Article

Relating the Relational-Matrix Model of Reality to Space-Time and Physical Reality

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ABSTRACT

This article is a continuation of Kaufman's work previously published in SGJ Vol. 2, No. 3 (2011), in which work the relational-matrix model was developed and described as a dynamic structure composed of existence involved in a defined set of relations with itself. The purpose of this article is to relate the relational-matrix model, as a dynamic structure, to what we apprehend as space-time by demonstrating that certain fundamental behaviors and aspects of physical reality can be explained in the context of the defined set of relations of existence to itself that were previously described as composing the fundamental structure of reality conceptualized as the relational-matrix. Specifically, within the context of the relational-matrix model, we will account for the following aspects of physical reality: (1) the relationship between space and time, including the basis of temporal relativity, as well as the precise nature of time as a function of the dynamic aspect of the spatial structure; (2) the basis of the speed-of-light constant, including why the frequency and wavelength of electromagnetic radiation are inversely related as a function of that constant; (3) the basis of Planck's constant, including why the energy associated with electromagnetic radiation exists in discrete amounts, or quanta; (4) the nature of gravitation, including why matter and gravitation are always associated and why gravitation is universally attractive; (5) the equivalence of the gravitational and inertial forces; (6) the relationship between electromagnetic radiation and gravitation; and (7) the nature of energy. Using the relational-matrix model to explain these aspects of the behavior of physical reality will establish a conceptual basis for understanding how physical reality extends from the structure of space. By the end of this article, we will also have established a conceptual basis for understanding why nothing can truly be separated from anything else—i.e., why nothing can be said to exist independent of all other things.

Key Words: relational matrix, space-time, dynamical structure, physical reality.

I wished to show that space-time isn't necessarily something to which one can ascribe a separate existence, independently of the actual objects of physical reality. Physical objects are not in space, but these objects are spatially extended. In this way the concept of "empty space" loses its meaning —Albert Einstein, June 9, 1952, Note to the 15th edition of Relativity

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> Einstein's efforts to uncover a unified field theory were rooted in his belief that the structure of space-time is the key to understanding the characteristics of the electromagnetic and gravitational forces. The World of Physics, vol. III p. 120

Section 1 Introduction

Almost 100 years ago, Albert Einstein, in his special and general relativity theories, developed mathematical formulas which told us that matter and energy are equivalent, that space and time are inseparable, that no physical object can travel faster than the speed of light, and that the rate of passage of time for a body in motion is relative to that body's rate of travel through space. In this way, Einstein was able to mathematically demonstrate that these apparently separate aspects of physical reality were all connected.

Einstein understood that all physical phenomena are connected through the spatial structure, existing as extensions of that structure. However, because he was unable to develop a visual model of that structure, he was never able to demonstrate *how* all these things are connected through that structure.

In this article, we will demonstrate that space-time functions as a dynamic relational structure. The relational-matrix model, as a visualizable representation of the structure of space, will be used to explain, among other things, why the physical relationships that Einstein mathematically described exist. Using the relational-matrix model to explain the behavior of physical reality, we will establish a conceptual basis for understanding how physical reality extends from the structure of space. By the end of this article, we will also have established a conceptual basis for understanding why nothing can truly be separated from anything else—i.e., why nothing can be said to exist independent of all other things.

Section 2 The "Big Bang" and the Relational Matrix

The universe is expanding. This observation, based on astronomical measurements, has led to the theory that the universe began in an outward explosion from some point. In general, the idea of this initial explosion and subsequent expansion of the universe is called the "Big Bang" Theory.

The relational-matrix model, as a visualizable representation of space-time, is consistent with the view of an expanding universe that began as a point. We have described the relational-matrix model as the dynamic structure that results when existence repetitively and progressively exists in relation to itself. Yet, there's another relationship within existence implied by the existence of the relational matrix that we haven't yet discussed. That implied relationship is between existence that's existing in relation to itself to form a relational matrix, and existence that isn't forming a relational matrix. That is, the relational matrix, as an aspect of existence, must itself exist in relation to another aspect of existence that's not a relational matrix. Putting it still another way, the relational aspect of existence must exist in relation to a complementary nonrelational aspect of existence.

The relational matrix, as a structure, represents a constraint, a limitation, that existence has imposed upon itself, upon limitless borderless nonrelative existence. Infinite borderless nonrelative existence can be imagined as a ubiquitous no-thing, as a nonstructure, like a blank sheet of paper extending forever in all directions. The relational matrix, as a structural imposition upon this structural nothingness, can be imagined as a dot (or point) placed somewhere upon that blank sheet of paper. This dot is relative existence as structure existing in relation to nonrelative existence that has no structure. This dot is the relational aspect of existence existing in relation to the nonrelational aspect of existence. In other words, the first relationship that existence forms with itself must be between finite and infinite existence, between relative and nonrelative existence, between existence as relational structure and existence as nonrelational nonstructure, between the finite point and the infinite nonpoint.

Existence exists whether or not the dot is there. However, the dot can't exist except within the context of existence that's not a dot—i.e., the dot can't exist other than as finite bordered relative existence in relation to infinite borderless nonrelative existence. The dot is existence existing in relation to itself. The dot is relative existence, existence that is what it is by virtue of its relationship to a complementary aspect of existence. This is why the dot successively dualizes into a relational matrix, because what the dot is is the relational aspect of existence; what the dot is is existence forming a relationship with itself. Therefore, the dot undergoing a process of successive dualization, of repetitive and progressive self-relation, is not other than relative existence continuing to be what it is—i.e., existence that has formed a relationship with itself. For this reason, existential self-relation, once it has happened, becomes an ongoing process.

However, as a relative reality, the dot (i.e., the relational matrix) must do more than internally dualize. As a relative reality, the dot must also penetrate or expand into the nonrelative existence that it exists in relation to. That is, just as the reality cells of the relational matrix maintain their relative existences through the dynamic of continuous interpenetration and interexpansion, the relational matrix as a whole must itself also maintain its relative existence by continuously penetrating and expanding into whatever it is that it exists in relation to, which in this case is infinite borderless nonrelative existence.

The universe conceived as expanding from a point of origin owing to a "big bang" represents our view of the dynamic that must be occurring in order for existence to sustain the relationship it has formed with itself. What we observe as the expansion of the universe isn't other than the ongoing penetration of one aspect of existence into its complementary aspect of existence. What we observe as the expansion of the universe isn't other than the ongoing penetration and expansion of the relational matrix, as relative existence, into existence that's nonrelative. In other words, what we observe as the expansion of the universe is one half of the dynamic involved in maintaining the state of relative existence that is the universe.

The other half of that dynamic involves the universe as relational matrix, as finite bordered relative existence, being penetrated by whatever it is that it exists in relation to, which, again, in this case is infinite borderless nonrelative existence. That is, as the universe expands into the surrounding nonuniverse, that surrounding nonuniverse must also be expanding into the universe. Putting it another way, as the relational matrix penetrates and expands into existence

that is nonrelative, nonrelative existence must also be penetrating and expanding into the relational matrix.

It's these penetrations of the relational matrix by nonrelative existence that create what we have previously defined and described as *distortions* of the relational matrix. That is, distortions of relational-matrix content originate in areas of the relational matrix that have been penetrated by surrounding existence which isn't the relational matrix. Distortions are patterns of reality-cell content within the relational matrix that differ from the uniform or baseline pattern and are at some level the opposite of the uniform pattern. The positive/negative polarity or complementarity of reality-cell content arises as the uniform relational matrix is penetrated by existence that's not the relational matrix.

As we will explained in upcoming sections, what we perceive as the fundamental forms of electromagnetic and gravitational energy are not other than the propagation of these distortions of reality-cell content through the relational matrix, once they've come into existence, with that propagation being driven by the dynamic intrinsic to the relational structure of space-time. This situation is somewhat analogous to what happens when the uniformly calm surface of a body of water is penetrated by some object, with the surface of the water in that area becoming then uncalm, or distorted, in relation to the uniformly calm pattern, followed by the propagation of that distortion from its point of origin outward as a water wave.

