without coherent resolution of context. If we don't take the existence of possibility for granted, we would need to assume the existence of possible variation and the existence of some continuing structure into which that variation fits. This structure would need to value the spectrum of possibilities from those that can't exist except as potential to those that must exist. It would need to relate possibilities now to what has occurred and what might happen. These assumptions mimic the Choice Mechanism. We currently take for granted that potential in the future reduces to now, that the vastness of all that might be reduces to a set of possibilities that apply to each and every Thing. We take for granted a relationship exists between the moment and continuing context. The oft-used phrase “survival of the fittest” means those Things whose possibility structures fit the possibilities enabled by continuing context tend to survive. Again, when you open a book about probability, it doesn't start “let's assume possibility” because we take for granted possibility exists and that we can evaluate it. While it may sound odd, even threatening, to say the Choice Mechanism relates the past to the present to the future, this is what we actually believe now.

We can now explain why we approached natural selection by discussing objections to it: natural selection exemplifies the fundamental importance of understanding why. We can describe the operation of natural selection and of evolution generally with astounding scientific detail but the lack of why — the inability to understand why natural selection exists and where it comes from — leaves room. We fill this space with belief. Without understanding the why provided by the Choice Mechanism, we don't realize objecting to natural selection is objecting to creation itself because natural selection is the expression of the enabling and resolution of possibility in this universe. Evolution expresses and embodies the Choice Mechanism for living things.

It is important to understand that belief, rational or not, is itself a product of the Choice Mechanism. The Choice Mechanism requires our observations of direction to resolve to a meaning. One scale effect of context, as we will discuss in greater detail in the Fifth Discussion Group, is that events have direction. It is rational to conclude purpose exists. It is rational to apply our imagination to what that purpose might be, to how it arises and what it means. It is rational to infer backwards from what happened to conclude a result was ordained. It is even in a sense rational to be irrational, to reject or distort evidence which challenges our belief structures. Perhaps most horrifying, it is rational — though not excusable — to do harm in the name of our beliefs. We find meanings because those meanings are possible to find. We find meanings because we are ourselves built by resolution of possibility to choice. We are always in a moment as Things which continue to exist in included and including context. The Choice Mechanism is part of us, part of how we are and how we think. We can't help but sense possibility coming into being in the continuing contexts of our lives. Our cultures reflect how we think and then impose context back down on us as individuals. They shape how we see what is and what might be, even when the results are hideous. We inherently perceive possibility resolving to choice and we recognize that process in life around us. We try to dominate, to control what others think because we respond to the urges of context.

We now turn to a related problem: economic markets. As with natural selection, we have a great deal of scientific research about what may generally be called economic markets. The most famous description remains Adam Smith's somewhat casual usage of an "invisible hand" to describe the force by which markets organize individual activities over time and space. As individuals act for their own self-interest, they pursue the possibilities they see as benefitting themselves within the contexts they perceive. These individual choices add together and that creates larger contexts which determine both the supply of goods and demand for them. Market forces determine prices, both at an instant and over long periods of time. We can in this age trade large values in milliseconds, just as caravans and sailing ships slowly carried silks and spices from Asia for exchange in Europe.

It should be obvious economic market forces and natural selection both express the coherent resolution of context for Things. To be clear, by "economic markets" we mean fundamental operation of economic principles not "free markets" or any other variety. Economic markets express the enabling of possibility and its coherent resolution into choices. Markets embody included contexts rising up to define including contexts and including contexts imposing resolution on included contexts. When we predict what will happen in a market, for a company, for a sector, for an economy, we analyze the coherent resolution of contexts to a moment to estimate the possibilities enabled by continuing context.

As with natural selection, without the Choice Mechanism, we have had no way of explaining at the fundamental level why economic markets exist or where they come from. We observe they exist, but have not derived that existence from absolute first principles. When we derive from first principles, we uncover a number of uncomfortable but undeniable truths. So for example, people who refuse to accept natural selection or evolution almost certainly believe in some form of markets, often in what may be described as "free markets". These beliefs are contradictions: if you believe in markets, you must believe in evolution or you can't believe in markets because natural selection is markets applied to biological processes just as markets are natural selection applied to economic activity. Both are direct representations of the Choice Mechanism.

The Choice Mechanism not only explains why economic markets exist but explicitly how. We can, for example, resolve much of the conflict between supply-oriented and demand-oriented models and can more appropriately understand the mechanisms of market competition and market development. We can more accurately describe the foundations which underly microeconomics and which relate that to macroeconomics. There is significant room for improvement, given the degree to which the field is dominated by belief structures rooted in relative principles that masquerade as absolutes in service of our strong tendencies to impose ideology as truth. This is partly a criticism, but mostly a statement about the difficulties inherent in examining actions and results which can't be isolated in a specific physical form. We will discuss this subject in more detail in the next Discussion Group.

Does this make sense? We have two essential forces we know operate in our world. They reasonably could flow from the same ancestor, if not from the same immediate cause. Both natural selection and economic markets strongly demonstrate coherence; they both must work in

every niche without exception. It is impossible to imagine the basic principles of economic markets not extending to some economic activity because that would require a different kind of human being. It is impossible to imagine natural selection not extending to some part of life because that would require a different form of life. To the extent we can identify a strange form of life or of economic behavior, we can see the specific context in which that occurs and why it reflects the possibilities enabled and constrained by that context. We can now say why: both natural selection and economic markets express the coherent operation of context in the Choice Mechanism within the IMP box.

At another level, any answer why must address this undeniable observation: both natural selection and economic markets require vast numbers of possibilities coming together over time and space to make actual results. These possibilities affect as many different scales as we can name, from viruses to dinosaurs, from a single transaction to the world economy. These possibilities must somehow exist in a moment and continue to exist from moment to moment. They must relate past to present to future. These observations may be summarized as follows: possibility must be enabled to resolve to choice in constraining context. That is what the Choice Mechanism does.

The Choice Mechanism provides a unifying, fundamental explanation and enables analytic methods which connect across areas of knowledge. As we've noted, statistical analysis can only work across disciplines because it looks at the same underlying context structure which literally manifests the existence and organization of numbers themselves. So for example, natural selection and evolution tell us the egg came before the chicken because a chicken must be born a chicken, but we apply the same tools used in economic analysis to tell us how chicken population expands to fill the space available given food, predators and other contextual factors.

Without structure in possibility, how would we compare different areas using the same tools? What would we be comparing? Even if we look only at results, we draw implications which estimate the possibilities continuing context enables. Because we act, our evaluations of what might be shapes what happens, whether we guess well or poorly. Even if an unknowable form of chance, a supernatural power or some other cause beyond imagination is the ultimate "explanation" for "everything", our analytic methods are so repeatable and so regular, the Choice Mechanism is what we see. As noted above, we see shared possibility structures in fundamental constants. Again, there may be some hidden method by which such deep similarity generates over and over, but the Choice Mechanism accurately represents it. A tree is a tree but each tree is unique. Each circle we draw uses  $\pi$ .

We discussed in this section how the Choice Mechanism generates through the operation of context what we identify as "forces" operating in nature, notably natural selection and economic markets. We concentrated on the aspect of coherence: both natural selection and economic markets reflect the coherence generated within the IMP box. As with every other example discussed in this entire work, neither of these forces has any other explanation and it seems even the question of why they exist is either taken for granted or treated as an issue of faith. It is striking that belief tends to deny the existence of one while affirming the existence of the other.



The contrast is informative. The belief structure that denies evolution has difficulty accepting the objective truth because the truth challenges substantial aspects of that belief structure. Note we said “the” truth, not “a” truth because evolution is true except in the context of belief that denies this aspect of reality. Economic markets, on the other hand, reflect relative beliefs struggling with each other: my idea about how markets work, how they should work and what that means is better than your idea. There can be no winner because the Choice Mechanism says there is no optimal system, a subject we will discuss further in the next section. These two aspects of belief reflect the human condition in the Choice Mechanism: we have great difficulty learning the most fundamental lessons and we are doomed to fight endless wars which cannot be won.

The Choice Mechanism not only derives the existence of context but makes it into a structure and a force that shapes reality. It is not merely that stuff happens in context, but that context itself is the mechanism by which stuff happens. Context is the structure in which possibility occurs and resolves to choice. The process of resolution occurs coherently across scales. The connection to the structure in the last Discussion Group should be clear: more complex events than the movements and interactions of fundamental particles fit to the same Choice Mechanism structure of Immediate and Larger Contexts. We can see these structures clearly, in a pure form, when we look at fundamental particles. We see their effects at larger, more complex scales. We have fingers and we pay a certain price for bread because the context structure coherently resolving moment after moment guides reality.

When we describe peer pressure, we look at contextual effects of the Choice Mechanism. When we describe inherent structures within language, we analyze expressions of the Choice Mechanism, both in the enabling of the language structure within us and in the language structure itself. When the same food tastes better served on more attractive plates in a better decorated restaurant, that is an effect of context within the Choice Mechanism. When we talk about how poverty exerts a powerful influence on the poor, we attempt to identify and measure the power of context in the Choice Mechanism. When population genetics analyzes the relative frequency of alleles, it relates included and including contexts within the Choice Mechanism. As a note, the Choice Mechanism says our understanding of the meaning of correlation and its relation to causation is somewhat incomplete and, to a degree, misleading. That is another topic.

## GROUP 4: PERSISTENCE

We focused in the last section on examples that express coherence. We now look closer at how coherence relates to persistence and the “persistent possibility structures” of Things. We discuss a number of examples that illuminate the coherent resolution of persistent possibility, including some which expand on the Third Discussion Group. This section is the longest by quite a margin. We apologize for the sprawl, but we need to cover a great deal of material and that takes space to unfurl.

To begin, if you remember back to the definition of Thing and the discussion of a composite Thing, we can say a physical Thing has associated with it an intangible Thing. This intangible part represents the complex Thing's “possibility structure”. Since a complex Thing consists of many contexts which embody its past and which extend beyond the moment, it has a “persistent possibility structure” which tends to continue from moment to moment. Since a complex Thing relates to other complex Things, an aggregate possibility structure for these Things tends to persist. We will flesh out what this means below.

