comments@geometryofideas.com

DIMENSIONAL THINKING AND THE LEVELS OF LOGICAL PERCEPTION v1.01

Tony Giovia

INTRODUCTION v1.0

Awareness, consciousness, understanding, intuition, wisdom, insight and inspiration are phenomena intrinsically associated with human life. Defining any of these phenomena in terms of another is a slippery slope, but each has a common lineage. Each phenomenon requires a fundamental ability – perception - for its usefulness and definition. For this reason, in this presentation the term perception will be interchangeable with any term that includes perception in its definition.

Broadly, perception is the faculty that distinguishes change from inertia, patterns within apparent diversity, and truth from falsity. The raw materials influencing perception are physical objects, ideas and events. As commonly understood, physical objects include solid and semi-solid objects, and ideas are unique thoughts and images. Events are the interaction of physical objects and/or ideas.

For perception to be visible – that is, for perception to evidence its existence – it must integrate with an architecture engineered to distinguish visibility from non-visibility. For perception to be useful – for example, for perception to distinguish truth from falsity – it must integrate with an architecture engineered to distinguish truth from falsity.

We can group the raw materials used by perception into two classes – stipulated facts that everyone agrees are true (“Last night there was a full moon”), and unstipulated facts (“Today will be better than yesterday”). Stipulated facts are defined exactly the same way by all observers, and unstipulated facts are subject to multiple definitions – multiple interpretations by different observers. Stipulated facts are equivalent to objective facts, and unstipulated facts are equivalent to subjective facts.

Both types of facts – stipulated and unstipulated – require specific perceptual architectures for their visibility and usefulness. For example, a fact such as “The shortest distance between two points is a straight line.” is true in the case of a Euclidean geometric plane, but false in the case of a sphere because there are only curved lines on the surface of a sphere.

It is common for a fact to exist completely in one architecture and incompletely or not at all in another architecture. Consider the nightly news shows. Assume they present the national news, the local news and the sports news in succession. These three categories - national, local, and sports news – are themselves individual architectures

composed of news events (and the facts that compose those events) that often exist in only one architecture – their own.

We can illustrate this with two news items: the federal government's announcement of last quarter's Gross Domestic Product, and a high school sports team that just won their state's division title. Within these two stories there are no facts which simultaneously exist in both national and local news architectures.

There are also cases where a news item exists in all three architectures. Consider a report describing a major league baseball player who just won an election to Congress. There are facts within that news item than exist in all three architectures – national, local (if the player is from your local team), and sports.

With a little digging we can see that each particular news architecture is itself composed of at least two sub-architectures. For example, the national news architecture contains a sub-architecture that functionally maps the state of existing events – call it a database of existing events. With that as a reference, a second sub-architecture monitors changes to this database. This second sub-architecture – call it a set of algorithms or logical instructions - distinguishes between existing events and 1) new events or 2) modifications of existing events. Each sub-architecture exists independently of the other sub-architecture, but requires elements of the other if their combined architectures are to be defined as a news report.

The independent existence of sub-architectures demonstrates the transportability or re-purposing of architectures. The national, local, and sports news categories each has its own database of existing events, which can be archived. Those archives can be used by historians and commentators for purposes other than producing a daily news program. Similarly, the monitoring sub-architecture of each category uses the same logical instruction sets – the "compare" function, the "and" function, the "or" function - to assess changes to the archived databases. Thus the core functions of the monitoring sub-architecture are adaptable to different databases – in this case, the national, local, and sports databases of existing events.

To summarize, the foregoing examples illustrate that any particular fact can reside completely within one news architecture (the Gross Domestic Product report) or within multiple architectures (sports hero goes to Congress). Just as importantly, they illustrate that separate perceptual architectures can be combined (via their shared elements) to form larger complex architectures, with each composing architecture maintaining its separate integrity and identity.

We recognize the existence of complex architectures each time we use phrases corresponding to "on the one hand this, but on the other hand that.", or "from this angle this, but from that angle that", or "on the positive side this, but on the negative side that", and (most common of all) "Yes, but….". These phrases indicate the existence of a particular fact integrating into more than one architecture. This integration may be direct (necessary for that architecture to maintain its purpose) or indirect (as part of an architecture that shares other facts – but not that particular fact - with a second architecture). These phrases also indicate the existence of a superior architecture

capable of perceiving and distinguishing differences between architectures with which it shares facts.

By now you have realized that the architectures we are describing have another, more familiar name: we call them contexts. In the following sections we will explain why we are referring to contexts as architectures, how contexts integrate with each other, and how complex architectures are organized. Along the way we will see the role that energy, the basic substance of the Universe, plays in explaining the nature of contexts.

THE PHYSICAL ARCHITECTURE OF CONTEXTS v1.0

The term “architecture” summons images of schematics and skyscrapers – that is, it suggests both the underlying conceptual design of an object and the physical expression of that design. Put more colloquially, architecture is a term with two faces: one face denotes the ideas guiding a physical construction, and the other face denotes the physical construction itself.

Both faces, obviously, are linked. The schematics of a hallway are ideas defining the design and purpose of a physical hallway in a physical building. Similarly, a hallway is the physical expression of the ideas used to construct the hallway. The fact that a hallway was constructed instead of a kitchen is proof enough that the ideas defining a hallway and the hallway itself are inextricably linked.

Ideas have traditionally been considered as ethereal phantoms with no material, physical existence. How then does one explain the linkage between ideas and the physical expression of those ideas? How do ideas affect physical reality? How is the linkage even possible?

We are used to seeing physical objects affect other physical objects – a boxing match, a game of billiards, and a magnet are all easy examples of this. If there was a way to prove ideas are themselves physical objects – that is, objects with at least one physical face – then the linkage between ideas and physical objects becomes understandable. It would be a case of the physical face of an idea affecting the physical face of a physical object.