To summarize, what we observe as the expansion of the universe is our perception from within the universe of the process whereby one relative reality or the relational aspect of existence penetrates or expands into its complementary nonrelative reality or the nonrelational aspect of existence. Also, what we experience as propagating distortions—i.e., what we observe as the electromagnetic and gravitational energy of the universe, as well as their material products—is the result of the nonrelative nonuniverse having penetrated the relative universe.

Thus, the universe contains infinite form, endless structural variations, because it's part of a process whereby finite structural existence is expanding into infinite nonstructural existence, while infinite nonstructural existence is also expanding into finite structural existence. The seeming infinity of form observed in the universe is the result of an ongoing dynamic between existence as structure and existence as nonstructure. In this way, the interplay or interrelation between structural constraint and unconstrained possibility creates a universe of infinite form and endless structural variation, wherein no snowflake is identical to another snowflake. This is finite structural existence embodied (i.e., taking shape) within, and in relation to, infinite nonstructural existence. Look at a flower, and what you're seeing is the marriage of the infinite to the finite, the marriage of existence to itself, as it exists in relation to itself. Look at anything else, or look into a mirror, and you're observing the same.

Section 3 Space-Time and the Relational Matrix

Einstein's relativity theory demonstrated the inseparability of spatial and temporal existence by revealing that the rate of passage of time which an object is observed to experience varies with object's rate of travel through space. This connection between the passage of time and material

velocity established the idea that space and time are the dual aspects of a single underlying reality, which is now referred to as space-time.

The structural and dynamic aspects of the relational-matrix model also have been described as the dual aspects of a single underlying reality. We will show that space and time are inseparably linked because they're the manifestations of the structural and dynamic aspects, respectively, of the dynamic relational structure that underlies our perception of the universe, as depicted in **figure 31.**

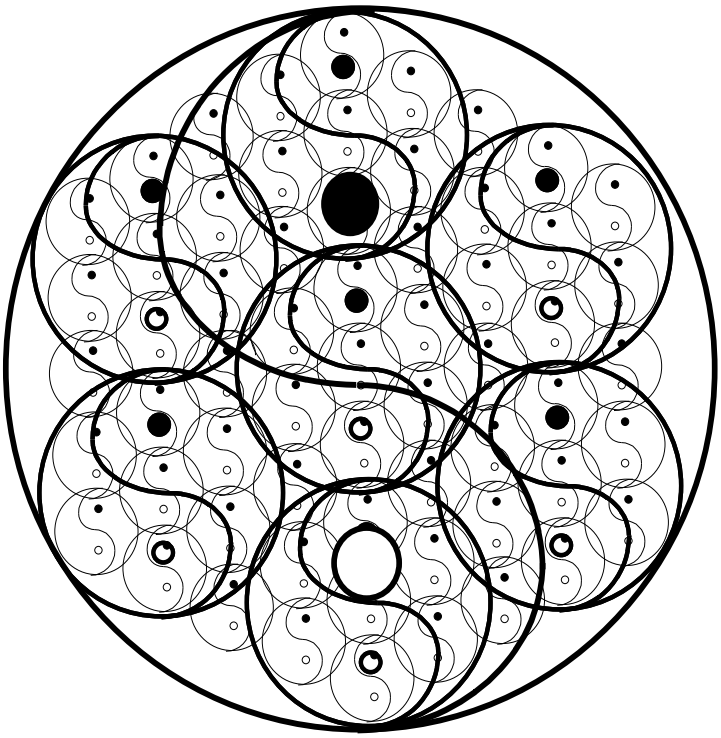


Figure 31 Diagrammatic representation of the dynamic structure we perceive as space-time. "Space" is derived from the static aspect of the spatial structure, wherein areas of existence are defined in relation to each other as reality cells of a certain size or volumetric existence (VE). The "time" aspect is derived from the dynamic aspect of the spatial structure, which involves the continuous exchange of spatial content between reality cells.

In the relational-matrix model, space is the manifestation of the structural aspect of the relational matrix, i.e., the volumetric existence (VE) of the reality cells. A reality cell defines a spatial construct, an area of relational structure within existence. The area so defined exists as spatial content, as an area of space. Space doesn't exist "within" the reality cell; space *is* the reality cell, and the structure of space is derived from the relationships between reality cells. As we will describe in upcoming sections, there's no empty space for things to be "in"; there's only the dynamic structure of space, which, as existence repetitively and progressively existing in relation

to itself, composes the energy, the matter, and then the experience of those things as existing "in" space.

Time, then, is the manifestation of the dynamic aspect of the relational matrix. Essentially, time will be shown to be nothing more than a measure of the cyclic or periodic activity of compound distortion processes or matter. Since time doesn't exist until there exists matter, we can't explain how the dynamic aspect of the relational matrix relates to time until we have first shown how matter arises within the context of the unified model of reality.

To demonstrate that space-time functions as a dynamic structure, and to eventually show how matter arises within the context of that dynamic structure, we will now relate reality-cell distortions and distortion propagation to some fundamental aspects of electromagnetic radiation and gravitation.

Section 4 Electromagnetic Radiation and the Relational Matrix

In this section, we will define the existence of electromagnetic radiation (EMR) within the context of the relational-matrix model.[1] We will demonstrate that the propagation of electromagnetic radiation through space is represented in the relational-matrix model by linearly propagating distortions that have a distortion content equivalent to the maximal distortion. In other words, electromagnetic radiation will be shown to represent the linear component of the linear-radial distortion complex. Modeling electromagnetic radiation within the context of the relational matrix will reveal the basis of some of its fundamental properties.

An individual electromagnetic wavicle,[2] or photon, is defined by its frequency, wavelength, and energy, all of which are related through physical constants. Wavelength (λ) and frequency (ν) are inversely related through the speed-of-light constant (c); this is stated as $\lambda\nu = c$. The frequency (ν) of an individual electromagnetic wavicle is directly related to its energy (E) through Planck's constant (h), also known as the quantum of action, as stated in the equation $E = h\nu$. The relationship between wavelength, frequency, and the speed of light is depicted in **figure 32**.

[1] Visible light is electromagnetic radiation, but it represents only a small part of the electromagnetic spectrum. X-rays, ultraviolet rays, and infrared rays are also part of that spectrum.
[2] The term "wavicle" is used here to denote the dual nature of electromagnetic radiation, as it exhibits both particle and wave characteristics. The source of this dual wave and particle nature is examined and explained in Part II of this book.

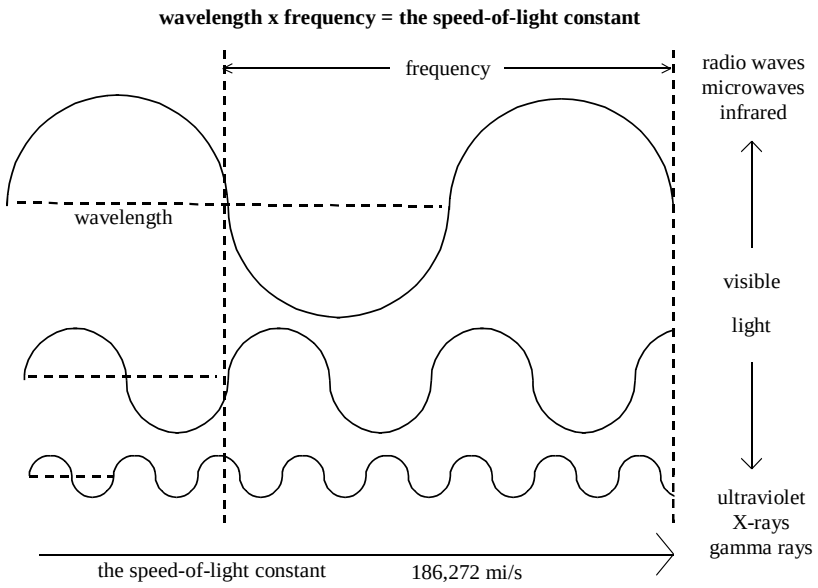


Figure 32 The relationship between the wavelength, frequency, and velocity of electromagnetic radiation. The shorter the wavelength, the higher the frequency. In a vacuum, all electromagnetic radiation, regardless of its wavelength and frequency, propagates at the same velocity of approximately 186,272 mi/s, (300,000 km/s). This invariant velocity is the speed-of-light constant (*c*).