Consider an intentionally small example: imagine you are approaching another and you both need to pass through a relatively small opening. We will use this example to develop a series of fundamental points concerning the application of context to persistent Things. You can be on foot, on a horse, in some form of vehicle or approaching the narrow place in any way you want. As you get closer, you evaluate the other and the opening. You decide whether you can fit, whether you both can fit, and so on. You respond, consciously and unconsciously, to the possibilities inherent in your own knowledge of yourself and your capabilities and desires. You see a set of possible choices and these possibilities resolve as each of you proceeds. The Choice Mechanism tells us these possibilities are enabled and constrained within this context of you and another approaching the narrowing. The possibilities we perceive and how we react reflect our persistent possibility structures as these relate at that moment to continuing context.

We often choose to squeeze through a narrow place at the same time despite the added physical difficulty or risk. This is especially true if our approach doesn't leave us much time to evaluate our options. Think about that using the Choice Mechanism. When we squeeze through, we resolve the possibilities we consciously recognize and unconsciously sense in the context of approaching. We reduce these possibilities to a choice that shifts us from the context of approaching to a context of immediate action to avoid inappropriate or unwanted contact — or perhaps to cause contact if the person approaching is attractive or any other result we can experience. We simplify to choice even though that choice may increase the risk of physical danger because coherent operation of the Choice Mechanism requires the context of approaching to resolve to choice. We can't stop time. We will interact. We must choose.

If we approach the narrow space more slowly, the extra time allows our experience to shape our response more. Our personal histories and cultural expectations tend to become more valuable. We might step aside for an older person because our cultural and personal experience increases the value of the risk of causing harm to the elderly. We might push past a child because

our culture and experience tells us to expect the smaller being to step aside. We make quick judgements based on instantaneous appreciation of relative status. Are you a threat? Are you higher or lower in the social structure? Are you someone we recognize? These judgements reflect the persistent possibility structures of our histories.

Contexts resolve to choice though choice shifts us from one context to another. This process is subtle, complex and powerful. Remember, value is determined in the Choice Mechanism through the utterly simple comparison structure embodied in Base 2, Base 10 and threads of IS and NOT. Some threads, whether important or unimportant, whether within us or outside us, resolve to choice at any moment while others continue. Any resolution to choice changes the values of related continuing threads, from immediately connected to remote. It also affects which new possibility threads arise, how the various threads relate and so on. This interdependent complexity of the many included and including threads resolving to choice guarantees shifting values across related contexts.

The Choice Mechanism process embeds choices within the flow of reality at every scale of our existence. We shift from one context to another, moment to moment, from larger to smaller and smaller to larger. We move from larger context to become absorbed in included context, and vice versa. We inherently reduce possibility to choice, even when we don't realize we are choosing. We shift because the process of the Choice Mechanism resolves possibility to choice and each choice leads to another choice to another choice. We shift because each choice occurs within continuing context. We shift because possibility resolves to choice in contexts that occur within contexts. We shift because all contexts exist within the IMP box and must be included or including. We shift out of important contexts to the trivial. We shift into contexts we don't want to think about.

Our daily lives are a massive assembly line of choices. We recognize some but most pass unnoticed even if we try to be mindful of our actions. When you reach for a cup, a huge number of possibilities come together to make that act and then the result of holding the cup. These possibilities reflect many sources: your persistent possibility structure, the cup's persistent possibility structure, the place you're in and what's happening in it, what has happened in other included and including contexts that brought you to this place and to this moment in this condition. Even if you focus on the smallest acts of drinking, when you reach for the cup, you then have to hold it and then drink without spilling and then speak while it's in your hand and then put it down and so on. Each of these steps is a resolution of possibilities to choice that shifts you into the context which is next, next, next. Each of these steps consists of smaller steps that are themselves resolutions to choice. Each word we speak or think is a resolution to choice, a process we notice mostly when the right words don't come seamlessly to mind or when we struggle to express a thought. We tend not to think about walking except when we see a baby taking its first awkward steps or when we hurt a leg or when age or illness reduces our physical abilities.

We are complex Things. The resolutions to choice that assemble to make each moment, each day and the entirety of our lives relate our persistent possibility structures to continuing context.

We could not lift a cup or hold it or hand it to another without persistent possibility. This kind of learning embeds in our possibility structures so we can perform acts like this while doing other things. When we take a walk, we anticipate and react to what our possibility structure enables us to perceive. We react to what context imposes because our possibility structures enable us as they constrain. We see the mountain lion next to the path and run from the danger but we can't run faster than the cat.

You are not instantaneously part of every new context: your adjustments are enabled and constrained by your persistent possibility structure. Step to the end of a line or into an elevator and you tend to adjust your behavior to fit that context. Step out of a warm building on a bitter day and you may be shocked by the cold because you were not prepared for the new context. You may become part of a crowd, perhaps to cheer at a game or to help in a crisis or to bully someone. You may stand by yourself and watch others dance. You may act like one person at home, another with your friends and still another at work. You try to focus on nice things but bad thoughts intrude. You try to work but find yourself making up stories in your head. This is the Choice Mechanism: as possibility coherently resolves to choice in context at every scale, your persistent possibility structure is immersed in context after context. Contexts resolve to choice for the smallest pieces of your existence, for your life as a whole, and for all the lives around you. Remember, it is not merely that the Choice Mechanism generates context but that it generates context coherently at every scale necessary and that possibility resolves to choice coherently in all contexts at every scale. We will discuss some larger meanings of context resolving at every scale in the Fifth Discussion Section.

As a variation on the intentionally small example, consider when you approach the opening expecting the other to act one way but must leap aside when that person acts differently. Surprise is the Choice Mechanism imposing a different resolution than expected by the contexts resolving for your choice. You respond to certain threads, some consciously and some not, some in your control and some not. Your actions reflect the resolution of possibility threads within the Thing that is you, but context exists outside you. You may be the jerk pushing people aside or you may be the one pushed. You may be the distracted one unaware of the inconvenience you're causing. You can be surprised and can impose surprise.

The Choice Mechanism means contexts can be considered as competing with each other. Contexts with higher value "win". The determination of "higher" value depends on the need of the selecting context. That is an application of the perspective function described earlier. Contextual perspective determines value: if you need a rock to throw right now or a rock to polish for jewelry, you select for that need. Natural history is filled with examples of a smaller Thing surviving instead of a larger Thing: dinosaurs and giant crocodiles are extinct. We placed this point in this section because contextual competition applies to all resolutions to choice not just natural selection. Each choice in the unimaginably vast flow of choices selects a winner that IS or is NOT. That is why the amount of calculation required in a moment is unimaginable.

The results of contexts competing are often messy. To return to the intentionally small example, consider when you collide with the approaching person. The lighting at the narrow

point may be too dim for you to see the other. You may be looking at your phone or changing the song on the radio or otherwise be distracted. Your actions and reactions may be affected by alcohol or lack of sleep or worry. You may see the oncoming person and decide not to get out of the way because children are playing where you would need to move and you worry about hurting them. An outsider might see a crash caused by one traveling too fast and the other not getting out of the way, without any understanding of why it happened. Any version of the crash requires the interaction of persistent possibility structures. Context coherently operates on persistent Things.

If we apply a test of true objectivity, any description of the crash will be incomplete. You experience your part of the crash but not the entirety, not even the entirety of your own experience, just the part you recognize. We can't perfectly describe the entire Thing of the crash because possibility inside the IMP box extends beyond whatever relative boxes we define and any Thing, remember, is a relative box. This is an application of IS and NOT and of Minimal Context; NOT extends to include potential to the IMP limits. A relative box means we must always apply a relative perspective function, which means we must always apply context. You may think the other is at fault but another context says you are. If the other person is higher status, you may be arrested no matter what happened because that society applies that context. One society may excuse you if your vision was impaired while another may fault you for driving with impaired vision.

We see here how natural selection relates to the more “ordinary” application of context. We can favor people with certain traits while punishing others. We can decide who lives and who dies. We apply context, sometimes at the point of a gun. Our actions may have massive, permanent effects: we can kill individuals and wipe out groups and species. Our actions occur within the Choice Mechanism, so we are subject to it. Since we are inside the IMP box, we are capable only of relative perspective. We must apply context and must have it applied to us. We can only make relative judgements, even as we believe we are absolutely right. The Choice Mechanism generates the fundamental relationship of a Thing existing in context. It is the essential process by which a Thing survives now and into the future in the continuing flow of contexts resolving to choice. Our perspective changes with time, with changing context, while natural selection is the Choice Mechanism itself coherently evaluating each Thing as it relates to continuing context. It is remorseless because it is the underlying process by which context resolves to choice for Things. That we live in contexts, that we apply contexts and are subject to them, doesn't excuse harming others. The Choice Mechanism generates the relative nature of existence and establishes the absolute standard of IS and NOT in the IMP box. We are Things. That which we do becomes part of the persistent possibility structure of the Things we are.

Our existence as Things in the Choice Mechanism's context structure limits our ability to see. No objective context exists to tell us what happened or what will happen. We are enabled within context as we are constrained by context. We argue incessantly about what happened and what it means. We have trouble discerning what is happening now and can only guess what will happen. We choose to squeeze through narrow openings or to leap across gaps or otherwise to put

ourselves in danger because context limits what we see. Only when we choose do we enter a context in which that choice may be good or bad. No one intends to make mistakes. If we make a mistake on purpose, that is not a mistake in that context. We rarely intend to make bad choices and if we do we have reasons for that. No country invades another expecting to be destroyed. When we commit evil, we generally believe we were doing what was necessary or required. Only in mid-air do we realize the other side is further away than we believed. We find out the narrow place is too small only when we try to fit through.

As noted in the last Discussion Group, it is not only rational to believe but rational to believe in purpose. We tend to believe certain results must happen, although the Choice Mechanism means we can't see all the applicable contexts with all their possibilities as they resolve into the future. We construct a route into the future through possibility after possibility and imagine belief will make that path come true. When a result we like happens, we construct a path that ascribes it to our beliefs. We are very good at convincing ourselves that relative truth is absolute. We tend to believe what happens fits a plan that mirrors our beliefs. We interpret events to fit our beliefs, amplifying the meaning of some, discounting or ignoring others. We can, of course, sometimes see the inevitable, though we tend most often to be correct in purely physical cases: if you jump out of a 10th story window, you will be subject to gravity so, putting aside fictional plot twists like the jump carries you into a waiting helicopter, you will hit the ground. We can sometimes analyze more complicated resolutions of possibility using the tools of probability. The rest is a guess. Certainty and doubt both flow from the Choice Mechanism.