There are two fundamental scientific theories that, when joined, can help us see the physical face of ideas. The Big Bang Theory states that the Universe was created in a Big Bang of energy, and that everything in the Universe is composed of that energy. Albert Einstein’s equation $E=MC^2$ states that energy has a mass component – a mass face, if you will. Both theories are joined by the term “energy”, and together state that the Universe is entirely composed of energy, and that all energy has a mass component.

Physicists define mass as the amount of matter in an object – meaning, simply, that matter is an inextricable component of mass. Matter is what we typically define as a physical object – rocks, water, plants and atoms. Clearly, if we can show that ideas are composed of energy, we can then show that ideas have mass – and we can show that

ideas have a face with a physical component. We would then have physical ideas affecting physical objects, and the linkage of ideas and physical objects would be reasonably explained.

We traditionally define a physical object as an object perceivable by what we call our physical senses - touch, taste, sight, hearing or smell. We can't hold ideas in our hands and feel their weight, shape or texture, so it may seem strange at first to conceive of ideas as physical objects. We can define a mind as a collection of ideas, and we can of course hold ideas in our minds, but again we cannot hold our minds (as an entity) in our hands, nor can we taste, see, hear or smell our minds.

Arguments can be made that we can hear ideas (language) and see ideas (written words and images), but all these arguments rely on a mind perceiving these ideas – and we are back to the fact that our minds are not palpable. Minds appear to exist, but there appears to be no "there there." These facts work against defining a mind, and the ideas that compose it, as a physical object.

This argument, and arguments similar to it, creates a clear distinction between ideas and physical objects. Called the mind-body problem, or more formally Mind-Body Dualism, it appears that a mind exists independently of the physical world defined by our five physical senses. There is no accepted explanation of how ideas affect physical reality – how a non-physical entity affects a physical entity – how schematics affect the building of a hallway – even though we have moment-to-moment evidence that mind does indeed affect body.

We mentioned earlier that there are two scientific theories – the Big Bang and $E=MC^2$ – that can help us see the physical face of ideas. If we can agree on one particular point – if we can stipulate one fact – we can then derive an argument that ideas can be viewed as physical objects. That particular point – that stipulated fact – is that ideas are perceivable.

It seems like a small request, and I believe it is a request most people would grant. No matter how each of us define them, ideas such as numbers, colors, morality and love exist as perceivable components of our minds. And that is the key. Because if we stipulate that ideas exist, even in what appears to be a non-physical entity such as a mind, then we are inferring that ideas exist in this Universe.

Why is it important to establish that ideas exist in this Universe? Because every entity in this Universe is a product of the Big Bang, and every product of the Big Bang is composed of energy. Further, energy is composed of mass and a constant – the speed of light squared ($E=MC^2$). This means that energy can be viewed as an object composed of mass, and mass can be viewed as an object composed of energy. Physicists call this relationship Mass-Energy Equivalence.

And there is our path. Ideas exist in this Universe, therefore ideas must necessarily be composed of energy. Because they are composed of energy, ideas can be equally viewed in terms of energy or mass. Physical objects have mass, and can be equally

viewed in terms of mass or energy. Physical objects and ideas can be viewed in terms of mass. Ideas can be viewed in terms of physical objects.

This derivation has implications far beyond merely explaining how ideas affect physical objects. It also opens a path in understanding the mechanics of logic, and how physical ideas are organized into physical architectures. Those topics are discussed in the following sections.

SHARED DIMENSIONS – THE STRUCTURE OF LOGIC v1.0

We have proposed that ideas can be viewed as physical objects, and that this physicality allows ideas to influence other physical objects. Idea physicality allows, for example, the idea of a green traffic light to influence how a car is driven. What we need to explain next is how we know a green traffic light is a “go” signal for a car. What connects the idea of a green light to the car’s accelerator pedal instead of to the car’s brake pedal?

The answer, of course, is logic. We logically “associate” the green light with forward motion, and proceed through the intersection. Logic is a methodology – a collection of rules - for manipulating ideas. Logic is a multifunction tool – for example, it can be used to determine change from inertia (as in the news example above), and it can be used to determine cause and effect – which allows us to reliably determine the reason one event occurs and not another (hence “reasoning”). Logic is a science because its results are reproducible - using the same rules on the same ideas in the same order will always produce the same outcome. Mathematics, the foundation of the physical sciences, is grounded in the logic of numbers.

Logic is so omnipresent it is the very fabric of our thoughts and accumulated knowledge. Yet consider that mind and body have traditionally been seen as separate and distinct – ideas are non-physical to the point of being ethereal, while physical objects are tangible and measurable. We universally stipulate that logic works, yet amazingly we have no practical explanation of how logic’s so-called non-physical ideas can affect physical objects.

Establishing that ideas can be viewed as objects composed of mass and matter resolves this age-old gap. Ideas can affect physical objects because ideas themselves can be viewed as physical objects. Physical ideas affecting physical objects is eminently, if I may say so, logical.

In the previous section we described the different ways of viewing an object as the “faces” of an object – one face of a hallway is its schematics, and another face is the physical expression of the schematics. On a larger scale, every physical object has two faces – one face shows it to be composed of energy, the other face shows it to be composed of matter.

The faces of an object are related to each other because they share stipulated facts. In the case of a hallway, the faces share the shape of the hallway, the length, width and so on. The schematics of course are not identical to the physical expression of the hallway

– the actual built hallway we walk through. Instead the schematics are the idea of the hallway, and because ideas are physical, the schematics are a different physical expression of the hallway. Different, yet related via shared facts.

We have talked about “faces” and we have talked about “facts” because these are familiar terms that I hope have eased understanding of the concepts we are proposing. To proceed further in this discussion we need to objectify and generalize our terms a little more. Going forward, a “face” will be referred to as a context, and a “fact” will be referred to as a dimension.