In this diagram, three different electromagnetic wavicles are depicted, representing, from largest to smallest wavelength, the primary colors, red, green, and blue, for which we have specific sensory receptors. However, visible light makes up only a very small part of the electromagnetic spectrum, which extends from waves of extremely high frequency and short wavelength to waves of extremely low frequency and long wavelength.

In the next few subsections, we will demonstrate that electromagnetic wavelength and frequency are manifestations of the structural and dynamic aspects of reality cells—i.e., the volumetric existence (VE) and the period of content exchange (POCE), respectively. We will also demonstrate how the energy associated with an electromagnetic wavicle is related to the distortion content of a reality cell. Finally, we will demonstrate that the speed-of-light constant and Planck's constant are both manifestations of constant relationships which exist within the dynamic structure that is space-time.

4.1 *Wavelength, frequency, the speed of light, and the relational matrix*

Previously, we defined the complementary structural and dynamic aspects of reality cells in terms of their volumetric existence (VE) and period of content exchange (POCE), respectively. Within space-time, electromagnetic radiation also has complementary structural and dynamic aspects that define its existence. These complementary structural and dynamic aspects of electromagnetic radiation are wavelength and frequency, respectively.

In terms of reality cells, the VE and POCE are inversely related through the rate-of-penetration constant (k_{RP}). In terms of electromagnetic radiation, the wavelength and frequency are inversely related through the speed-of-light constant (c).

The rate of propagation of a distortion of reality-cell content is equivalent to the k_{RP}, which is defined as the VE multiplied by the POCE—i.e., VE x POCE = k_{RP}. Similarly, the linear velocity of electromagnetic radiation is equivalent to the speed-of-light constant (c), which is defined as the wavelength multiplied by the frequency—i.e., $\lambda\nu = c$.

Thus, the relationships between the complementary structural and dynamic aspects of electromagnetic radiation exactly parallel the relationships between the complementary structural and dynamic aspects of reality cells. These parallels allow us to begin to define electromagnetic radiation within the context of the relational-matrix model as a linearly propagating distortion of reality-cell content.

Within the context of the relational-matrix model, electromagnetic wavelength is equivalent to reality-cell VE, electromagnetic frequency is equivalent to reality-cell POCE, and the speed-of-light constant is equivalent to the k_{RP} and the constant rate of distortion propagation. The parallels between these different aspects of electromagnetic radiation and linearly propagating distortions of reality-cell content are depicted in **figure 33**.

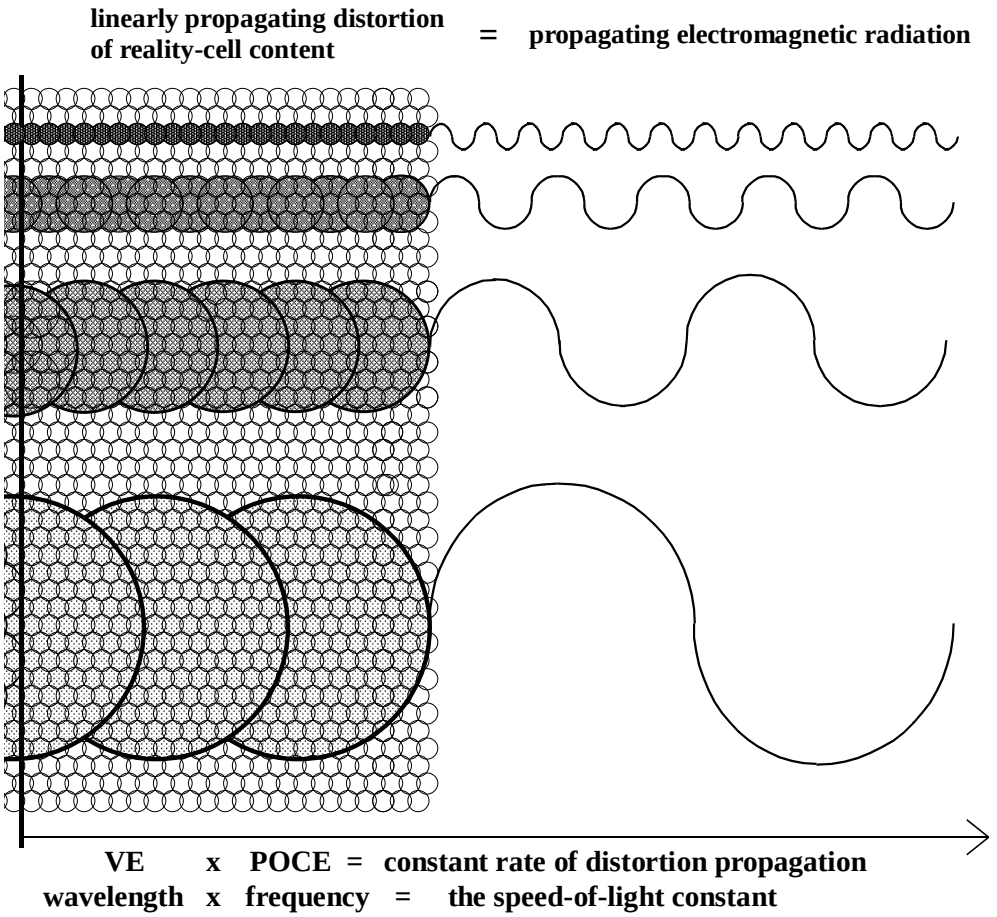


Figure 33 The relationship between the basic aspects of distortion propagation and electromagnetic radiation (EMR). (Left) Four different linearly propagating distortions of different sizes or VEs. (Right) Four different wavelengths of EMR. The reality-cell VE is analogous to EMR wavelength, the reality-cell POCE is analogous to EMR frequency, and the constant rate of distortion propagation is analogous to the speed-of-light constant. Also, as discussed in the next subsection, the discrete relationship between reality cells at different relational levels of reality, depicted here as four different sizes of propagating distortions, is what's responsible for the quantum nature of EMR.

Having defined electromagnetic radiation within the context of the relational-matrix model, we will now relate other aspects of electromagnetic radiation to that model. In so doing, we will provide further evidence that space-time functions as a dynamic structure, and that what we experience as physical reality exists as an extension of that dynamic structure.

4.2 *The quantum nature of electromagnetic radiation* **quan·tum** (kwòn¹tem) *noun plural* **quan·ta** (-te)

1. A quantity or an amount.

2. A specified portion.

3. Something that can be counted or measured.

4. *Physics.* **a.** The smallest amount of a physical quantity that can exist independently, especially a discrete quantity of electromagnetic radiation. **b.** This amount of energy regarded as a unit.[3]

The concept of electromagnetic quanta refers to the fact that the energy associated with electromagnetic radiation exists in discrete quantities, rather than in a continuous gradation. That is, although there's an electromagnetic spectrum or continuum, that continuum isn't continuous! Rather, the electromagnetic spectrum is divided into specific and discrete energy quantities.

The reality cells of the relational matrix also have a discrete or quantum nature. The reality cells don't occur in a continuous gradient but in discrete sizes. Because each reality cell exists as a result of the dualization of a larger reality cell, this relationship creates "quantum jumps" between one reality-cell size and the next smaller or larger reality-cell size. Thus, each relational level of reality within the relational matrix is made up of reality cells that all have the same specific and discrete VE and POCE—i.e., they all have the same discrete structural and dynamic parameters.