Coherence means the context structure fits together without gaps, not that results optimize for you or for any group over any particular period of time. It is wrong to believe the Choice Mechanism generates the best results, unless one defines "best" as "whatever happens". Coherence ruthlessly imposes efficient resolution to choice at every scale of context. Our language reflects this. The world is on a string one day, but we are down in the dumps the next. We can win the battle and lose the war. Bad things happen to good people. If it weren't for bad luck, wouldn't have no luck at all. We speak of turning points, high water marks and watershed moments. Victory is snatched from the jaws of defeat. Pride goeth before destruction, and a haughty spirit before a fall. It's always darkest before the dawn. Fate is a cruel mistress.

Coherence drives us, beats us, pulls us, yanks us forward with a power beyond control. As values change at various scales in threads of IS and NOT, possibilities in contexts are forced to resolve and that moves us ineluctably into the next context. As we see with the intentionally small example, coherence acts on the possibility structures of our personal histories and cultural expectations, on our physical capabilities to recognize and respond. Coherence acts on us as Things. Good decisions and bad depend on how we interact in context. We choose, consciously or unconsciously, and have choices forced on us as coherence acts on the possibility structures of the complex Things we are.

It is tempting to say persistence resists coherence or that it causes inefficiency, but these are value judgements which impose a context in which a favored result is "best." Choices which generate the least or most heat or which avoid or cause a crash are only efficient if you apply the

relative perspective of the context which values that result. A more accurate description is that persistence generates complex resolution. Persistence pushes the efficient resolution of coherence through complex layers of context and coherence, in turn, requires all these complex layers resolve. As a note, we can see here one relation of the Choice Mechanism to the laws of thermodynamics: coherence applied to persistent Things must account for all of the Things.

Persistence operates through two intimately related general forms, friction and inertia. Friction directly reflects the interaction of Things. Drag a finger across a rough surface, such as an unshaved part of your body. Your hair grows in response to its internal contexts. You must cut it to make your skin smooth. Your hair doesn't learn, at least not very well; it continues to respond to its internal contexts. This is true for all friction, for all kinds of Things: when Things interact, they express the persistent possibility of their included contexts as they have developed over time through interaction of included with including contexts. Complex Things can not fit themselves by some unknown process to a super-imposed “objective” context that determines the “best” outcome. Two blocks of wood can't rub together more smoothly than they can. To use the intentionally small example, when you interact with the other as you approach and pass through the narrow place, the complexity of your persistent possibility structures causes friction we experience as clumsiness, as less than perfect reactions, as injury, as bruised feelings and so on. As another example, we care for animals who hide illness from us until they are too sick to carry off acting normal. Most animals can't learn they should show weakness to us to get treatment. Their persistent possibility structures respond to what they are, not to what might be best for sick pets. We experience friction from these interactions as veterinary bills and worry.

The other main expression of persistence is inertia. The more complex a Thing, the more layers of possibility enabled in threads of IS and NOT. These threads tend to persist to their own resolutions; they occur in contexts driven by coherence to choice. This means a Thing tends to persist as it is and on its path. Inertia expresses complexity; the simpler a Thing, the more efficiently it may react to changes imposed by shifting contexts. The denser the possibility structure of a Thing, the more the threads within it respond to their included threads and tend to proceed to their resolutions with less reference to what an including context demands. Persistence within a Thing leads to persistence of a Thing as it is from moment to moment, choice after choice, in context after context. We can see friction and inertia are closely related; they express different aspects of how persistent possibility structures interact. The intentionally small example involves friction resulting from the inertia of possibility structures preventing perfect interaction. A sick cat hides because its possibility structure has inertia and that generates friction as it interacts in context with the worried person. As a note, this explanation agrees with — and underlies — the various forms and definitions of inertia we usually consider.

Coherence and persistence together make a grinding wheel which resolves possibility to choice in context no matter the effect in any specific context or on any Thing. Consider your arm. The defining of the Thing of your arm within the Choice Mechanism draws a relative box which both enables and constrains that Thing. Your arm is a highly persistent structure consisting of your physical arm together with a possibility structure developed over the history of human

evolution, your family genetics and the vagaries of your life. If you fall and hit your arm against a brick wall, your arm does not bend and return to shape. That is persistence. Your arm may break, bruise or come through unscathed because that is how the possibilities resolved, not because the universe somehow ignored the event or made some sort of exception for you. That is coherence. The wall is also a Thing with a persistent possibility structure: it is constructed out of materials by a process and interacts over time with the world. The wall does not give way to cushion you and then snap back into place. That is persistence. You can't fall and magically not hit the wall; it won't vanish and reappear after you've passed through. That is coherence. Your arm and the wall are persistent, relative box Things generated by functions within the IMP box. The Choice Mechanism acts coherently on these persistent Things. Note we could also describe this interaction of your arm and the wall in terms of friction generated by the inertia of the Things' possibility structures.

In the last section, we saw how natural selection and economic markets manifest coherence. If we apply persistence, we see how the Choice Mechanism generates results, including physical structure, which are less, not more efficient from the perspective of a larger context. Persistence explains, for example, why the recurrent laryngeal nerve descends into your chest and then ascends to your larynx instead of traveling the much shorter direct route. The Choice Mechanism says the nerve's construction represents many layers of possibility. The nerve is not merely a physical object but has attached to it a possibility structure which generates and maintains the physical nerve as possibilities continue to resolve in continuing context. It is a complex, persistent Thing which exists as a representation of its included contexts as those contexts relate to the other contexts of your body and to the larger contexts outside you. We know the nerve took a direct path in the first organisms in which it appears. Incremental changes — the neck gets longer, the nerve gets longer — “cost” less at each resolution to choice, meaning the value of the possibility threads of IS and NOT for changing the nerve's length bit by bit continually outweigh the value of the possibility threads for radically redoing the route. The radical adjustment threads exist but they lose in the competition among contexts resolving to choice. To say this another way, the value in continuing context is higher for possibilities which adjust the nerve incrementally and those possibilities at the same time fit the nerve's persistent possibility structure. Coherent resolution to choice acting with ruthless efficiency on persistent Things leads to a nerve structure we can describe as “inefficient”. The nerve will not radically restructure to fit a remote, more “objective” context just because that would be neater.

Evaluation occurs as context after context after context resolves coherently to choice. These calculations — all done at the most basic level by simple counting of possibility states — relate the value of contexts at different scales. These values express the nature of the persistent Things in those contexts. One can imagine, for example, a nerve might generate as perhaps a branching of an existing nerve to serve some other immediate purpose and that nerve might over time become a shorter route to the larynx. This result would occur because those threads of IS and NOT resolve to choice in context after context until that happens. Coherent resolution to choice of persistent possibility structures doesn't allow gaps. When a river cuts a more direct path and isolates an oxbow bend, that occurs because the possibilities have resolved over time to build the



value of the context of the new path. Though the actual event may be dramatic, even catastrophic, the process doesn't skip contexts to reach a desired result.

Try to imagine how these changes could happen without invoking persistent possibility structures. We could try to isolate the physical aspects from the intangible by constructing a series of snapshots that somehow exist one after the other or all at once. This alternative fails no matter how we construct it because we need to apply this snapshot mechanism consistently across every context at every scale. Even static representations, meaning pictures that don't move, when applied at every scale generates the Choice Mechanism: existence in context at every scale creates movement or, at least, what we think of as motion, just as still picture after still picture makes a movie. We saw this idea explicitly when deriving the constant  $e$  and when discussing the logarithmic spiral: the spiral consists of a series of snapshots of Minimal Context and the constant itself consists of every iteration of value compressed and expressed in a moment. We can't eliminate context within the IMP box. Even if we imagine all of the universe exists at one moment in every permutation, context would still exist and would still at least appear to resolve to choice moment to moment. We will discuss in more detail why this is true in the Fifth Discussion Group.

We explained in the last section how coherence generates current value for the possibility structure of continuing context. To go over that one more time, each resolution to choice for any Thing occurs within including and included contexts that continue. The possibility structure for these continuing contexts relates what might happen to what has happened. Continuing context enables potential to become possibility in any moment for each and every Thing. Some of that possibility has little value in continuing context: it doesn't survive long. Other possibility may become you, a Thing continuing to exist in context.

Consider a plant. A plant has a persistent possibility structure which enables and constrains the complex Thing of the plant as context resolves to choice within and around it. The plant shifts toward the sun because that is where continuing context enables possibilities which fit its possibility structure. It pushes out roots because that is where continuing context enables possibilities and those roots go where the possibilities allow them to go. A fire comes and the plant may turn away from the heat but it can't pull itself out of the ground to run. It moves toward the possibilities enabled by continuing context. It does what it can because that is what it can. It is enabled and constrained by what it is. A simple living Thing reacts to possibilities enabled by its future, with "react" meaning the Thing follows the threads of IS and NOT enabled by continuing context because those are the possibilities which exist for it. Remember, when we say a plant follows the possibilities enabled by context, we mean its physical behavior fits within this structure and the Choice Mechanism is the underlying reason why.

Consider again a virulent disease. A virulent disease has high value in the continuing context of the Thing it infects, even to the Thing's destruction. Why does this happen? Why would the Thing of the disease kill the Thing it inhabits? The question assumes the Thing knows its context, while the Choice Mechanism says the threads of IS and NOT in the possibility structure of the disease resolve toward their own choices. That is an application of inertia; the Thing can

only take advantage of possibilities enabled for it within continuing context and that happens to cause its own end. Even if we ascribe intelligence to the Thing, we can say it can only see its value in continuing context and NOT beyond that. Note that death of the infected Thing in this case may be described as friction, especially if we aggregate to look at the disease in a population. As mentioned above, your pet hides its illness from you because its persistent possibility structure can't adjust to fit your needs as a pet owner wanting to keep a beloved animal alive at rational cost. It does what it can because that is what it can. It is enabled and constrained as a persistent Thing within continuing context.

Consider a lion. A lion is a complex, persistent Thing existing over time in context. All lions share a possibility structure and each lion is an individual: lions are a Thing and each lion is a Thing. When a male lion kills another male's cubs to give his own cubs, which may not yet be born, a better chance at survival, the lion takes an action whose effects reach across time. While we can see the “what if” relationships, the lion acts without knowing its actions have these possible future consequences. The Choice Mechanism explains why: a Thing's behavior develops over time as continuing context pushes chains of dependent resolution back at it until these dependency chains become part of the Thing's persistent possibility structure. Continuing context has over time generated a strategy for the lion which gives the killing lion's cubs a better chance, even when they don't yet exist. This strategy extends over time into the future and reduces to enable present possibility and current action.