A “context” is a set of ideas related by logic. Definitions are the primary expressions of contexts. Common contexts are shades of red, flavors of ice cream, makes of automobiles, and the varieties of potatoes. Larger contexts would include number theory, music, medicine, religion and biology.

A “dimension” is a particular, uniquely definable element of an object’s outline, magnitude, architecture or design. Dimensions are stipulated facts – unique definitions composing a unique context. An object is any collection of logically related dimensions – a refrigerator, a song, an idea, a context and so on. In the case of the hallway schematics, the drawn outline of the hallway is a dimension, as are the annotated magnitudes – 40 feet deep, 15 feet wide, 12 feet high. The materials used to build the hallway – wood, or stone, for example – are among the architectural dimensions. The design of the hallway is akin to its purpose – as a connecting path to rooms in a building.

Take two contexts – “The planets of the solar system.”, and “The ranking of the planets by size”. Both contexts contain, among other elements, identical stipulated facts – the planets Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. The first context associates these planets with the Sun; the second measures the planets relative to each other. Each context has a different architecture, design and purpose. Yet each context is constructed using the planets as stipulated facts – as stipulated dimensions.

We can combine both contexts by creating a new context – “The planets of the solar system ranked by size”. This context includes both the measurement algorithms and the Sun. Both contexts, though combined, still exist independently as separate contexts – each can be disassociated from the whole and stand alone as a complete logical entity.

Let’s look a little closer at what happens when we disassociate contexts from a larger whole, because it raises an interesting question. The context “The planets of the solar system ranked by size.” is grossly constructed of the nine planets, the Sun, and measurement algorithms. This context contains two sets of information, each expressed by its own context. “The planets of the solar system.” requires the nine planets and the Sun for its definition – its architecture. “The ranking of the planets by size”. requires the nine planets and measurement algorithms for its definition.

These two similar but different sets of information share a common set of dimensions – the nine planets. The nine planetary dimensions are logically associated to both the Sun

dimension and the measurement algorithms when the context is “The planets of the solar system ranked by size.” But when we disassociate this context into “The planets of the solar system.” and “The ranking of the planets by size”. what happens to the nine planetary dimensions? Does each disassociated context have its own copy of the planetary dimensions, or does each context still share a single set of planetary dimensions?

We need to remember two facts about dimensions. One, they are unique definitions with concomitant unique architectures. Two, as perceivable entities, they can be viewed as physical objects. So the proposed question is actually “Are dimensions unique physical entities, or are they instead logically reproducible organizations of matter (i.e., are there multiple copies of uniquely defined dimensions)?”

In the case of “The planets of the solar system ranked by size.” the elegant solution is that both sub-contexts (“The planets of the solar system.” and “The ranking of the planets by size”) share the same planetary dimensions. The reasoning is simple enough – if they did not share the same dimensions, but instead each maintained its own copy of planetary dimensions, how would the sub-contexts physically combine to form the architecture of the larger context?

It is reasonable and possible that intervening contexts (“plus”, “with”, minus”, etc.) could negotiate some physical “bridge” between copies of the planetary dimensions. These contextual bridges could then be considered part of the planetary dimensions, changing their physical definition. Visualize a two-headed creature – or a molecule - with the body of a bridge and an identical dimension at either end and you will get the general idea.

Fortunately, whether contexts combine using a single set of shared dimensions, or whether the combining contexts maintain their own sets of identical dimensions and combine via contexts that intervene between these sets, or both, has no immediate bearing on this discussion. Intervening contexts would change the architecture (and therefore the definition), but the results would be the same – contexts are physical structures composed of other (not necessarily lesser) physical contexts. Combining contexts is akin to building a physical structure of dimensions, with different systems within the building sharing common dimensions.

This is a modest example of the mechanics of logic, and a window into the architecture of contexts. The key enabler of logic is shared dimensions. Viewing ideas as physical objects facilitates this understanding: when we combine contexts we are connecting them physically via shared dimensions. This is how logic “works” – how a logical concept expands and contracts.

Logic is a construction of dimensions, and this construction is the foundation of perception. There is a natural hierarchy created when contexts logically combine to form larger contexts. How that hierarchy is designed, and the forces that determine the hierarchy are the topics of the next section.

A UNIVERSE OF PHYSICAL DIMENSIONS v1.01

Logic is an assembly language, a set of rules that assembles dimensions into physical architectures that our perception, itself composed of assembled dimensions, uses to create meaning.

Logic is not an assembly language, and it is not a set of rules. Logic does not create anything; instead, logic is an after-the-fact perception of natural forces at work.

Let me explain.

In the previous sections we defined a “context” as a set of ideas related by logic, and a “dimension” as a particular, uniquely definable element of an object’s outline, magnitude, architecture or design. We provided reasoning to conclude that ideas can be viewed as physical objects. Further, because contexts are composed of ideas, contexts are physical objects. By these definitions, ideas are dimensions because they are definable elements of a context.

The physical sciences are built on logical reasoning. There are many definitions of Logic, but all share a common skeleton. For example, one dictionary definition is “The science that investigates the principles governing correct or reliable inference.” Another definition uses a sharper point: “The relationship between elements and between an element and the whole in a set of objects, individuals, principles, or events.” Both these definitions are valid, but a little fuzzy for engineering work. For our purposes, we will temporarily use a minimalist definition: Logic is the set of rules (a.k.a. “algorithms”) perceived to organize dimensions.

Mathematics is a completely included context of logic – think of mathematics as a purely objective and precise logic, as a logic that operates only on stipulated facts. The physical sciences have proven that physical objects obey known physical laws. Many of these laws are expressed as mathematical formulas.

You can guess the rest. If ideas are perceived as physical objects, then ideas must obey the discovered and undiscovered physical laws that all other physical objects must obey. And because laws are nothing more than logical algorithms (a.k.a. “rules”), ideas must necessarily obey logic.