Having related electromagnetic wavelength to reality-cell VE, and electromagnetic frequency to reality-cell POCE, we can now state that the discrete quantum levels of electromagnetic radiation each correspond to a certain relational level of reality within the relational matrix wherein all the reality cells have the same discrete structural and dynamic parameters. *In other words, the discrete nature of reality-cell existence is what forms the basis of the quantum nature of electromagnetic radiation.* This discrete nature of reality-cell existence is depicted in figures 15, 22, and 33.

We can now use this understanding of the existence of electromagnetic frequency, wavelength, and quanta, as they've been defined within the context of the relational-matrix model, to examine and understand the existence and basis of the energy itself that is, and is associated with, electromagnetic radiation. To do this, we will need to revisit the concept of distortion content and the special case of distortion content that represents a maximal distortion.

4.3 *Energy and the relational matrix*

In this subsection, we will relate the concept of energy, as it applies to the quantity of energy associated with electromagnetic radiation, to the relational-matrix model. Specifically, we will approach the concept of energy through the well-known relationship of electromagnetic energy (E) to frequency (ν) and Planck's constant (h) as stated in the equation $E = h\nu$.

We have already related electromagnetic frequency to reality-cell POCE, and so we can begin by substituting POCE for frequency in the equation $E = h\nu$ as $E = h$ x POCE. However, to

[3] *The American Heritage Dictionary of the English Language*, Third Edition, copyright © 1992 by Houghton Mifflin Co.

understand the nature of energy within the context of the relational-matrix model, we must also define Planck's constant within the context of this model, so that we can then solve for E in the equation $E = h\nu$ wholly within the context of the model.

In the following subsection, we will show that Planck's constant is the manifestation of a relationship intrinsic to reality cells which remains constant at all levels of scale. Understanding the basis of Planck's constant within the context of the relational-matrix model will allow us to understand what it is that makes energy energetic.

4.31 *Electromagnetic radiation, Planck's constant, and the relational matrix*

Electromagnetic wavicles or photons each are associated with a certain quantity of energy, and propagating distortions each are associated with a certain pattern of distortion content. So, there's a parallel between the distortion content of a propagating distortion and the energy of an electromagnetic wavicle, inasmuch as they both represent what is delivered by their respective realities. We can then postulate *that energy is equivalent to distortion content*, as depicted in **figure 34**. The nature of this equivalence is what we will explore next.

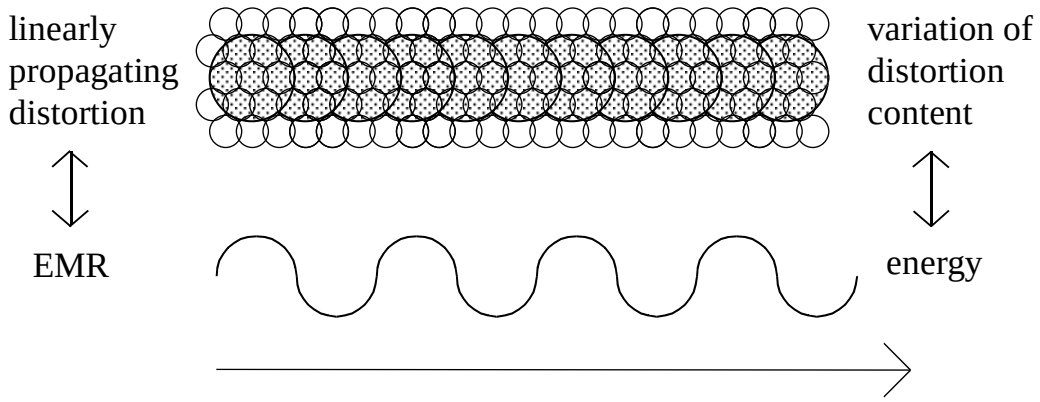


Figure 34 The energy associated with an electromagnetic wavicle is equivalent to the distortion content associated with a propagating distortion. Electromagnetic radiation (EMR) represents a certain quantity of energy, whereas a propagating distortion represents a certain pattern of distortion content. Since electromagnetic radiation has been modeled as a linearly propagating distortion, the energy associated with an electromagnetic wavicle is then analogous to the pattern of distortion content associated with a propagating distortion.

For a particular electromagnetic wavicle, the quantity of energy is constant, as stated in the equation $E = h\nu$. That is, the quantity of energy associated with an electromagnetic wavicle doesn't increase or decrease as it propagates. We also know that in a vacuum, and in the absence of a gravitational field, an electromagnetic wavicle propagates in a straight line. We will use these properties to further define electromagnetic radiation within the context of the relational-matrix model as a specific type of propagating distortion.

Since electromagnetic energy is equivalent to distortion content, and the quantity of energy associated with a particular electromagnetic wavicle is constant, then electromagnetic radiation modeled as a propagating distortion should be represented by a reality-cell distortion that propagates through the relational matrix with a constant pattern of distortion content. In chapter 1, where we developed the relational-matrix model, we described the scenario of a linearly propagating distortion with a constant pattern of distortion content.[4] In that scenario, the constant pattern of distortion content is that of the maximal distortion.

Using the parallelism between wavelength and VE, frequency and POCE, and the speed-of-light constant and the constant rate of distortion propagation, we have already defined electromagnetic radiation within the context of the relational-matrix model as a linearly propagating distortion.

Now, using the parallelism between constant electromagnetic energy and constant pattern of distortion content, we will further define electromagnetic radiation within the context of the relational-matrix model as the *linear propagation of a maximal distortion*. As described in chapter 1, a linearly propagating maximal distortion is one component of a linear-radial distortion complex.[5] Therefore, we will define electromagnetic radiation as the *linear component* of the linear-radial distortion complex, as depicted in **figure 35.**

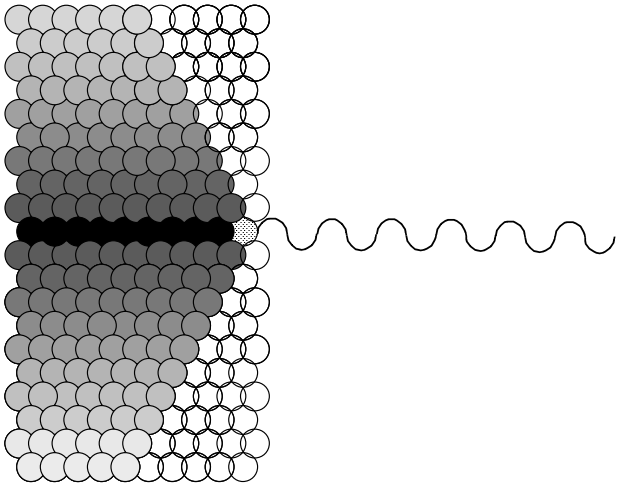


Figure 35 (Left) A linear-radial distortion complex. (Right) An electromagnetic wavicle. Within the context of the relational-matrix model, electromagnetic radiation is analogous to the linear component of the linear-radial distortion complex. As explained earlier, the pattern of distortion content represented by the linear component of the linear-radial distortion complex is that of a maximal distortion.

Distortions of the relational matrix consist of patterns of reality-cell content distribution that differ from a content pattern that is defined as uniform. Maximal distortions all have the same pattern of reality-cell content distribution, regardless of reality-cell size, or VE, because the

[4] See part I, chapter 1, subsection 7.2.
[5] See part I, chapter 1, subsection 7.3.

content pattern that represents the maximal distortion is the opposite of the uniform pattern. Thus, the pattern of reality-cell content distribution must be the same for all maximal distortions.