The Choice Mechanism relates any action taken by a Thing in the moment to what might happen. For any complex Thing, persistent possibility structure continues as it is enabled moment to moment by the future. When we describe a lion's behavior as a strategy for survival, we mean the future drives what we label as strategy backwards into each moment. The future builds these behaviors bit by bit into the persistent possibility structure of a Thing — and into many Things through their shared possibility structures. Continued existence in context constructs a relationship in which the future makes the present possible even as present choice defines the future. Any complex living Thing — whether a lion or you or even slime mould — feels the future in the chains of dependent possible outcomes embodied in its persistent possibility structures. The links become encoded. We carry them around and pass them to our offspring. As a note, we lack the space here to do more than point out the obvious manifestations of the Choice Mechanism in the physical encoding structures.

We can't impose the larger, objective context of our needs on a Thing whose persistent possibility structure responds to itself. As we've seen in the intentionally small example, we can't even control ourselves particularly well: outside of sports, we rarely crash into each other on purpose. As a Thing becomes more complex, its reactions to possibilities become more complex. We can look at a plant reaching for the light and ascribe meaning greater than its persistent possibility structure responding to the possibilities enabled by continuing context. Anyone who has tried to squash a bug knows it tries to save itself. All Things, animate or not, have developed possibility structures through continuing existence, through the interaction of the Thing's persistent possibility structure and continuing context. Granite resists crushing and flies are hard

to swat because that is how continuing context has enabled them over time. We will see below how “doing what it can” translates into concepts like “want”.

Turning to economics, coherence and persistence explain why and the actual process by which expectations reduce to present action. They also describe the limits to this relationship. We expect future actions because the Choice Mechanism links physical actions in contexts that extend over time and space by enclosing other contexts. We saw this explicitly in the Second Discussion Group and we will discuss it further in the Fifth Discussion Group. When a cat stalks a bird, the cat expects its actions may result in a kill. The cat and bird both bring their persistent possibility structures to the moment, matching the stealth of the predator to the wariness of the prey. We process information and make current decisions like the cat and bird. We expect future outcomes because contexts resolve inside and outside ourselves. We hunt. We place bets. We approach narrow openings and try to squeeze through. We walk down steps in the expectation we will not fall. The mechanism is the same.

Problems arise when we simplify. Certain economic “equivalence” propositions — such as “Ricardian Equivalence” — tend to highly over-state the extent to which expectations reduce to the present because they fail to account for the inefficiency caused by persistence and expressed through friction and inertia. The Choice Mechanism means our knowledge of future events, our ability to comprehend them and our ability to estimate their current effects are highly limited. We see through lenses that distort both historical and current facts and what we believe might or should or will happen. We tend to confuse efficiency of coherent resolution with optimal results. Aggregation of our responses sometimes amplify individual irrationality into what changing context reveals to be societal insanity. While it is tempting to imagine and often useful to model relatively instantaneous and essentially offsetting reactions, that is not how the Choice Mechanism works. This is especially true across time and space and when very large numbers of complex Things, meaning people and activities, are involved.

Persistence limits what we tend to label “efficiency”. Wages, for example, tend to be “sticky” because they represent complex possibility structures which respond to included contexts when external contexts try to force change. Persistence generates a “less efficient” result in a context that describes as “efficient” rapid change in response to pressure applied by including contexts. Wages are paid to human Things which exist in the contexts of individual, family and cultural needs and expectations. People live in these webs of persistence. It is no more possible to change this behavior than to mandate a utopia of communal sharing. While we can define “rationality” as “efficiency”, the Choice Mechanism means it is irrational to believe that definition works extensively in life.

Persistence also makes prices relatively inflexible. A price is a complex possibility structure which embodies costs of production and delivery, expected or required return on investment and so on. When context imposes a lower price, the possibility structure resists. If you put a plate of bananas on the counter of your little café and they don't sell, that is at root the same Choice Mechanism process of possibility resolving to choice as when a multinational company introduces a product after extensive development and it fails to sell. Experience embodied in

persistent possibility structure informs capabilities and understanding of the moment. We evaluate the chains of “what if” possibilities that stretch into the future and guess. We experience friction in the form of lower sales but the inertia of the possibility structure makes us stubborn. Maybe we don't want our customers to think our prices are “soft” or that we have no confidence in our development process. Maybe we hate admitting mistakes. Rather than reduce the price, we may choose to throw out the unsold bananas, while the company might prefer to sit on the unsold inventory until it is dumped at fire sale or salvage prices. The details always differ, but the Choice Mechanism process is the same: persistent possibility structures make prices somewhat rigid and less than ideally responsive.

To continue with simple, rather obvious examples, the Choice Mechanism explains why markets often act like a herd of cows. A herd shares a possibility structure made of the possibility structures of smaller groups of cows down to individual cows. Herd behaviors develop over time just as described with the lion above: the future drives this strategy back into the present through the dependent chains of possibility enabled by continuing context until the behavior becomes encoded in individuals. The possibility structures at various scales within the group significantly determine resolution to choice for each individual; you do what the cows near you do, whether this is the best choice for you and your smaller group within the herd or not. The possibility structures not only aggregate but they have real power over individuals because the group context imposes resolution to choice on smaller groups and individuals. A turning, a rapid movement, a panicked run by one cow might become a few and then many as the possibility structures resolve to choice. As noted in the last section, peer pressure is an expression of the actual force of resolving context; the power of the shared possibility structure of the group drives individuals to bad choices or good, to choices they might not make in other contexts. We rightly speak of markets being “spooked” and of the “animal spirits” of investors. Again, we know all this is true; the details of every situation differ but the Choice Mechanism provides the underlying reason why.

An army breaks the same way. Its panic may be stopped by units whose possibility structures gives them the strength to stand. That persistence, that resistance to context being imposed by other units breaking, may come from training, a charismatic leader showing courage, a threat of execution and so on. When markets panic, they run into similar possibility structures of resistance, from previous price points to estimates of book value to key market figures visibly buying. A previous price point is a possibility structure which represents all the reasons in that price, as contained in contexts that value prospects for individual companies to sectors to the national and world economy. It is more than a number. When a downturn tests prior lows, that embodies complex evaluation of these various possibility structures against this new context. When a respected market maker steps in to calm the markets, the possibility structure embodied in that reputation signals how the competition among contexts should resolve.

We have been briefly exploring the line between tangible actions which convey information, like nods or shifts in posture, and intangible possibility structures. The possibility structure of a herd, of an army, of a city, of a family, of a culture shapes behavior. It alters how what happens is

interpreted and that to an extent governs and motivates what happens and doesn't happen. An individual cow, like an individual soldier or an individual investor, reacts to tangible actions, even imagined actions, and interprets those in contexts. Using the Choice Mechanism, we can now describe rigorously the term "context" rather than using it as a generic notion. A cow in a herd acts on expectations though, like the lion, it's ability to understand future consequences is limited. Though people see further into the future, we know we can panic. A nod is a physical behavior, but the meaning and often the impetus reflects intangible possibility structures that connect the past through the moment into the future.

As noted in the last section, the particular difficulty in discussing economics is we can't isolate the force of markets in a physical organism as we can with natural selection. We can not only look repeatedly at the development of the eye and see the same thing each time but we generally agree we should be looking at change over time of physical structures and capabilities. What matters in the biological sciences is the physical Thing. That is why we focused in the last section on the importance of understanding the why behind natural selection: when we present the absolute of the Choice Mechanism, we need to discuss its obvious conflict with resistant belief structures. Economics lacks this physical form of objectivity, which means any approach to economics must be relative. The problem can be summarized as the difference between Choice Mechanism optimality and optimality for you or me or a particular group. We are literally unable to bridge this gap between the absolute of the Choice Mechanism and the relativity of our needs. The Choice Mechanism doesn't care but we must. What follows may at times make you uncomfortable. We apologize.

The essential operation of the Choice Mechanism is the enabling of possibility within the constraint of contexts that coherently resolve to choice at every scale. Every resolution is a supply of possibility which fits that particular demand for choice. Coherence means every choice in the uncountable flow matches supply and demand, so every resolution to choice is optimal in the Choice Mechanism. But we tend to believe in optimal results. We tend to believe, for example, there must be an optimal form for organizing markets, from no regulation to absolute control. The Choice Mechanism says that is not true. If we step outside the prejudices of our belief structures, no matter the measure of success sometimes government is good and sometimes it is bad, sometimes markets generate wealth and sometimes they generate poverty, sometimes market concentration is good and sometimes it is bad. We tend to believe markets can or even will solve the problems we identify as though markets care what we think is a problem. They don't. We can't point to a social problem and say the market will fix it because markets focus on what resolves to choice, not on what we want. Markets resolve possibility to choice in contexts and that is all. The market solution may be to ignore the problem or to make it worse. The Choice Mechanism is a remorseless grinding wheel. It doesn't care if an economy lingers in depression. It doesn't care if a society destroys its productive capacity and disintegrates. It doesn't care if children starve. It doesn't care. The idea that a pure or relatively pure market system would solve our problems at all, let alone with efficiency, is ridiculous.

Bias is inherent in any relative perspective. Most market economies generate subsistence or relatively low levels of material well being, but we draw distinctions that allow us to set them aside if that suits our needs. Most places with small government are poor, but we set them aside. We see what we want to see. We impose definitions of context, sometimes without realizing we are doing that, and generalize from these to construct and bolster belief structures which claim idealized success flows naturally from the ideas and crucial differences we insist we have identified. All else tends to become heresy. We imagine ourselves only made better instead of seeing what actually is. We impose our version of history to teach our lessons. People will try to control power because that benefits them and they will justify their actions as necessary and appropriate, even as holy mandates. An economic system dedicated to individual economic liberty will generate concentrations of oppressing power because individuals pursuing their own ends will hurt others even to the point of enslavement. A system dedicated to joint production and shared prosperity will run into the same reality. It is perhaps the greatest pity that so much misery has been done in the name of making ideology fit people and people fit ideology: remake character, get rid of those who don't belong, cow them into submission, coerce them into believing, police their behavior, put them in prisons, kill them. It is hubris to believe a set of principles can somehow define the contexts that matter for success or failure, for life or death.