Stated in other terms, if we stipulate that ideas exist in a Universe composed solely of energy, then we must stipulate that ideas are composed of energy. An established science such as Physics stipulates mathematical laws that explain and predict the behavior of energy. This means that mathematical laws must also explain and predict the behavior of ideas. Because contexts are solely composed of ideas, it follows that mathematical laws explain and predict the behavior of contexts.

This is not a big leap in understanding. Symbolic Logic already applies mathematical laws to variables which ultimately represent uniquely defined entities. All we are doing here is adding the dimension of physicality to ideas. Adding this dimension gives us insight into the physical construction of contexts, and gives us a new tool to examine

contextual properties in the same terms we use to examine other physical objects in the Universe.

Whether there is a one-to-one relationship between existing mathematical laws and ideas, or some mix of existing and new laws has yet to be determined. But one thing is certain – it has been demonstrated that energy obeys laws, and therefore laws that apply to energy also apply to ideas and the contexts they form.

With this foundation we can look at the mechanics of logic and move common abstractions into the physical world. We have said that ideas obey laws. But what is the practical meaning the statement “Ideas obey laws”? What exactly do we mean by “obey”?

We have proposed that ideas are dimensions of contexts, and that ideas have a logically derived physical dimension. If we conceive of the totality of ideas, and the totality of their dimensions, we are conceiving a vast pool of physical dimensions. Add to this pool the dimensions of traditional physical objects. We now have a Universe of physical dimensions.

The Universe of physical dimensions we are describing includes all possible instances and all possible combinations of dimensions, because each combination is a unique definition and therefore a unique dimension. This proposed Universe is as close to a practical definition of infinite as we can imagine, and it is the definition of infinite we will use in this text. However, to any particular human mind, the set of accessible dimensions is finite, not infinite. This is because human minds are burdened by a limiting factor. The limiting factor is perception.

The collective minds of Neanderthal cave men could not conceive of, much less construct, a Winchester rifle to help them hunt for food and defend against predators. The Romans could not imagine modern Caterpillar earth-moving machines that would help them build roads. Charles Babbage did not have the tools to even dream about the intricate design of a modern Intel processor.

The limiting factor in all these scenarios is the limited perceptions of the minds involved – the limited perceivable dimensions available to their minds. Thus while the Universe of physical dimensions is infinite, each mind worked with a finite subset of dimensions.

As far as we know, every human mind since creation has worked with or is working with a finite subset of the infinite Universe – the infinite pool - of dimensions. The totality of dimensions perceivable to minds in the year 2009 is (presumably) much smaller than the perceivable dimensions that will be available in 3009. Therefore when we speak of the pool of dimensions available to a mind, we are actually speaking of the pool of perceivable dimensions – the set of dimensions perceivable to a particular mind.

The concept of a Universe defined as an infinite pool of physical dimensions is very useful. Since every object exists in this Universe, we can now define every object in this Universe in terms of dimensions.

Beyond that, because we are working with physical objects, the very idea of the term "definition" requires the assembly of physical objects into a larger physical object – a larger context. Put another way, a definition organizes dimensions into a structure unique to that definition.

Which brings us back to the question – what do we mean by the term "obey" in the phrase "Ideas obey logic."?

Substitute "are dimensions included in the dimensional structure of" for the term "obey" and you will have a practical definition for obey. One plus one equals two not because the number two is following a set of external rules. One plus one equals two because the definition of one is a physical structure, and adding the physical structure of one to itself creates a new physical structure. This new physical structure creates a new dimension, and a new definition. We define this new structure as "two", and it can be seen as two or as one plus one. The equals sign is a pivot between the two points of view.

We began this section by stating that logic exists, and that logic does not exist. We can now explain what we mean. When we look at the results of a logical operation we can see how the result was obtained, and we say it is a logical output so logic exists as an independent entity. But if we pivot and look at the physical structure beneath logic, we can say that adding one physical structure to another necessarily produces a third structure – and that logic did not create the result, but rather logic was created by the result.

As a practical matter, we can say that logic has an independent existence when used as a tool for prediction. On the other hand – on the other side of the equation - when we disassemble a context to see its underlying structure, we are revealing the natural forces that produce a result we call logical.

Every dimension must necessarily be uniquely defined, however exactly or inexactly, for it to be perceivable. Each definition is its own context, and because contexts are composed of dimensions, contexts are necessarily composed of other contexts. The organization of these contexts-within-contexts is the subject of this presentation, but before proceeding to that tier we need to define the various forms of logical expression in terms of each other. We do that in the next section.

THE MATHEMATICAL FOUNDATION OF LOGIC v1.0

In the preceding sections we have used the terms law, rule and algorithm interchangeably, and in fact they are all functionally equivalent. However, each term has associated contexts that broaden their meaning. We need to define these terms relative to each other so we can think more precisely as we move forward.

For our purposes, the term "Logic" (capital "L") is a physical context composed of each and every unique logical expression, which is to say that Logic is composed of each and every perceived and unperceived logical context, whether lexigraphic (language-based) or mathematical (number-based). It is important to note that Logic, as we use the term, is not a "container" context for logical expressions. In a physical Universe of shared

dimensions, Logic is a physical structure completely defined by its composing logical expressions.

Also for our purposes, the term “Rule” is synonymous with the term “Law”. In general usage, rules are associated with lexigraphic logic, and laws with mathematical logic, but there are many exceptions (ask a lawyer!). Rules and laws organize dimensions via shared dimensions. Rules and laws are the particular unique forms that logic can take, such as a particular mathematical formula like F = M x A. In this sense, all the individual mathematical formulae, all the Boolean operators, all the forms of dialectics and syllogisms – all possible logical expressions of any type – combine to construct the context “Logic”.

The term “algorithm” refers to the logical ordering of rules, where one rule organizes other rules in a hierarchal structure. Essentially, algorithms are rules nested within rules, which is merely another way of stating that an algorithm applies multiple rules in a particular order on particular dimensions.