The relationship between any two quantities can be expressed as a ratio, which is one quantity divided by the other. Thus, any pattern of distortion content could be expressed as a positive/negative or negative/positive ratio, which we can call the *distortion ratio* (DR). Since the maximal distortion represents a constant and consistent pattern of distortion content—i.e., a constant and consistent pattern of reality-cell content distribution—its distortion ratio would be invariant, or a constant, regardless of the size of the maximal distortion—i.e., regardless of the VE of the maximally distorted reality cell. The distortion-ratio constant associated with maximal distortions will be denoted as k_{DR}. The relative quantification of the distortion ratio is depicted in **figure 36**.

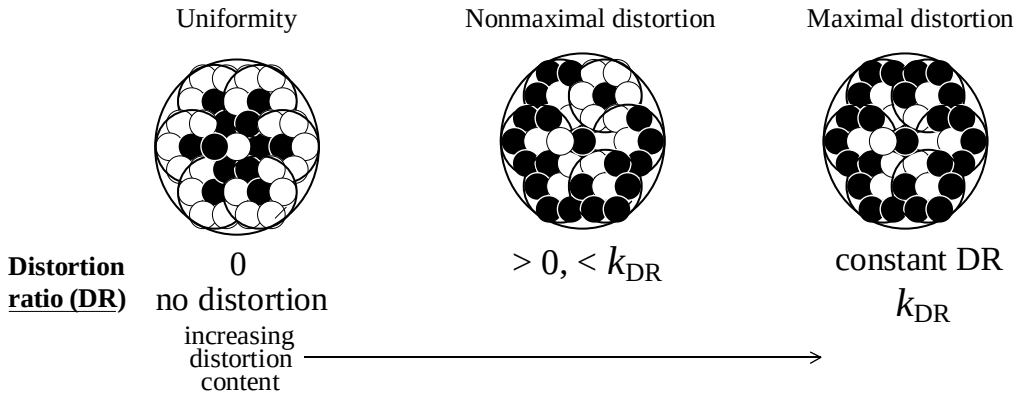


Figure 36 The distortion ratio (DR) is the positive/negative, or negative/positive content ratio of reality-cell content that exists for distortions—i.e., the nonuniform pattern of reality-cell-content distribution. Uniformity, being a state of nondistortion, has a distortion ratio defined as zero. The maximal distortion has the greatest distortion ratio, which is the distortion-ratio constant (k_{DR}), and all intermediate degrees of distortion have a distortion ratio between zero and k_{DR}.

As stated previously, the quantity of energy associated with an electromagnetic wavicle is equivalent to the distortion content of a linearly propagating maximal distortion. The distortion content of a linearly propagating maximal distortion can be expressed as a constant positive/negative or negative/positive ratio of reality-cell content called the distortion-ratio constant. Therefore, the quantity of energy associated with electromagnetic radiation is related to the distortion-ratio constant (k_{DR}).

However, the quantity of energy associated with electromagnetic radiation isn't precisely equivalent to the distortion content of a linearly propagating maximal distortion, or else the energy associated with all electromagnetic wavicles would be identical, since the distortion content or distortion ratio of all linearly propagating maximal distortions is the same.

What a linearly propagating maximal distortion delivers is a constant and consistent pattern of distortion content, represented by the k_{DR}. Reality cells existing at different relational levels of

reality deliver those constant and consistent patterns of distortion content in different sizes (i.e., with different VEs), and at different frequencies (i.e., at different POCEs).

We know from the equation $E = h\nu$ that energy is directly related to variable electromagnetic frequency through Planck's constant. Therefore, within the context of the relational-matrix model, the "energy" associated with a linearly propagating maximal distortion is related to the reality-cell POCE through a constant analogous to Planck's constant (h), expressed as E = (constant)POCE. The question is, what constant in the relational-matrix model represents Planck's constant?

In the preceding paragraphs, we developed a constant, k_{DR}, that represents the constant and consistent pattern of distortion content propagated by the linear component of the linear-radial distortion complex. Planck's constant, according to the equation $E = h\nu$, represents an invariant quantity of action associated with electromagnetic radiation. As the frequency of electromagnetic radiation increases, its energy, equivalent to Planck's constant times the frequency, also increases, and so the energy for a higher frequency of electromagnetic radiation is greater than for a lower frequency of electromagnetic radiation.

What a propagating distortion does is change the pattern of reality-cell content in an area of the relational matrix. This is the specific action performed by a propagating distortion. For linearly propagating maximal distortions, this action is always the same, since the degree of distortion is always maximal. Whereas the area of that action, and its frequency, vary according to the inverse relationship between reality-cell VE and POCE, the action itself, that of maximal distortion, is invariant.

Thus, there's a parallel between Planck's constant, as an invariant quantity of action intrinsic to electromagnetic radiation, and the distortion-ratio constant (k_{DR}), as the invariant action intrinsic to linearly propagating maximal distortions. *Therefore, within the context of the relational-matrix model, Planck's constant is equivalent to the distortion-ratio constant*, as depicted in **figure 37**.[6]

[6] By equating Planck's constant to the k_{DR}, Planck's constant can be seen as the manifestation of a relationship that's intrinsic to reality cells, one that remains constant regardless of scale. This situation is similar to the basis of the constant π, which represents the relationship of a circle to itself, which intrinsic relationship also remains the same regardless of scale. In the case of both the speed-of-light constant and Planck's constant, we have now demonstrated that these physical constants represent invariant relationships which are intrinsic to the relational matrix, i.e., invariant relationships which are intrinsic to the dynamic structure of space.

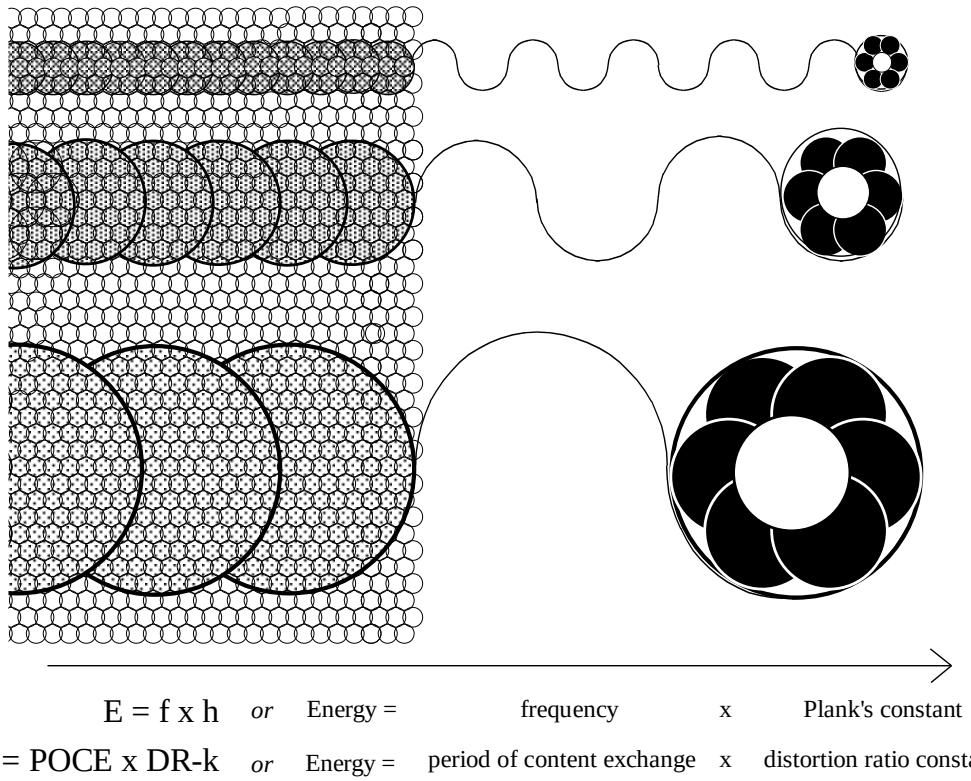


Figure 37 The parallel between Planck's constant and the distortion-ratio constant. Electromagnetic radiation (EMR) has been modeled as a linearly propagating maximal distortion. The maximal distortion content that's propagated has been relatively quantified as the distortion-ratio constant (k_{DR}). Whereas Planck's constant (h) represents an invariant quantity of action associated with EMR, the k_{DR} represents an invariant action intrinsic to linearly propagating maximal distortions. Therefore, Planck's constant is equivalent to the distortion-ratio constant. (Left) Propagating distortions. (Right) Electromagnetic wavicles, modeled as all carrying the same pattern of maximal content distortion represented by k_{DR}. What both linearly propagating maximal distortions and electromagnetic wavicles deliver is a constant degree of spatial-content distortion. The frequency (POCE) of that distortion content is the variable that determines the quantity of energy associated with a particular wavelength of EMR.