The Choice Mechanism makes us believe and then denies our beliefs. This must be so because the Choice Mechanism is absolute while everything within the unimaginably vast IMP box is relative. We are made to define truth as we see it and condemned to believe we are right. We struggle to impose our relative truth on others, sometimes with compassion, sometimes with awful cruelty. Success seems so close sometimes, maybe if only, maybe one day, maybe but then and maybe, maybe it's almost in reach, almost, almost, sometimes almost in reach. We fail to grasp this repeated process of failure is itself the lesson. We cannot reach the dangling carrot. We will not go over the rainbow. We cannot achieve purity of thought, of form, of belief, of behavior. The Choice Mechanism shoves this form of failure in our faces over and over and over in every guise, in every form imaginable. That is the lesson. Will we one day see?

If we accept how the Choice Mechanism works, we can understand the limitations inherent in any perspective and what that means for any argument. All premises within the IMP box are relative first principles from which we choose to argue. We have no choice with a subject like economics but to choose a relative first principle premise. The same is true for many fields. In the Choice Mechanism, the choice of premise alters how the threads of IS and NOT resolve; the choice of premise actually affects the value of threads resolving. We showed this is true with the intentionally small example. We cannot fully understand, nor can we fully value other perspectives because the choice of our relative box premise alters how the Choice Mechanism resolves to choice in our heads, in our guesses, in our projections of dependent chains of possibility stretching into continuing context and in the actions we take. The Choice Mechanism alters how we perceive and that effect is real.

We do not have the space to discuss these issues in substantial detail, but consider optimality one more time. As noted above, every resolution to choice matches supply of possibility to

demand, so every resolution is optimal in the absolute Choice Mechanism sense. Continuing context means dependent chains of what if possibility extend into the future. Our persistent possibility structures affect how we perceive these possibilities in continuing context; they limit what we can see, what we value and what we believe we can do. We move toward those possibilities which our persistent structure sees and values and believes can be achieved. The process is the same whether we are right or wrong, whether we succeed or fail. As an aside, we can derive from the Choice Mechanism absolute all forms of sub-optimal resolution, whether failures of demand or supply or of rationality versus irrationality.

The inertia of our past shapes our future as the possibility structures of Things persist. Friction arises as these structure interact. We've seen how context imposes resolution that favors one over the other, that hurts you and not me, that benefits you more over time, and so on. When we analyze the reduction of continuing context to the moment, we impose relative not absolute definitions of optimality. Pick a perspective and your perception of fact and truth shift to fit. You may be correct for now but context will shift and you will then be wrong. Inertia will make you more wrong. You will distort the past and the present to fit your beliefs and that means you will be unable to clearly see the possibilities enabled by continuing context. You will refuse to accept what is happening, except to insist it must be wrong, even immoral. Friction will increase. You will try to impose your beliefs on others. You will believe that is necessary. You will cause harm.

This is why we chose the intentionally small example: almost any example imaginable would work but we chose this one because it is the kind of utterly common interaction we sometimes notice and sometimes don't, that sometimes flows smoothly past us and sometimes not. Its smallness and ubiquity means we can generalize from it without challenging belief structures about what is right and wrong or about how society works and should work. Please be clear: the Choice Mechanism is not at all a relativistic value system. Remember, any IS exists along with NOT up to the limits of the IMP box and Minimal and Immediate Context place you alone in the universe compared to this absolute box. The Choice Mechanism is an absolute scale which evaluates every resolution to choice of every Thing at every scale. This is not belief; it is a statement about the operation of the Choice Mechanism. In the last section, we discussed a specific belief structure in relation to natural selection only because the objective nature of biologic science places the Choice Mechanism in direct conflict with belief structures that deny physical reality. While we avoid discussing the belief structures inherent to economics or other fields, the Choice Mechanism certainly evaluates them. By using the intentionally small example, we don't have to discuss with any specifics why so many of our beliefs are terribly wrong or what that means.

We don't want to end this section on such a depressing note. To return to our intentionally small example one last time, no matter how you each approach the narrow space, you bring to that context your persistent possibility structures. You may commit to a decision only to find it was a mistake. You may find you were overly cautious. You adjust. You think about adjusting. You react by instinct. This process reflects how you, consciously and unconsciously, estimate the value of possibilities and that reflects how you see the situation and your own capabilities. The process

expresses how you perceive and value these possibility structures. As possibilities resolve and values shift, your perspective on what is happening changes. You experience this. Your experience of your own existence depends on the persistence of possibility structures.

We have seen that most resolutions to choice don't matter in the great flow of choices that envelops any complex Thing. The interaction at a narrow place may be uncomfortable but it rarely has lasting value. What if you are knocked over and crack your skull and die? What if you bump into that attractive person and you live the rest of your lives together? You may remember a near miss and become more careful. You may be grateful so you buy a lottery ticket to celebrate and win a huge jackpot. A near miss may make you over-confident in your ability to react so next time you get hurt or injure someone else. How you respond depends on your persistent possibility structure as it is enabled within continuing context.

Consider in this light the importance of NOT. Each small resolution invokes what did NOT happen. You did NOT die. Or you did. You were hurt. Or NOT. Every choice is also a choice of what is NOT. Remember, the Choice Mechanism enables definition of what IS by what is NOT in each resolution to choice. That unites the threaded context structure to the means of evaluation within the overall structure, meaning the relationship of IS and NOT literally manifests Base 10 and Base 2. When a male lion kills another male's cubs, that choice IS and is NOT another choice. We jump out of the way to avoid a car because we want NOT to be killed. It is wrong to think only of choices made because they always occur in contexts that define what is NOT.

Each choice selects what IS and what is NOT. Some of us define ourselves more by what we don't want to be than by what we want to be. We may pretend to be something other than what we are and use that to gain advantage, meaning we try to fit ourselves to what we believe context requires. We see animals pretend to be what they are NOT through camouflage. We see predators disguise their approach to prey. They don't want to disturb what the prey discerns as IS; they want to be NOT seen so the prey doesn't recognize the context of danger. If we consider the intentionally small example, we may want NOT to be hit, NOT to be injured, NOT to miss the opportunity to come close to that attractive person.

When a dog approaches us wagging its tail, we may imagine we read its mind but the dog may be curious or anxious, may smell something, may be looking for play, may want to identify us, and so on. We don't need to understand what is actually going on in the dog's mind to decide the dog is NOT threatening us. As we read what the dog is NOT, we decide the dog IS friendly. As we read what the dog IS, we decide what the dog is NOT. If a bird senses “wrong” movements, it may not stick around to see if a cat is in striking distance but will fly away. The bird treats the existing context of safety as IS and reacts to a change as NOT safe, but it also treats any change which alters the safe context as IS.

It is often difficult to see we select NOT and that makes the choice of IS or that we select IS and that makes the choice of NOT. The complexity of the coherent flow of choices makes the labels of IS and NOT slippery: the dog IS friendly and the dog is NOT threatening essentially at the same time. It is impossible to imagine our universe without NOT and without the ability to



select NOT. Atoms could not make the bond that IS a molecule without other choices being NOT: 2 hydrogen atoms and an oxygen atom make water because these atoms select what is NOT even as they select what fits as IS. We could not exist and could not act without both perspectives of the 2 Minimal Contexts that comprise Immediate Context. These 2 Minimal Contexts appear in every resolution of possibility to choice. When we say Immediate Context is the Thing that is you alone in the universe, we mean each choice in the vast flow of resolving contexts invokes the Minimal Contexts and 4 possibility states of IS and NOT, NOT and IS. We can now see Immediate Context lies at the heart of every Thing's continuing existence at any moment. This enables us to focus on individual choices or on the flow of choices, on the particle or the wave.

We've spoken many times of layers of complex Things. Generating these layers depends greatly on NOT: each iteration, each mistake, each exclusion and choice of “not that thing” generates a better definition of what IS. As internal contexts build to form larger context, the shape that takes over time is defined partly by what it becomes and partly by what it does NOT become. A complex Thing relates dependencies that reach further in continuing context so both IS and NOT represent current values for strategies that preserve or enhance existence. We keep our options open. When choice retains dependencies, NOT can become IS as the values in continuing context shift. We learn through mistakes because NOT teaches what IS. When we learn behaviors to be successful, we define ourselves by what those behaviors are and by what they are NOT. When we emulate successful models, we not only follow the examples but learn how they are NOT us so we can better define what we are.

Remember the definition of Thing and, in particular, the relationship of a tangible object to its attached intangible possibility structure. Remember the rock. A rock is a Thing made of its physical existence together with its intangible possibility structure. We can even describe this Thing as a composite made of the physical Thing of the rock together with its intangible Thing. This persistent possibility structure changes as it interacts with other Things. Though the rock doesn't “know” what happens, its physical existence represents a valuation of the state of its possibility structure. The same is true of any Thing. Simple organisms have small possibility structures associated with them that repeat with very high reliability, that resolve the possibilities of internal and external contexts in narrow, highly repeatable ways. A rock's persistent possibility structure is less complex than a peony's which is — perhaps — less complex than a housefly's which is less complex than a cat's which is less complex than a person's. We can see why rocks of the same kind tend to be more similar than cats from the same litter. It may seem odd to lump people together with objects, flowers, flies and cats, but at the most fundamental level, any physical Thing associates a tangible object with a possibility structure that relates internal and external contexts. This possibility structure calculates in various threads of IS and NOT. This is an elemental level all Things share, whether animate or inanimate, just as all physical Things are made of matter.

As the possibility structure attached to a physical Thing becomes more complex, the more this intangible Thing develops into a collection of Things. This process generates “awareness”.

We put the word in quotes to make clear no judgement is being passed about the quality of “awareness” in plants or animals. The Choice Mechanism says awareness is a Thing which arises in the relation and moderation of Things in included and including contexts. Remember, Thing can stand for a group of Things. As we move from a plant to a cat to person, this Thing becomes more complex and more distinct from the various contexts rising up and imposing down. The moderating or relating Thing develops persistence as threads of IS and NOT resolve in contexts at various scales, meaning contexts continue over time as choice occurs. As this happens, the actual physical object or tangible existence of a complex Thing less and less embodies the totality of the Thing. That is inherent to the definition of Thing. In the Choice Mechanism, the “awareness” of a plant is on a spectrum which leads to the “awareness” of an animal and eventually to what we know as human awareness. All forms of awareness manifest the existence of persistent possibility structures and the coherent operation of context, whether in the physical world or in you directly.