Broadly then, Logic is a construction of rules, and rules are contexts that consistently assemble the unique dimensions of any particular, perceivable pool of dimensions into the same physical structure. Take the same set of dimensions in the same set of contextual conditions and a particular logical rule or algorithm of rules will organize those dimensions in the same structure every time. Because rules are the expressions of logical reasoning, rules are the embodiment of Logic.

These definitions serve three purposes. First, they synthesize the concepts of ideas and physicality. Second, algorithms reveal that rules can exist in a hierarchy, with some rules controlling the execution of other rules. Third, consider that rules exist in this Universe. This means that rules themselves are composed of dimensions, and therefore rules are themselves contexts. Defining the term “rule” in terms of physical dimensions implies a unification of the organizer object and the organized object at a basic level.

When logic is applied to a subset of the totality of dimensions in the Universe of dimensions we get rules like $a^2 + b^2 = c^2$ and V = L x W x H. When used in the contexts for which they are intended, and when working with the same set of dimensions, these mathematical rules consistently assemble the same results.

The context Logic is constructed of the totality of rules and the totality of dimensions. The rules that compose Logic, then, are logical subsets of dimensions. These subsets of dimensions can be of any size, to which Georg Cantor’s “Infinity of infinities” reasoning can attest. But what is the rule that, so to speak, rules all the subset rules? What is the accepted physical rule that legitimizes Logic?

We have already come across that rule. It is a mathematical formula that applies to each and every physical dimension in the Universe, and to each and every physical relationship of these dimensions. The rule is $E=MC^2$.

If every dimension is composed of energy, then every dimension can be defined in terms of $E=MC^2$. This essential foundation is the stipulated fact integrated into every rule. The relationships among energy, mass and the speed of light are logical

relationships. This makes $E=MC^2$ the scientific justification of Logic. This justification leads to an interesting implication. Because Logic can be defined in terms of a mathematical formula, it means that lexigraphic logic and mathematics can be explained in terms of the other and both must exist with equal capabilities.

The equivalence of lexigraphic logic and mathematics has implications for Godel's Theorem, which we discuss elsewhere. Our purpose in this text is to unify all aspects of Logic into a coherent foundation so our conclusions will apply to both lexigraphic and mathematical expressions of dimensional organizations.

Lexigraphic and mathematical equivalency is a necessary tool in our quest to analyze how contexts align to create the phenomenon we call reasoning. Before we begin the analysis we need to add a few more tools, covered in the next section.

DIMENSIONAL THINKING v1.0

Thus far in this presentation we have offered reasoning – that is, we have supplied modules of logic - that supports the existence of physical ideas. We explored how physical ideas affect our understanding of Logic – that is, physical ideas mandate a physical Logic, and a physical Logic mandates a physical structure for Logic. Because reasoning is a logical activity, the physical structure of Logic is the physical structure of reasoning.

So the question arises, how exactly does reasoning work in a physical Logic? What are the mechanics of a physical Logic? How does Logic embody judgment and subsequent meaning? In this section we offer an overview. In the next section we offer practical examples.

The task of explaining how contexts organize to create meaning is not as ambitious or as philosophical as it may sound. It is practical work that blurs the line between engineer and artist. Adding a physical dimension to reasoning affords clarity into logic that borders on the mundane, but this clarity can only be achieved by using well-defined terminology. To that end, it will be helpful to review concepts (logical architectures) introduced in earlier sections. We also need to formally introduce additional concepts, most of them old friends, and re-define them in terms of a physical Logic.

Previously defined:

1) A dimension is any uniquely definable element of an object. Uniquely defined ideas are dimensions.

2) Contexts are a set of dimensions related by logic.

3) Rules are contexts that consistently assemble the unique dimensions of any particular, perceivable pool of dimensions into the same physical structure.

4) Shared dimensions among physical contexts provide connections among contexts. These connections are nexus points in the architecture of a complex context.

5) Logic is an architecture of shared dimensions. Rules organize the dimensions in logical architectures.

6) Contexts are composed of energy and therefore they can be viewed as physical objects.

7) Physical contexts can be nested within other physical contexts, creating complex contexts.

8) Complex contexts form a hierarchy of rules.

9) $E=MC^2$ implies the equivalence of lexigraphic and mathematical logic.

New definitions:

1) Thinking - “Thinking” is a complex context that identifies dimensions and relationships within any perceivable pool of dimensions. Filtering, judgment and meaning are rules included within the architecture of thinking.

2) Filtering - “Filtering” is a physical process of adding new contexts to an existing context by correlating the mutually shared dimensions of both the new and existing contexts. Filtering is also the opposite process - discarding new contexts that do not mutually share dimensions with an existing context. Filtering is a recursive process – the dimensional structure of an existing context must share one or more dimensions within the dimensional structure of a new context or the new context will be filtered out. Because Dominant Rules share the most dimensions in a complex context, they are the dominant filter for the dimensions introduced by new contexts. Filtering is a mechanical process.

3) Judgment - When two contexts share dimensions, the number of shared dimensions determines the strength of the bond. “Judgment” is specifically a context within the larger complex context of thinking that organizes levels based on the number of shared dimensions.

4) Meaning - We earlier described a “dimension” as a particular, uniquely definable element of an object’s outline, magnitude, architecture or design. For our purposes, the term “meaning” is equivalent to an object’s design – an object’s purpose.

5) Point of View (POV) - A “Point of View” (POV) is an object whose outline, magnitudes, architecture and meaning are each exactly or relatively defined. The POV is the Dominant Rule of a complex context. POVs can contain multiple relatively defined meanings.