Substituting k_{DR} for Planck's constant, we can now solve for electromagnetic energy in terms of the relational-matrix model. The equation $E = h\nu$ can be stated as $E = k_{DR}$ x POCE. What this shows is that, *within the context of the relational-matrix model, the energy associated with electromagnetic radiation is equivalent to the frequency of maximal distortion*.

So, energy is related to distortion content, although energy doesn't exist directly as distortion content. That is, energy, in terms of the relational-matrix model, is directly related to both the frequency of distortion and the degree of distortion. The greater the frequency (POCE), with the distortion ratio held constant, the greater the energy. Conversely, the greater the distortion ratio,

with frequency held constant, the greater the energy. Lesser degrees of distortion, creating smaller distortion ratios, with frequency held constant, would correspond to less energy. That is, for submaximal distortions, according to the equation $E = k_{DR}$ x POCE, the smaller the distortion ratio, the less the energy associated with that distortion.

Although intuitively it may seem that greater energy should be associated with a larger area of distortion (i.e., greater VE or wavelength), this isn't the case. As stated in the equation $E = h\nu$, or $E = k_{DR}$ x POCE, it seems that what's important in terms of the quantity of energy is not *how large* is the area of space with a distorted content, but *how distorted* is the area in question, along with the *frequency* with which that distortion occurs.

Ultimately, the point of relating Planck's constant to the distortion-ratio constant was to show that, according to the equation $E = h\nu$, energy is fundamentally nothing more than a propagating distortion of spatial content. How the concept of energy as a propagating distortion is analogous to the concept of an energy field will be discussed in the next subsection.

4.4 *Energy as distortion field*

Because the reality of space-time consists fundamentally of existence existing in relation to itself, nothing is what it is intrinsic to itself. Rather, all things are what they are only in relation to the complementary thing that they're not. Thus, hot exists in relation to cold, up in relation to down, good in relation to bad, distortion in relation to uniformity, and energy in relation to nonenergy. The only thing that is what it is, as it is, is absolute existence, which isn't a "thing" at all.

What is energy? Energy is fundamentally a distortion of reality-cell content propagating through the relational matrix. Even though we have defined propagating distortions as energy, it should be understood that energy doesn't exist as such except in relation to nonenergy—i.e., distortions exist as such only in relation to uniformity. There are no independently existent energy processes or distortions. The existence of any reality is derived from the relationship to its complementary reality. Thus, what energy *is* can be understood only in the context of its relationship to what it's not.

That energy is inseparable from what isn't energy can be understood by looking at energy as a field. What is a field? It's one area of space that is distinguishable from another area of space in terms of its content or appearance. A field of wheat is distinguished from a field of corn by what grows in them. Were all spatial content the same, no area of space would be distinguishable from any other, and there would be no field, no energy, only uniformity. So, a field is defined as such according to what it is in relation to what it's not.

Likewise, energy is discernible as energy only in contrast to what isn't energy. An energy field exists as such only in relation to other areas of space that aren't energy fields. In terms of the relational matrix, areas of reality-cell distortion within the relational matrix exist as such only in relation to areas of reality-cell uniformity. The relationship between fields, distortions, and energy is depicted in **figure 38**.

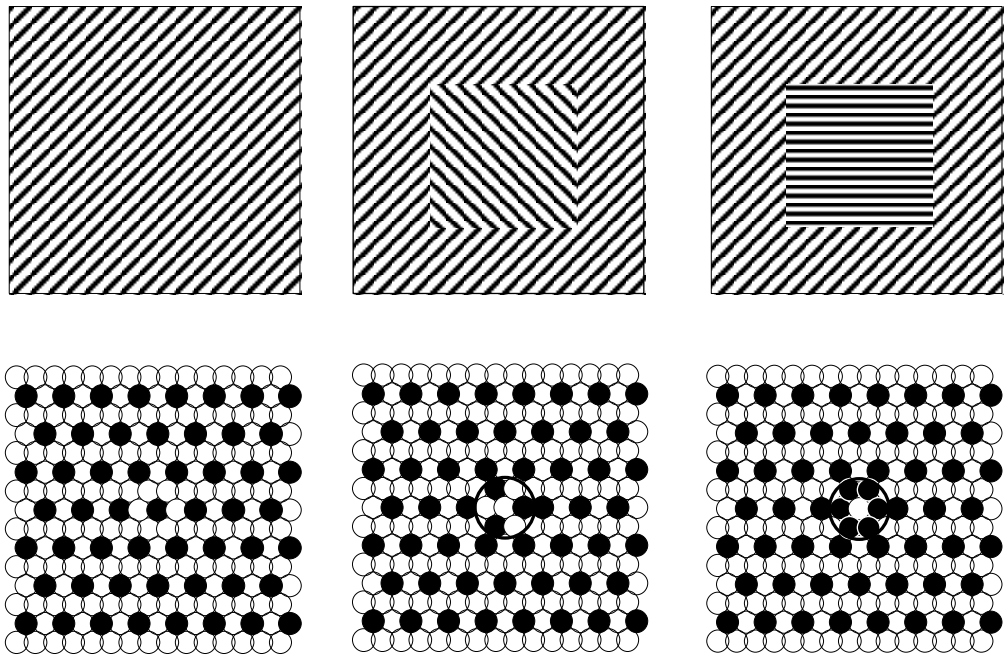


Figure 38 Depicted in the boxes at the top are fields, i.e., areas that differ from the surrounding area in terms of their content pattern. Depicted in the boxes at the bottom are distortions, which are also areas that differ from the surrounding area in terms of their content pattern. The boxes on the left show the state of uniformity, the boxes in the middle show an intermediate variation of the uniform pattern, and the boxes on the right show a maximal variation of the uniform pattern.

We have described energy as a field because we have recognized that energy represents some variation of content pattern within the spatial structure. Propagating distortions are equivalent to energy. Energy isn't something other than space; rather, energy is a propagating pattern of spatial content that differs from the baseline or uniform pattern of spatial content.

Energy doesn't exist "in" space, as if it were somehow separately existent from space. Energy *is* space, but it's space that's deviated or distorted, dualized or polarized, from its original state.[7] Energy is a spatial "field," an area of space that's distinguishable from other areas of space because of a difference in its content pattern. Just as a water wave is still water, it's also an area of water that's distinguishable from other areas of water because of a different pattern of existence in that area.

Energy thus represents a moving spatial field, or a propagating distortion of spatial content. A distortion is energetic both because it exists in contrast to its opposite and because it propagates. This characteristic property of energy derives both from the relative distortion of spatial content and from the fact that the distortion content is moving from place to place.

[7] The pattern of space-time content becomes deviated from its original or uniform state because space-time is itself being penetrated by the existence that it, as universe, is expanding into or penetrating (see part I, chapter 2, section 2).