To be clear, it is not simply that a Thing sits between included and including contexts and this Thing then acts like a switching system or as a remote moderator. That would be a grotesque simplification. As we saw with the discussion of natural selection, the Choice Mechanism mediates between the past and the future in each moment. A Thing continuing to exist in context must have a method by which it acts and reacts as possibilities are enabled into its future. This method must relate the Thing's possibility structure to its physical being. The Choice Mechanism generates Things which begin as relatively simple repeating switches that moderate including and included contexts as they change value. A simple physical Thing, organic or not, relates contexts in simpler, highly repeatable ways compared to a more complex Thing. Continuing context enables fewer possibilities for less complex Things: a plant's future in continuing context is more highly constrained than a cat's or a person's. As a Thing becomes more complex, its continuing context becomes more complex as well. Continuing context for a complex Thing requires more complex moderating intangible Things until the switching processes become complex Things of their own. As mechanical acts of moderation become more densely threaded, persistent Things develop which observe processes and use the results.

An example is the need of a complex Thing to evaluate short versus long term risk and reward. Your actions in the moment manifest your persistent possibility structure and relate that possibility structure to what might happen in continuing context. This is broadly true. It applies to something as commonplace as choosing clothes in the morning; your choices reflect what you hope and anticipate or fear might happen that day. They reflect what you are, what you want to be, and how you want to appear to yourself and others. The same Choice Mechanism process applies to your decision to study hard now because you want to become a professional years later.

We as human beings relate to continuing context with a higher degree of awareness than dogs or cats, but the underlying method is the same for all Things. The need grows the more the current value of possibilities enabled by continuing context conflict. That happens because current value develops more dependencies of “what if” so the actual resolution to choice becomes more confusing. We mentioned this point above when discussing selection of NOT. This

point needs emphasis: the Choice Mechanism enables choice which extends further into continuing context as dependencies must be reduced to value. The more complex the Thing, the more the moment connects to the future. This is the attraction of games. What might happen in this situation in this game with these players? Want to bet on it? Can the chess player recognize the result hidden moves ahead? This is also a root of play as learning. We test and learn behaviors through play because choice for a complex Thing requires resolving to the moment possibilities that extend into future. When animals play fight, they develop skills for what might happen. All these behaviors directly reflect persistence of a Thing into continuing context.

The definition of Thing and multiple layers within the Choice Mechanism enables creation of multiple intangible Things related to a physical object. You are reading this, understanding this, thinking about it, questioning it, because you are a Thing, meaning you in the Choice Mechanism are more than your physical body. The complex Thing that moderates and relates contexts in you participates in the even more complex Thing that is you. You experience involvement and detachment because the complex Thing that IS you is sometimes immediately and directly participating and sometimes remote and observing. You know sometimes you experience events directly and other times you feel detached. You know sometimes you experience the world within you and other times you're involved in the world outside you. That is the Choice Mechanism: you are a Thing, a tangible object with an exceedingly complex, intangible and persistent possibility structure of Things attached to your physical being. That which is "you" can't be isolated to one particular part of this complex Thing.

We all experience the shifting from moment to moment as the Choice Mechanism resolves possibilities to choice after choice after choice in context after context after context. The changing value of threads as possibilities resolve means a Thing becomes the focus, then the next Thing, then the next. This is as true for a cat as for you except for your greater complexity. Each Thing represents not only a thread's resolution to choice but another context, another set of possibilities embodied in threads of IS and NOT that arise and resolve to choice. Threads constantly present themselves to focus, while other threads continue to resolve in the background and then shift to focus as the values change in contexts. Choices flow one after the next, sometimes so smoothly we don't notice, other times abruptly. We described some of these basic Choice Mechanism functions using the intentionally small example.

The Choice Mechanism — and only the Choice Mechanism — relates including and included contexts so we connect to both the larger world and to what is inside us. We are able to be self-aware because Things inside the complex Thing that is you can observe and describe and evaluate other complex Things inside you. That point needs emphasis: without the persistent possibility structure of Things existing in the Choice Mechanism, we would not be able to see ourselves and could not judge our thoughts and actions. Whatever physical structures exist in our brains to support awareness and consciousness, when we look in the mirror or use our imagination to judge how we look or what we are as a person, we evaluate possibility.

Once again: does this make sense? Fundamental problems such as awareness sit uncomfortably in systems built to analyze physical events. Go backwards: from the inherent

process that shifts focus from context to context, that moderates between contexts, to the imposition of context as a force to the physical representation of actual forms of context to the derivation of the Choice Mechanism and the definition of Thing. The definition of a Thing is that any IS must be accompanied by NOT. Remember, if we define a tangible Thing, that physical Thing associates with an intangible Thing representing all the related possibility, so the composite Thing contains both the physical and the intangible and exists along with NOT. All of this rests on IMP, on the absolute impossibility in the inability to form a true universal set, and the translation of IMP into the maximum and minimum limits for possibility as it exists in our universe. You are an IS. You have attached to your physical IS an intangible IS. It is not merely that we all know and feel but the definition of Thing and the operation of the Choice Mechanism allows us to speak rigorously about what we all know and feel. That is the point. We know this is how the universe works because this is how we experience reality. When we break down the complexity of the world and the cacophony of our thoughts, it rests on the Choice Mechanism.

Examine your own experience. You can sometimes select which context matters: the loud people at the next table can distract, but they can also force you to focus more intently. Sit in a loud room and you don't notice the same dripping faucet that drives you crazy when you are trying to sleep. All sorts of coping strategies depend on shifting the context that's in focus. You may find counting sheep helps you sleep. You may find a prayer helps you be brave. If you hide the candy, you don't eat as much because "out of sight" is another context that is at least a little "out of mind". Your feelings change as your focus shifts because the Thing that is you exists in a multitude of complex contexts both within and without you. You are not a rock. You are sure you're right only to discover you were wrong. You write something brilliant only to notice problems with it when the context in your head shifts. You think your hair looks great one day and terrible the next, though it's entirely likely no one else notices the difference. When you like yourself, you hope the feeling lasts though you know it won't. When you hate yourself, you try to remember that too will likely fade.

Associations to specific triggers can become powerful positives and negatives. We all become caught in loops in which a thread returns over and over, but some find themselves trapped in fixations. Things come "alive" and speak to us in our heads, sometimes as healthy imagination and other times destructively. The Things in us direct our actions, sometimes for good and other times for bad. We can feel alienated from others and from ourselves. We can taste a cookie and remember all the love we felt as a child. We may pick up a coin off the floor because that act opens a door to memories of our own children hunting for change in every store. A touch may call forth memory of abuse. All this rests on the Choice Mechanism's structure of persistent Things coherently resolving in contexts.

Look at yourself. You embody a mix of tangible and intangible traits passed down through time, encoded into your physical being, imposed on you by your culture, by good or bad luck, by your family, by how others react to you. The life written on your face, the promise in any child, the experience of any person or of any object embodies what it has been, what it is and what it

may be. The next time you approach a narrow space, try to think of all the choices you are making and all the experience they embody. This is who we are. The Choice Mechanism is why. I look at my left hand, at the scars running the length of my fingers where they were almost torn off when I was a child. I often find myself rubbing my right thumb over them: each small scar crossing the long ones represents the black burr of a stitch I can see in my mind. When I open my hand, the long, curved scar on my palm remains the most prominent line. I have a life line, a heart line and a river in the shape of a reverse c. I think of how I had to become right-handed, how different my life would be if my mother hadn't insisted the surgical resident not cut off my fingers, how I didn't realize until decades later that my vision and particularly my depth perception were set up for a left-hander. The most vivid memories of my life are these: extremely bright lights in my eyes, one person holding my legs, another my right shoulder and arm, another my left, twisting my head toward the people at the end of my arm, saying "I just want to see", the doctor trying to keep control, raising his hands slightly in exasperation, "Can't you keep him quiet", the heels of a nurse's palms pressing against my forehead, a cotton rag shoved in my mouth, the feeling of giving up. The nurse holding my head against the table lets go with one hand to wipe the sweat away from eyes. Their voices surround me as I stare up at the lights. I taste the dry roughness of the cotton on my tongue. It is one thing to think of experience as psychological or cultural or religious and another to understand the actual mechanism by which the possibilities resolve to make it happen and by which we relate to it over time through all the layers of our being. When I go to the dentist, I make sure the light doesn't shine directly in my eyes.

Remember, we are not presenting any physical process by which awareness occurs in animals, in people as a whole or in any individual. We do not claim simple reference to the Choice Mechanism explains mental illness. We are not discussing philosophical or theological implications of consciousness. We are using awareness to discuss fundamental aspects of how context inherently operates on persistent Things in the Choice Mechanism. Remember again back to the original discussion of how the Choice Mechanism relates a rock to the intangible possibility structure that exists within it and outside it at any moment and over time. This discussion is an application of that idea: you are both the physical you and the complex, persistent possibility structure associated with your physical existence. As mentioned above, the Choice Mechanism establishes your relative existence as a Thing and relates that existence to all the potential of the IMP box. While all Things and all contexts are relative box functions, each Thing and each context exists in Minimal Context as IS and NOT. Things and contexts exist relative to each other and in absolute individual relationships with the IMP box. It is beyond the scope of this paper to discuss what that means.

In discussing the effects of context, we began with representations of the actual forms of the contexts which make up the Choice Mechanism: logarithmic spirals, the double-slit problem and partial reflection by two surfaces. We next discussed how contexts express as forces, focusing on natural selection and economic markets as examples of coherence resolution. We applied coherence to the persistent possibility structure of Things. We discussed how persistence manifests as friction and inertia. We showed how context inherently shifts from choice to choice

and how all the definition of Thing leads to awareness. We now move to an example which expresses the effects of context at scale.

## GROUP 5: SCALE

We focus in this section on the inherent effects of scale in the Choice Mechanism. We discuss three examples: the direction of time, the subjective experience of time and how constants such as  $e$  or  $\pi$  can exist. We saved this material for last because it demonstrates the extraordinary power of the Choice Mechanism and because it is so much fun.

As a quick review, scale is a fundamental along with coherence and persistence. The Choice Mechanism acts a) coherently, b) on persistent possibility structures, c) at various contextual scales. Coherence derives from the IMP box, specifically from the enabling of function and its expression in the Choice Mechanism context structure. It is impossible to escape the essential completeness that within the IMP box all possibilities are enabled in contexts and resolve within their constraints. Persistence expresses the complexity of Things in the Choice Mechanism context structure. Even a simple Thing may relate to other Things to make a complex Thing whose possibility structure persists. Scale expresses the variance of relative box Things within the IMP box: Things exist in contexts which include other contexts and in contexts which are included within other contexts.