6) Levels - Every context is composed of dimensions, and each dimension is itself a context. This means contexts are necessarily composed of other contexts, and therefore every context is a complex context. “Levels” are definable contexts within

a complex context. You may notice a resemblance between" levels" and "rules". The whole of Logic is constructed of a collection of rules, and rules are contexts that consistently assemble the unique dimensions of any particular, perceivable pool of dimensions into the same physical structure. By this definition, levels and rules are functionally equivalent. However, as we will be using the term, levels add a dimension of hierarchy to rules.

7) Geometric Architecture (GA) – The physical manifestation of a rule. Rules organize physical dimensions; essentially, rules are dimensions organizing dimensions. These physical dimensions form a physical architecture – a GA. Thinking of rules as geometric architectures removes a layer of abstraction, and this will be useful when we look into the relationships among contexts.

8) Dominant Rule (DR) – A complex context is a set of contexts that directly share one or more dimensions. Some contexts in a complex context directly share more dimensions than other contexts, creating a hierarchy of contexts. Each context is a rule, and the rule at the top of the hierarchy – the Point of View – is the Dominant Rule.

9) Recessive Rule (RR) – – – A complex context is a set of contexts that directly share one or more dimensions. Some contexts in a complex context directly share more dimensions than other contexts, creating a hierarchy of contexts. Each context is a rule, and the rule at the top of the hierarchy – the Point of View – is the Dominant Rule. All other contexts are Recessive Rules. A Recessive Rule in one POV can be a Dominant Rule in other complex contexts.

These nine new terms all rely on each other for their usefulness. Succinctly, the big picture here is that a Point of View is a physical context composed of dimensions, where each dimension is itself a standalone context, and where each standalone context is mechanically organized into a geometric architecture by a logical rule. Rules are composed of dimensions, and organize with other rules on the basis of mutually shared dimensions.

Thinking is a rule that identifies the dimensions of a context, and in so doing causally acts as a filter that links together contexts that contain identical dimensions. These linked contexts are complex contexts that share one or more identical dimensions, creating an "architecture of architectures".

Because a logical rule organizes the dimensions of a context, all contexts are the embodiment of a rule. These rules are organized into a hierarchy of Dominant and Recessive Rules, where the Dominant Rule is simply the architecture composed of more shared dimensions than any of the other architectures. Judgment is a rule that keeps track of these shared dimensions and organizes the contexts in a complex context into a hierarchy based on their shared dimensions.

Each context in a complex context is a rule in its own right; however, based on their shared dimensions each rule assumes a greater or lesser role in the overall Point of View. These roles are levels of relevance and form a hierarchy. The Dominant Rule is

the Point of View and the dominant level. Recessive Rules form the lower levels – the sublevels - of the hierarchy. Recessive Rules are complete Points of View in their own right, however they are subordinate POVs to the Dominant Rule POV.

It is this hierarchy of levels – this hierarchy of dimensional architectures - that determines the relevance of any particular context's Point of View to other contextual POVs. Directly shared dimensions are best seen as purely physical connections among contexts. A Dominant Rule shares its dimensions with Recessive Rules, and potentially with both Dominant Rules and Recessive Rules of other, not yet perceived architectures (in this sense perception is the engine of growth). This design of hierarchal levels determines how a complex context will interact with the architecture of other contexts. An architecture's form is its function.

If Logic is a physical object then it can be defined in purely physical terms. In this explanation of the mechanics of Logic, we have taken traditionally ill-defined or weakly defined concepts and re-interpreted them in terms of physical dimensions. This re-interpretation allows us to think precisely about Logic as a "hard" practical science just as we think about physics and chemistry. We have eliminated the mystery of how a Logic of ethereal ideas can predict physical processes by defining Logic as one and the same as those physical processes.

A Logic composed of physical dimensions invites us to re-evaluate the fundamental nature of our thoughts. If Logic can be defined in terms of dimensions, then Logic can be defined as Dimensional Thinking.

Moving from a Logic of ideas to a Logic of dimensions allows us to view our perceived world with a more structured set of tools. The best way to illustrate this is by offering a few examples. We present them in the next section.

THE LEVELS OF LOGIC v1.0

A context is a physical architecture of physical dimensions. When a dimension in one context is identical to a dimension in another context, we say a logical relationship exists between the two contexts. When two or more contexts combine in this manner, we say a complex context has been formed.

A complex context can be seen as a pool of perceivable dimensions. The dimensions are organized into separate contexts by rules. These rules are themselves composed of the dimensions they "organize". There is no abstraction implied by the term "rules" – they are nothing more than the very same dimensions they organize. Rules and contexts are equivalent.

Within any complex context some rules have more influence than other rules. The term "influence" is used in a functional sense. Contexts associate based on shared dimensions, therefore a context's component dimensions act as filters for the component dimensions of other contexts. Put another way, a context's component dimensions act as nexus points – as attachment areas - for other contexts. Contexts

with shared dimensions create relationships, and contexts without shared dimensions do not.

The rules of a complex context can be organized in terms of their influence on the complex context. A Dominant Rule (DR) is the backbone architecture of a complex context – it earns this title by sharing the most dimensions with the most contexts in the complex context. The Dominant Rule becomes the Point of View (POV) of the entire complex context.

Recessive Rules in the complex context are Points of View in their own right; however, they are subordinated to the POV of the Dominant Rule because they share fewer dimensions within the complex context. This creates a hierarchy of rules with the DR at the top of the hierarchy.

Because each Recessive Rule is itself a POV, they can at any time become the Dominant Rule of the context if the pool of dimensions composing the complex context changes. For this reason subordinated rules are called Recessive Rules.

Inherent in a hierarchy is the dimension of levels. The Dominant Rule is the top level of a hierarchy, and the Recessive Rules are sublevels. The “top level” simply means the DR shares the most dimensions which in turn causes it to have more influence in the complex context.

Let’s look at a few complex contexts and identify the levels that compose them.

A straightforward example that is easily recognizable is Georg Cantor’s case for relative infinities. In a phrase, Cantor showed that some infinities are larger than other infinities.