For many years, physicists have sought a unified-field theory, a way to explain all energies as variations or extensions of a single underlying field or structure. The relational-matrix model represents a nonmathematical unified-field theory. In this model, the uniform pattern of spatial content of the dynamic structure of space is itself the underlying unified field from which different types of energy extend as variations of that content pattern. Specifically, variations of the uniform pattern of spatial content exist as propagating patterns of distortion content, or moving spatial fields, that form the basis of what we observe as energy. In this model, different patterns of distortion propagation represent different types of energy.

So far, we have related one type of energy, electromagnetic radiation, to one type of propagating distortion, the linear component of the linear-radial distortion complex. In the next section, we will relate the gravitational field or force to the radial component of the linear-radial distortion complex. We will then be in a position to describe the nature of matter and its relationship to, and inseparability from, the dynamic structure of space. Once we have described the relationship between the structure of matter and the structure of space, we will go on to describe the nature of time and its relationship to the dynamic aspect of the spatial structure.

Section 5 The Complementarity of Electromagnetic Radiation and Gravitation

In this section, we will define gravitation within the context of the relational-matrix model. Essentially, we will demonstrate that electromagnetic radiation and gravitation represent the complementary patterns of distortion propagation intrinsic to the linear-radial distortion complex. The linear component of the linear-radial distortion complex has already been accounted for through our description of electromagnetic radiation as representing a linearly propagating maximal distortion. In this section, we will relate gravitation to the radial component of the linear-radial distortion complex. However, we will first develop a chain of logic to provide a basis for this proposed association between electromagnetic radiation and gravitation.

5.1 *Matter as associations of electromagnetic radiation*

According to Einstein's relativity theory, matter is made up of the accumulation, association, or interaction of the stuff we call energy. We can relate matter to electromagnetic radiation through the concept of energy. If matter is equivalent to energy, through the equation $E = mc^2$, and electromagnetic radiation is a type of energy, through $E = h\nu$, then the energy of matter may be the same as the energy of electromagnetic radiation.

As an example, consider the Sun or any other star. Stars are thought to form as accumulations of hydrogen, the simplest atom. Once the density of hydrogen is sufficient, the hydrogen atoms begin to undergo nuclear fusion, combining to form atoms of heavier elements, with substantial amounts of energy (in the form of electromagnetic radiation) being released as the byproduct of these atomic recombinations.

Thus, as the matter of which the Sun is composed undergoes fusion, what is released is electromagnetic radiation, part of which we see as the radiant light of the Sun. Therefore, it's

probable that the hydrogen-matter of which a star is composed is itself composed of accumulations of electromagnetic radiation and that the process of nuclear fusion involves the release of some of that electromagnetic radiation from its previously stable interaction as hydrogen atoms.

For example, let's say we have two small wooden chairs, and we want to make a single larger chair. In combining the two chairs we end up with a couple of left over pieces of wood that aren't needed to compose the structure of the new, larger chair. So we toss them aside. This is what the stars are doing in nuclear fusion. When hydrogen atoms combine to form a heavier atom, some of the constituent pieces that make up the hydrogen atoms aren't needed to compose the structure of the single heavier atom, and so they're tossed aside or released. What's released from stars through nuclear fusion is electromagnetic radiation, part of which we perceive as visible light. Therefore, it's not unreasonable to postulate that hydrogen atoms are composed, at least in part, of constituent pieces in the form of electromagnetic radiation.
Therefore, the chain of logic linking electromagnetic radiation to gravitation begins by postulating that matter is, at least in part, focal accumulations of interacting or structurally associated electromagnetic wavicles. Putting it another way, when two or more electromagnetic wavicles form a stable association, that association exists as matter. Just how electromagnetic wavicles interact to form such stable associations will be explained in an upcoming section.

5.2 *The EMR-gravitation complex*

It's commonly thought that the existence of matter somehow creates or causes the existence of a gravitational field around itself. That is, matter is seen as a primary cause, and gravitation is seen as a secondary effect that the presence of matter has upon the structure of space-time. That we see matter as primary and gravitation as secondary is no doubt influenced by our perspective, inasmuch as we tend to see ourselves as material beings and so tend to see matter as primary or central.

However, since gravitation and matter are always found in association, it's probable that whatever exists as gravitation is as vital to the existence of matter as matter is to the existence of gravitation. That is, it's probable that without gravitation there'd be no matter. One doesn't exist without the other in our experience. Thus, when we speak of either matter or gravitation, we're really speaking of a matter-gravitation complex.

If matter is composed of stable associations of electromagnetic radiation, as we have postulated, then the matter-gravitation complex can be considered to be more fundamentally an *EMR-gravitation complex*. That is, electromagnetic radiation and gravitation aren't two separate fields or forces; rather, they're in some way complementary and, thus, mutually coexistent energy fields.

The next step will be to define the existence of the EMR-gravitation complex within the context of the relational-matrix model in terms of the linear-radial distortion complex, thereby demonstrating the source of the complementarity of electromagnetic radiation and gravitation.

We will then be in a position to relate the existence and properties of matter to the relational-matrix model.

5.3 *Relating the EMR-gravitation complex to the relational-matrix model*

Within the context of the relational-matrix model, the EMR-gravitation complex is analogous to the linear-radial distortion complex. More specifically, gravitation is represented in the relational-matrix model by the radial component of the linear-radial distortion complex. That is, gravitation is a radially propagating submaximal distortion that coexists with a linearly propagating maximal distortion, which we have previously related to electromagnetic radiation, as depicted in **figure 39**.

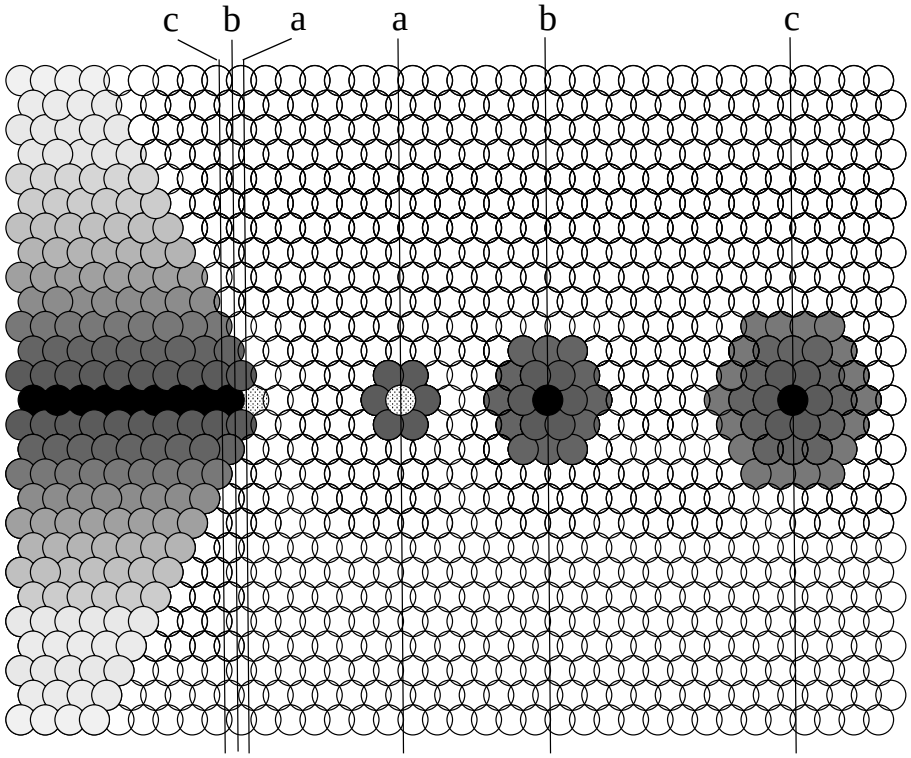


Figure 39 A lateral view (left) and cross sections (a, b, and c on right) of a linear-radial distortion complex, or an EMR-gravitation complex. The linear component is analogous to electromagnetic radiation, and the radial component is analogous to gravitation. The linearly propagating electromagnetic component (black areas) outwardly radiates a gravitational distortion (gray areas), while the radially propagating gravitational component also inwardly radiates an electromagnetic distortion, which electromagnetic distortion then outwardly radiates a gravitation distortion and so on. Which came first, the chicken or the egg, the linear component or the radial component? Neither, for they're complementary or opposite aspects of what's actually a single process.