Scale is also manifest in what we call “consistency”. Complex Things, particularly large aggregates of Things, not only persist but persist with consistency. A complex Thing tends to remain fundamentally as it is because change imposed by including contexts has more difficulty penetrating and altering the Thing at included contextual scales, while change arising from these included scales has difficulty expressing itself meaningfully throughout the Thing. The relation to inertia should be obvious. Complex Things exist in extremely large contexts up to the limit of the IMP box. To be clear, it is not that a huge context sits at “top”; since there is no true universal set, there is no absolute context at the top, just the limit of IMP. It is rather that very large, complex Things persist and resolve in very large contexts. These very large contexts relate to other very large contexts of complex Things and that forms very large persistent structures which tend to be highly consistent. These huge persistence structures reflect the intimate operation of the Choice Mechanism expanded through vast layers. That is important: highly persistent, highly consistent structure is the Choice Mechanism's simple structure writ large. We see this on the scale of galaxies made of a hundred billion stars.

The direction of time manifests both consistency and the underlying process of the Choice Mechanism driving all resolution to choice. The process of resolution to choice in any context at any level inherently generates “immediate” direction while many layered, highly consistent structure generates “overall” direction. Direction is embedded in the fabric of our universe as both the underlying method of the Choice Mechanism and its great complexity at scale. The arrow of time manifests both the basic method by which possibility resolves to choice in context and the effects of scale.

To be clear, it is not that direction must flow toward the resolution of a non-existent super context. Direction comes from scale, from very large, highly consistent structure persisting as possibility coherently resolves. Persistent Things resolving coherently impose ordering as

including and included contexts resolve. Imagine a universe with 5 highly consistent structures. The more these structures relate, the more they resolve as a coherent whole so they generate ordering that fits together. Remember, ordering itself comes from the coherent resolution to choice of including and included contexts. As the number of structures grows and the interrelations become more complex, the more coherent resolution generates ordering that fits and the more these structures share the same direction.

Scale restricts the amount of literal reverse time, meaning for example particles actually going backwards in time. Backwards direction can occur only at fundamental levels because resolution to choice in context imposes higher orders of consistency at higher levels. To be clear, this restriction applies to antimatter in general. The multi-layered possibility structure also means it is impossible to unravel events above the smallest scales. We can't process the resolution of possibility backwards so events did not happen because a complex possibility structure has too many dependencies to unravel while maintaining coherence. As a note, one odd consequence is an observer standing outside the limits of IMP might see the direction of time within our universe changing or wandering — however that might look outside IMP — while we inside the limits of the IMP box see one direction except at the smallest scales.

The Choice Mechanism also generates the subjective experience of time. It is a function of contextual scale: the inclusion of context within context. We discussed in the last section the inherent shifting of focus from context to context as the value of threads of IS and NOT change. Each step at any level is still a step. When we are engaged in a larger or included context, we experience the possibilities at that level. A step or action or moment in a larger context may include many steps within included contexts, while a step in an included context may not amount to a noticeable step in an including context. We've all had the experience of doing something fairly complex, like driving or running, and realizing some time has passed while we were thinking about something else. We did a series of actions without focusing on them because part of our awareness was absorbed in another included or including context.

The solution for boredom is, in fact, becoming absorbed in something else, because the more absorbed you become in an interesting context the less you remain aware of the boring context. We've always known this to be true and now we know exactly why: the subjective experience of time is a result of the ordering of choice by the coherent resolution of possibility to choice in including and included contexts across different scales. In the Fourth Discussion Group, we described how our lives are an assembly line of choices, most of which pass unnoticed. We are complex Things whose awareness generally occurs in contexts that include other contexts. This explanation unites subjective experience with the external and connects time to awareness. We experience time as a series of events within contexts that fit within and which include other contexts.

One more time: does this all make sense? Part of the response is we are applying context in the specific sense, in the specific structure derived from an absolute first principle and these results clearly flow from the Choice Mechanism. These results not only provide an answer where none exists but an answer which is part of a larger answer. This answer is coherent both in the



common sense that everything fits together and in the more rigorous sense that it applies at all levels, at all scales. Within the IMP box, the Choice Mechanism provides an answer that coheres, that applies to all Things in all contexts.

The Choice Mechanism explains, for example, why the future is generally unknowable. We discussed this topic before but not in relation to time itself. Contextual time establishes ordering which puts some events on display while hiding others. This occurs because a moment connects to possible futures. Some of these connections become embedded in the persistent possibility structures of Things. The contextual structure of time generates all these possible futures across all scales. For any Thing at any moment, multiple chains of dependencies extend from the past into the future. The future reduces to the moment but remains unknowable because the complexity of coherent resolution for persistent Things generates a range of possible outcomes from inevitable to impossible for every choice at every scale. We see here again the direct relationship between statistics and the Choice Mechanism. It is not merely that a thread relates the past to present choice to possible future but that all these threads together weave a veil of dependencies which makes the future unknowable.

The second part of the response is that time and our experience of it obviously express the resolution of possibilities. When we speak of time having an arrow, we mean possibility comes together to make events happen in what appears to be a direction. We mean the ineluctable resolution of possibility to choice. When we speak of time passing slowly or quickly, we mean the possibilities of this moment and this stretch of time at least appear to be coming together slower or faster than they are at other times. Only the Choice Mechanism explains why this happens. We want to emphasize this point: it is not merely that IMP enables the existence of possibility but that it generates a structure which acts as a mechanism at every scale of existence. Time is a scale effect generated by the Choice Mechanism.

The third part of the response is it fits what we generally think. We use the word “context” all the time. We use contextual thinking all the time. We have not been able to connect all these dots because we could not define context in a truly rigorous manner from first principles. This inability means we argue about what context means, when it applies, why it should apply or not, and so on. The Choice Mechanism generates a specific definition for context and turns it into a structure that shapes and a process that acts on reality. Time expresses the same underlying structure that enables and resolves all possibility in contexts. We experience in contexts that arise within us and which impose upon us. To even say time can be experienced subjectively invokes context. The combining of including contexts generates an objective quality for time in which events occur at rates beyond our control. Both special and general relativity invoke context. We act in context. We perceive in context, sometimes involved in the flow of work or play and other times removed. Our sense of time varies as context shifts. We experience the sensation of time slowing even as things happen at high speed. Now we have a specific way of describing why and how those contexts exist and form, how they resolve and how we experience the effects.

The last and perhaps most important part of the response is this explanation relates time to the fundamental expression of numbers. Time expresses contexts and contexts involve threads of

IS and NOT and the selection of Things. The resolution of possibility to choice occurs through evaluation in layers of countable Base 10 and Base 2. We can say the direction of time and its subjective experience manifests the existence, arrangements and scale of numbers themselves. Time has direction because that result calculates, not once but each and every moment within and through all the context layers. We experience time subjectively because that calculates for us within the contexts of our lives. We noted earlier simplicity is not merely theoretical elegance but reflects the greater reality that fundamentals tend to be simple because they are fundamental. Time rests on counting possibility states in Base 10 and Base 2. This is as it should be.

The contextual definition of time and its unification with numbers explains — again, for the first time — how constants are in the most literal sense able to exist. The answer has two parts. First, persistence reveals why constants are constant — or constant enough. We can rely on constants, can call them constants, because they represent possibility structures repeating with such regularity we treat them as constant. Consider the ratio of the radius of a circle to its area or of the diameter of a circle to its circumference;  $\pi$  exists for both physical and abstract objects — or Things — and we calculate it to extraordinary depths. We can see  $\pi$  requires persistent possibility structure if we look at the ancient method for determining it by adding sides to a polygon until the shape approximates a circle. A polygon is a resolution of possibility to that shape: a square represents the resolution of all the possible arrangements into this one chosen shape with 4 equal sides. The process of adding sides resolves possibility both to each resulting polygon and to the overall repeating process. These are functions within the IMP box. Using the Choice Mechanism, we translate into numbers all the possibility embodied in every stage and in the repeating process as a whole.

Second, as we've noted many times, the constant  $e$  crams all the values of Minimal Context and all the values of a Thing into a moment. Each time we use the constant  $e$ , we calculate with a number that is itself composed of more layers than we can count. Same with  $\pi$ . Since we exist in time, since applications of the constant occur over time, how does an infinitely-layered constant come into being and continue to exist in a universe in which time has an arrow of direction? To say those layers just exist is not an explanation for how they can exist. How do constants calculate to such depths within the experience of time moving in a direction? How can we use constants like  $e$  or  $\pi$  inside our experience of time?

As described above, the Choice Mechanism generates time through the interaction of contexts at scale. Time is a product of the Choice Mechanism's vast complexity of contexts and possibility structures. That means time is a constraint imposed by context. Time restricts us to a moment, to the present, instead of all moments happening at once. Time limits our ability to retain the past and see into the future. It is a reduction from some other definition of “time”, one that lacks at least some of these constraints. The constant  $e$ , by contrast, is enabled by IMP and constrained only by IMP; the complete abstract value of Minimal Context and of a Thing both express the function of IMP as upper and lower limit. The constant's value generates “before” contextual scale develops into the time constraint for physical objects. This enables the constant to calculate to vast depth without the constraint of time and then to be used during time,

whether by nature or by us in our calculations. This means the constant exists both “outside” and “inside” time: it calculates to infinite depths as a condition of all context and that makes it available for use within the contexts of our actual universe.

It is not merely that constants represent persistent possibility structures but that constants can exist because the Choice Mechanism coherently generates persistence both outside and inside the constraints of time. Possibilities resolve within contexts: they are enabled within and are constrained to choice within contexts. Our physical context, though extremely complicated, is no different from any other context except it is our lives, our world, our universe. We saw in the explanation of the double-slit experiment that possibilities exist within a context which ends when the particle hits a screen. We can choose to view these possibilities because they continue to exist in context. We saw how the length of glass determines the length of existence in time of the context of partial reflection. Possibilities exist and resolve to choice at every scale. This happens because possibility is enabled in a larger context that includes physical context. We exist in an included context inside the IMP box. That is how possibility calculates over time and space. That is how resolution at literally unimaginable scales occurs within each moment and across time. That is how a physical Thing consists of the intangible attached to the tangible.

To repeat, all the possibility that goes into a moment can calculate because it occurs in a context which includes the physical context in which we, for lack of a better word, physical exist. This is true for any Thing. We saw how logarithmic spirals generate at the scale of galaxies over billions of light years. This can happen because the constant  $e$  generates and applies at that scale in those utterly massive physical contexts over extraordinary spans of time. That these physical events happen is undeniable. The Choice Mechanism is why.