Here are three contexts:

1) The set of whole numbers is infinite – [1,2,3,4,5,6….n].

2) The set of even numbers is infinite - [2,4,6…n].

3) The set of odd numbers is infinite - [1,3,5....n].

You see the problem. Clearly, the set of whole numbers includes the dimensions of all the even and all the odd numbers, and must be larger than either the even or odd set. Yet all three sets are infinite. So how then do we define infinity?

Dimensional thinking allows us to define infinity in terms of dimensions, which further allows us to introduce levels and eliminate conflicts inherent in a non-dimensional Logic. These three sets compose a complex context, because they are logically related by shared dimensions (the numbers). In this complex context the set of whole numbers is the Dominant Rule because it shares more dimensions within the perceivable pool of dimensions than the even number and odd number contexts. The set of even numbers and the set of odd numbers are Recessive Rules within this complex context.

Infinity is a complex context defined (in this case) by three contexts organized into levels of influence. The Dominant Rule is at the top of the hierarchy. Unusually, in this

case the Recessive Rules are equal to each other in their influence within the complex context because each shares an equal quantity of dimensions with the Dominant Rule. This complex context of infinity therefore consists of a Dominant Rule and two Recessive Rules, with each RR equal in capability to the other.

For our next example let's return to a context used in an earlier section - "The planets of the solar system ranked by size". In that discussion we found two other contexts that, when combined, contained the same information as "The planets of the solar system ranked by size". Those two contexts were "The planets of the solar system.", and "The ranking of the planets by size".

We demonstrated at that time that all three contexts were related by their shared dimensions. All three contexts contain, among other elements, the identical stipulated fact "planets" – removing that fact from any of the contexts changes the definition of the context. Put another way, all three contexts share the dimension "planets".

The sharing of dimensions is the basis of a physical Logic. In this case, we have three separate contexts, each with a different physical architecture and meaning, combining to create a complex context. One context associates these planets with the Sun; another measures the planets relative to each other, and the third associates the planets with the Sun and also measures them relative to each other.

So far we have demonstrated how the separate physical architectures of these three contexts can be logically connected via their shared dimensions. Each context is its own Point of View, organizing a circumscribed pool of dimensions by applying a logical rule. Yet one Point of View is clearly more dominant than the other two POVs – "The planets of the solar system ranked by size". The question becomes, why is it more dominant?

We can analyze these three contexts by listing the primary dimensions that compose each context. This list will produce the perceivable pool of dimensions for all three contexts, and the complex context they form.

"The planets of the solar system."

1) Planets
2) Solar system

"The ranking of the planets by size."

1) Rank
2) Planets
3) Size

"The planets of the solar system ranked by size".

1) Planets
2) Solar system

3) Rank

4) Size

Clearly “The planets of the solar system ranked by size”. shares more dimensions in the perceivable pool of dimensions than either of the other two contexts, making it the Dominant Rule and Point of View of this complex context. “The ranking of the planets by size.” and “The planets of the solar system.” share fewer dimensions in the perceivable pool of dimensions and are the Recessive Rules of this complex context.

In this example it is plain that the hierarchy of rules extends to the Recessive Rules as well. “The ranking of the planets by size.” shares three dimensions, while “The planets of the solar system.” only shares two dimensions in the perceivable pool of dimensions. Thus this complex context demonstrates three well-defined levels – the Dominant Rule, Recessive Rule 1 (RR1) and Recessive Rule 2 (RR2).

The two preceding examples illustrate the direct sharing of all the dimensions in a perceivable pool of dimensions. Most non-mathematical contexts, however, are not so neatly composed. Our next complex context introduces the indirect sharing of dimensions.

Let’s make a small but significant change to the planetary complex context above by adding the dimension “gaseous” - “The gaseous planets of the solar system ranked by size”.

Our preliminary perceivable pool of dimensions now looks like this:

“The planets of the solar system.”

1) Planets

2) Solar system

“The ranking of the planets by size.”

1) Rank

2) Planets

3) Size

“The gaseous planets of the solar system ranked by size”.

1) Gaseous

2) Planets

3) Solar System

4) Rank

5) Size

The definition of “planets” filtered (modified) by the dimension “gaseous” is different from the definition of “planets”. The dimensions composing “gaseous planets” are not an exact match with the dimensions composing “planets”. This means that the perceivable pool of dimensions must be expanded to allow accurate definitions of each dimension.

The pool of perceivable dimensions for the dimension “planets“ is: [Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune].

The pool of perceivable dimensions for the dimension “gaseous planets“ is: [Jupiter, Saturn, Uranus, Neptune].

This gives a new list of perceivable dimensions for the complex context “The gaseous planets of the solar system ranked by size”.

1) Gaseous
2) Planets
3) Solar system
4) Rank
5) Size
6) Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune
7) Jupiter, Saturn, Uranus, Neptune

Note that while we are adding more dimensions to the perceivable pool of dimensions, we are not removing any dimensions. This means our original Recessive Rules “The planets of the solar system.” and “The ranking of the planets by size.” are still included within the architecture of “The gaseous planets of the solar system ranked by size”. That is, the RRs still share dimensions with “The gaseous planets of the solar system ranked by size”.

Adding the dimension “gaseous” breaks up our neat symmetry of shared dimensions among the three contexts. The dimension “planets” in each context requires eight dimensions for its unique definition – Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus and Neptune. The dimension “gaseous planet” requires four dimensions for its unique definition - Jupiter, Saturn, Uranus and Neptune.

The architecture of the context “The gaseous planets of the solar system ranked by size.” does not include the dimensions Mercury, Venus, Earth, Mars. However, the architectures of both “The planets of the solar system.” and “The ranking of the planets by size.” do include Mercury, Venus, Earth, and Mars, along with Jupiter, Saturn, Uranus and Neptune.