Why does the universe go through this process? Because it can. While that may sound silly, it carries some of the deepest meanings imaginable: constants such as  $e$  or  $\pi$  exist because they are possible in this universe. This has two meanings. First, once we've generated possibility from the absolute impossibility of IMP, the constant's value exists because it can and because the process that makes it can possibly exist. The only limits to the possibility that can exist or to the form it can take are those imposed by the IMP box. Second, very few possibilities have lasting meaning and of course very, very, very few become constant conditions of existence. We could have listed “very” a hundred times over to represent the immense scale of unlikeliness built into the most fundamental aspects of physical existence. Of all the possible values of Minimal Context and of a Thing, of all the possible values in all the possible arrangements one can imagine, of all the gin joints in all the towns in all the world, only one fits all contexts at every scale. The constant  $e$  exists because it can and because it works in the vast scheme of contexts in the Choice Mechanism. Of all that might be, it is the only that IS.

We rarely think about the possible arrangements that have little or no persistent meaning in our physical context, though the concept is important in quantum mechanics. We discussed this issue in some depth with regard to natural selection and the enabling of possibility out of potential. In that section, we noted even a universe of static pictures in which every possibility somehow exists at once would generate at least the appearance of motion. Resolution to choice

in context is an algorithm or process whose structure the Choice Mechanism describes. Once the possibility for resolution exists, it expresses itself coherently and persistently across all scales. That generates changing values and shifting contexts and also becomes time. That is the universe we experience: the possibility for resolution applied to the enabling structure for possibility. Because it can and because it works.

As with all our topics, time is much more complicated than we can present here. We have discussed only the most general aspects. We do not consider the relation of contextual time to our physical context except for direction and subjective experience. We do not touch the beginnings of time, nor the relation of contextual time to the formation and continuation of the universe.

This ends our discussion. We limited ourselves to discussing only a handful of questions the Choice Mechanism solves and have stuck to basics that illuminate the most essential aspects. By basics, we mean areas so well known they can be rendered in relatively few words, not simple issues. We aimed for clarity, not completeness. We needed to show how the Choice Mechanism calculates and how it physically manifests. We needed to show the most elemental ways by which context operates, meaning coherence and persistence at scale. We avoided issues that require discussing complicated mathematics or which demand substantial explication to render or both. We apologize for being incomplete.

# Conclusion:

## IMPOSSIBILITY'S CHILDREN

We are now at the conclusion. We will begin by asking one more time: what lies beyond IMP? Remember IMP is the minimum and maximum limit for possibility: it defines “what can be formed”, from “what might be formed” to “what can be formed”. One basic meaning already noted is that possibility, which is infinite, is carved out of something larger. That something larger is “incomprehensible”, meaning it lacks the NOT term of absolute impossibility, not that we can't understand it. We can structure incomprehensibility, which is an interesting and difficult topic beyond the scope of this work, but we can't render or resolve the incomprehensible into the impossible without identifying absolute impossibility. That is perhaps the largest, furthest or most extreme meaning of the Choice Mechanism: it is the inherent structure which marks the shift from incomprehensible to impossible and thus to possible. We are defined by what we are and by what we are NOT. We are defined by what is absolutely and thus relatively impossible. We are impossibility's children.

When we derived the Choice Mechanism, we noted IMP enables the specific existence of possibility within our universe. To say this one more time, we define in the Choice Mechanism the particular form possibility takes in our universe. We can now see more clearly what that means: whatever exists outside the limit of IMP, that which is incomprehensible, however structured or not, contains the attributes necessary for both possibility and impossibility. IMP cages possibility and imposes a structure on it. We see that, as explained many times, in the NOT term that accompanies any Thing. If we step outside the IMP box and remove the NOT term from possibility, we reach towards a form of possibility — and impossibility — for a box whose sides we can't comprehend.

Relative impossibility is resolution which can't happen because resolving contexts in the Choice Mechanism make it impossible. We can say some resolutions are so unlikely they are impossible but actual relative impossibility comes from context excluding other context. We trust you can see the connection to probability. Relative impossibility is real but relative because it relies on being in this and not that context, in this thread of IS or NOT and not that thread. We see a version of relative impossibility in belief structures: beliefs resist facts because they exclude resolutions of possibility which can't be incorporated into the belief structure and alter those which can to fit. Relative impossibility also translates into physical impossibility. Some resolutions are physically impossible because our physical existence is a context which shares a physical term. Physical impossibility is relative compared to the absolute impossibility of IMP but is, of course, absolute to us in our physical context.

We can now answer more completely one of the first questions asked in this paper: why do we take fundamentals like the existence of possibility for granted? In normal life, the Choice

Mechanism presents us with possibilities that connect in contexts. Understanding the appropriate context usually provides the solution we need because the Choice Mechanism resolves possibilities to choices and these choices should often be the answers we need. Again, probability generally expresses these relationships and life would be very strange if results did not flow with general certainty from actions that seem related to the effect. In other words, the creation of context in the Choice Mechanism means we see questions in contexts of possibility that tend to generate solutions because the Choice Mechanism generates contexts that resolve to choices. We push our knowledge as far as we can within the contexts we see because that is where the possibilities lie. These possibilities resolve to answers. So we identify the constant  $e$ , identify alternate expressions that generate it, identify where it appears, investigate its nature. We then know  $e$  is transcendental, these expressions generate it, it appears here but not there but we don't know why it exists because the context that tells you why can not be reached by examining how  $e$  manifests in the universe.

We can't see the Choice Mechanism unless we look directly at what generates it. This is how it hides in plain sight. It is like there is only one entrance in or out of a building containing an infinity of rooms. Each room connects to the entrance and to its closest neighbors and through these to every other room. Since the connection we need appears in every room, it is part of the scenery and we don't recognize it's the door to the outside. It is what we take for granted. We call this the "ubiquity problem": the Choice Mechanism is so ubiquitous it associates with every problem. Now add to ubiquity the distraction caused by the process of resolution to choice at every scale and of context inherently shifting as the values of threads change and we can see why the obvious is hard to see: we are trapped by the Choice Mechanism into not being able to see the Choice Mechanism. It is not merely that we are inside the IMP box, but that we don't realize the box exists.

We can also now answer a question we've never explicitly asked: what is a possibility? If we stop taking the existence of possibility for granted, if we step beyond the self-referential idea that possibility is somehow the existence of alternatives, what exactly is it? Not why possibility exists, nor where it comes from, nor the form of how it exists in our universe, but what rigorously is a possibility as defined from absolute first principles? The most fundamental possibility is the attachment of IMP to a Thing to make a unique NOT in one of the Minimal Contexts within Immediate Context. Layers of contextual Things then develop in Larger Context and that generates vast scale. What is a possibility? A possibility is a contextually defined Thing. It first comes into existence as the Thing of the barest Minimal Context imaginable, the Minimal Context generated by IMP. If we could identify the needed information, we could perhaps order every Thing in this universe in relation to this original Thing.

Remember the discussion of unlikeliness and the limits we tend to impose on the universe's ability to calculate. The vastness of calculation is built into everything. We carry in us and with us that which enables and constrains us and that which reaches beyond our relative boxes to the limit of absolute impossibility. In the IMP box, every act, every moment of existence, every physical and intangible Thing has built into it the heights and depths of infinity. The constants

exist, the process that makes them exists, because you are IS and NOT. Infinity is embedded in you. Eternity attaches to you.

We return finally to the paradoxes that reveal IMP. These paradoxes define a resolution of possibilities to choice which negates itself; resolution to choice cannot occur without that choice negating itself so it cannot happen. Since all possible resolutions take place within the IMP box limits, that which is absolutely impossible is that which cannot resolve to choice. In other words, the paradoxes define cases where the Choice Mechanism absolutely can't decide. All other resolution of possibility occurs in and is constrained by context. The Choice Mechanism resolves possibility to choice within the IMP box, from “whatever might be formed” to “whatever can be formed”. It is relative boxes. It is function. It is every choice that can be made. The words “absolute impossibility” may sound grand, but think about it this way as well: our universe's borders are defined by not being to choose. Absolute impossibility is also an absolute inability to decide. The incomprehensible which lies beyond expresses itself in our universe as perpetual, unresolvable confusion.

Our rigorous thinking usually consists of exploring long and complicated threads, identifying what we can see at the edge of our knowledge and chasing what lies beyond. We normally develop assumptions, often from observation, and test them until we develop an explanation. This work is different. It examines what we are unable to see. It looks at what we all know. We live immersed in possibility. We can't imagine a universe without possibility. The existence of possibility is a candidate for the most obvious thing in the entire universe. This obviousness strips away our explicit and implicit assumptions about the universe and our reality until only the absolute remains.

The typical problem with simplifying matters is they lose meaning as they become more universal. Most simplifications are higher level Things abstracted many levels from the underlying facts and details. The Choice Mechanism is a different kind of simplicity, one that is not only ubiquitous and fundamental but structural. It is the ordering principle generated by what may be the essential organizing principle. It gives form to the consequences flowing from the existence of absolute impossibility in this universe. This organizing principle then imposes actual structure on the existence of both tangible and intangible reality. This principle creates possibility and relative impossibility, not only that which can be and that which can never be but that which in context cannot be or must be. Relative impossibility generates chance, from none to inevitable. It is indeed all so very simple: the lack of a true universal set generates IS and NOT and Things and the simplest possible expressions of these make the fundamental contexts of Minimal Context, Immediate Context and Larger Context. These contexts resolve to choice coherently and persistently at scales within the IMP box. That is all there is to it.

The Choice Mechanism makes rigorously clear what has become progressively more obvious over the last century of scientific inquiry: various possible actions over time come together to make a moment. We have spoken at length of persistence. One of the most elemental implications of persistence is that possibility is a Thing living in context: context creates possibility and sustains it. This is also perhaps the most challenging conclusion presented because

it gives a degree of substance to the intangible and connects the past to the future as continuing context coherently resolves to make each choice at every scale of existence. This moment, the one you are in now, is an unimaginably vast assemblage of possibilities coming together to make you, to put you in your chair, to make the world's events occur, to make it all happen from the grandest scales to the most intimate, from behaviors of fundamental particles to the flow of human and natural events. We have long calculated probabilities but the exact relation of the intangible to the tangible world has been difficult to describe with rigor. The Choice Mechanism relates the universe of intangible possibility to you at this moment in this world right now and then again in the next moment and then again in the next moment and then again and then again and again and again.

Thank you for your time,

Jonathan