This is an example of indirect sharing of dimensions among contexts. All three contexts are logically related via their shared dimensions, yet some dimensions in the perceivable pool of dimensions - Mercury, Venus, Earth, and Mars – exist in two

architectures, but not the third. The architectures of “gaseous planets” and “planets” contain different sets of dimensions. All non-directly shared dimensions in a complex context are indirectly shared by all contexts composing the complex context.

To spell it out, “The gaseous planets of the solar system ranked by size” directly shares the dimensions Jupiter, Saturn, Uranus and Neptune with its Recessive Rules “The planets of the solar system.” and “The ranking of the planets by size.” However, because all three architectures are logically joined by shared dimensions, “The gaseous planets of the solar system ranked by size”. indirectly shares the dimensions Mercury, Venus, Earth, and Mars because these dimensions are required for the unique definitions of “The planets of the solar system.” and “The ranking of the planets by size.”

Phrases such as “That was taken out of context.”, “Where there is smoke there is fire.” and “There is a grain of truth in that.” refer to rules created (1) using indirectly shared dimensions within the architecture of a perceivable pool of dimensions, or (2) by taking a legitimate shared dimension and removing dimensions from or adding dimensions to the original pool. These phrases correctly identify relationships that certainly exist, but which may actually share direct relationships with a Dominant Rule different than the DR organizing the original perceivable pool of dimensions. Essentially, these phrases often elevate a Recessive Rule to a Dominant Rule by eliminating dimensions from or adding dimensions to the original pool of perceivable dimensions.

There are four key points here. First, any particular dimension can and does simultaneously exist in multiple Dominant and Recessive Rules. Second, a complex context is a physical architecture composed of a perceivable pool of physical dimensions. Third, every dimension within the architecture of a complex context is either directly or indirectly shared by each and every Rule within the complex context. Fourth, the architecture of each and every Rule in a complex context directly or indirectly shares a minimum of one dimension with every other Rule in that complex context.

CONCLUSION v1.0

Ideas are the sum and substance of human knowledge. Each idea is distinct from every other idea, which is to say each idea is defined uniquely, differentiating it from every other idea. Ideas exist in several objective forms – they can be language-based, mathematical, pictorial, or musical (in this foursome I include objectively measurable ideas generated by sight, hearing, taste, touch and smell). Ideas can also be subjectively defined, as they are when they are defined by sight, hearing, taste, touch and smell when they are not objectively measured.

Ideas are defined in terms of other ideas. This means ideas co-exist with each other. We have many names for this co-existence, this ecosystem– knowledge, science, lore, myth, rationality, intelligence and consciousness are common examples. The entire ecosystem can be called a mind, although we generally use the term ”mind” to refer to a single human being’s idea ecosystem.

Ideas are used to describe other ideas, and they are also used to describe what we traditionally call physical objects. Collectively, objective ideas, subjective ideas and physical objects entirely compose what we commonly call our Universe.

The fact that uniquely defined ideas are defined in terms of other uniquely defined ideas implies there is a structural framework to an idea ecosystem. Structure implies relationships, and Logic is a science that examines relationships. Logic assumes two main forms – lexigraphic (language-based), and mathematical. Both lexigraphic logic and mathematical logic require clear, distinct definitions to be effective.

Logic is composed of ideas, and ideas have traditionally been considered to be non-physical entities. Despite this non-physicality, Logic is used to describe and predict the behavior of objects traditionally considered as physical objects. Logic, for example, was employed to put men on the moon and return them safely to Earth.

From its beginnings, Science has used objective ideas to explain or predict the actions of physical objects. These ideas take the shape of mathematical formulas and lexigraphic arguments. While these ideas have proven their validity by being reproducible and consistent, these same ideas have also been considered non-physical and distinct from the physical objects they describe.

This begs the question, how do non-physical ideas interface with physical objects? How does the thought of standing up cause my body to stand up? How can an “abstract” mathematical formula for acceleration accurately predict the performance of an airplane engine? Where does the abstraction end and the physicality begin?

Dimensional Thinking is a discipline that defines ideas as components of the Universe, and in so doing argues that ideas are composed of the same energy as other objects in the Universe. Objects composed of energy have a mass component, therefore ideas have a mass component, and therefore ideas can be viewed as physical objects.

Defining ideas in terms of their physicality resolves the age-old Mind-Body Dualism problem. Physical ideas interacting with physical objects presents a unified physical architecture of mind and body. Physical ideas integrate the collective ecosystem of ideas with the collective ecosystem of physical objects.

By unifying mind and body, Dimensional Thinking offers a window into the physical architecture of Logic. Within that architecture can we see the dimensional structure of contexts. We can see a hierarchy of contextual levels. We can see a physical definition of judgment. We can see a physical definition of meaning.

Dimensional Thinking offers logical tools for analyzing the very Logic that recursively produces these logical tools. The tools are embodied in the structure of Logic; they are an added dimension of Logic. Using these tools, Logic is no longer an abstract discipline commenting on its own abstractions and on the behavior of physical objects. Instead, Logic is no more than and no less than the revealed structure of a mentally and physically integrated creation.

When we “apply” logical rules to ideas and physical objects we are working within the system – because we are physically and intrinsically part of the system we are analyzing. “Thinking” acts on physical ideas and physical objects, and is controlled by the same forces of Nature that act on all physical objects. We accept that our bodies are ruled by physical laws. Physical ideas require the same acceptance.

Pablo Picasso said, “If there were only one truth, you couldn't paint a hundred canvases on the same theme.” Dimensional Thinking offers a structured explanation for this statement – the “theme” is a unique Dominant Rule, and the “hundred canvases” are the manifold Recessive Rules capable of sharing dimensions with the Dominant Rule. Examining the hundred canvases with an objective set of tools enables clarity into our thought processes and revitalizes our understanding of the Universe and our place in it. Dimensional Thinking empowers us to evaluate Truth, one canvas at a time.

THE END