The radially propagating gravitational component has some qualities that are the same as, and some qualities that are different from, the linearly propagating electromagnetic component.

Because the radial component is a propagating distortion, it propagates at the same rate as do all distortions, i.e., at the rate-of-penetration constant, which we have shown to represent the speed-of-light constant. Therefore, the rate of propagation of the radial component (i.e., the gravitational distortion) is the same as the rate of propagation of the linear component (i.e., the electromagnetic distortion) with both occurring at the speed of light. This result is consistent with Einstein's theory of gravitation, wherein accelerated masses produce signals (gravitational waves) that travel at the speed of light.[8]

Because the gravitational distortion propagates radially from its point or axis of origin, the distortion content or distortion ratio decreases the farther the gravitational distortion propagates from its point or axis of origin.[9] In this way, the radially propagating gravitational component differs from the linearly propagating electromagnetic component, inasmuch as the linear component (i.e., electromagnetic radiation) maintains a constant level of maximal distortion as it propagates.

Since the distortion content, quantified as a distortion ratio, is related to the energy level of the distortion field in question, saying that the distortion content of the radial component decreases as it propagates away from the point or axis of origin is the same as saying that the gravitational field or force diminishes the farther it propagates from its point or axis of origin.

Thus, within the context of the relational-matrix model, the basis for the diminishment of gravitational field or force that occurs with increasing distance from matter or mass can be understood as a manifestation of the decrease in distortion content that occurs as the result of radial distortion propagation. That is, gravitational force diminishes with distance from matter because it's a radially propagating distortion, whose distortion content decreases, becomes diluted or lessened, becoming more like the uniform content pattern, the farther the distortion gets from its point or axis of origin. This diminishment of gravitational field or force occurs unless the gravitational distortion combines with another gravitational field, in which case the gravitational distortion increases in the area of overlap.[10]

Next, we will examine how EMR-gravitation complexes interact to form matter. We will show the EMR-gravitation complex to be the primary unit composing matter. For that reason, and to facilitate the discussion of how EMR-gravitation complexes interact to form matter, we will now define a single EMR-gravitation complex as a *primary distortion process.*

[8] Owing to the relative weakness of the gravitational force in relation to the electromagnetic force, such waves have yet to be indisputably detected.
[9] See part I, chapter 1, subsection 7.21.
[10] See part I, chapter 1, subsection 7.22, figure 27.

Section 6 Primary-Distortion-Process Interaction (The Dynamic Structure of Matter)

In the discussion that follows, we will describe how matter is composed of interacting of primary distortion processes (i.e., EMR-gravitation complexes). First, we will explore the reason why primary distortion processes are able to form stable interactions. Second, we will describe the structure of the *compound distortion processes* (i.e., matter) formed by those stable interactions. Once the structure of matter and its relationship to the structure of space-time have been described, we will then be in a position to examine and understand the basis of some fundamental properties of matter, such as momentum, inertia, and the relativity of time and mass.

6.1 *The pattern of primary-distortion-process interaction that forms matter*

In order for primary distortion processes to interact so as to form matter, they must form stable associations. The basic pattern those stable associations take is that of a twist or spiral. That is, the interaction occurs as the linearly propagating electromagnetic components repetitively circle or orbit around one another, resulting in a twisting or spiraling pattern of interaction, similar to twisting two strands of rope together. Thus, in the interaction of primary distortion processes, a change occurs from linear propagation to relatively nonlinear (i.e., circular or twisting) propagation of the electromagnetic component.

Since these patterns of interaction are composed of individual propagating distortions, any interaction between primary distortion processes must occur along paths of distortion propagation that are allowed by the structure of the relational matrix, i.e., by the spatial structure. In this way, the structure of space-time limits, constrains, and determines the structure of matter. This twisting pattern of primary-distortion-process interaction is allowed by the cubic-closepacking structure of space-time, and is depicted in **figure 40**.

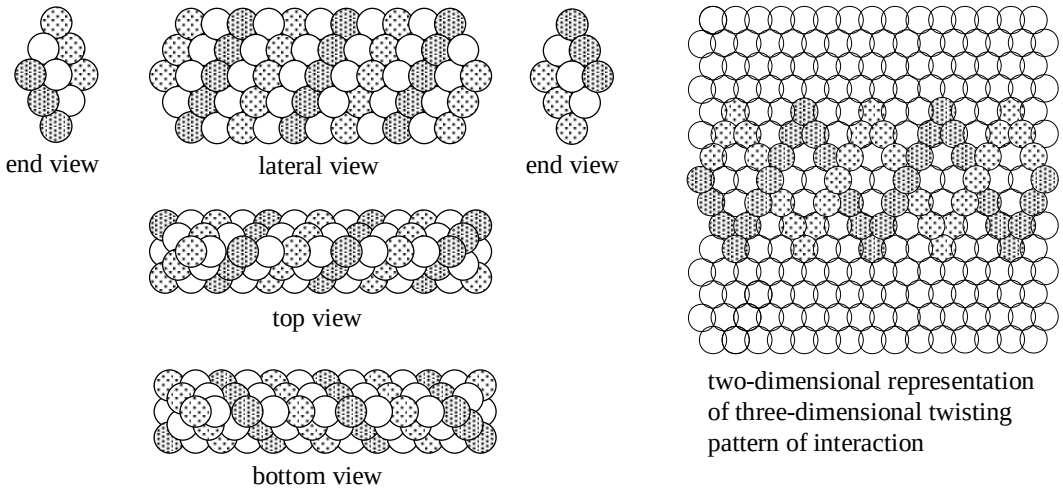


Figure 40 (Left) Different views of a three-dimensional representation of the twisting pattern of interaction of the electromagnetic components of two primary distortion processes. (Right) How that twisting pattern of interaction will be represented in two dimensions. It's this twisting pattern of primary-distortion-process interaction that

> forms what we observe as matter. In the diagrams on the left, the relatively nonlinear propagation of two different electromagnetic components is depicted with two different shades of stippling. (The gravitational component is not pictured.) The white areas are the areas of "space" between the electromagnetic components, which would be occupied by the gravitational distortion associated with each of those electromagnetic components. In the diagram on the right, the relatively nonlinear propagation of two different electromagnetic components is depicted.

This pattern of primary-distortion-process interaction represents the basic structure of matter and also represents the third level of existential self-relation, or the third way in which existence can form a relationship with itself, as depicted in figure 2. This new level of existential self-relation both requires, and is limited by, the dynamic structure of the two prior levels of existential self-relation, i.e., the dynamic structure of space-time and the dynamic structure of energy.

Once we see how matter exists as an extension of the spatial structure, we can begin to establish a basis for understanding and explaining how the behavior and characteristics of matter are linked to this structure. For, as we shall see, it's this unbreakable linkage, this inseparability of the dynamic structure of matter from the dynamic structure of space-time, that's the source of temporal as well as mass relativity.[11] But before we get to that description, we need to know more about primary-distortion-process interaction.

6.2 *The gravitational distortion as the basis of primary-distortion-process interaction*

Question: What causes the change in the direction of propagation of the electromagnetic component of a primary distortion process, causing it to propagate relatively nonlinearly in a twisting pattern around the electromagnetic component of another primary distortion process? *Answer*: The radially distributed gravitational distortion associated with the other primary distortion process—i.e., the gravitational distortion associated with the other primary distortion process that it's orbiting, twisting about, or interacting with. We will now explain this answer in detail.

We know that gravitation "bends" light, i.e., changes its direction of propagation: Light "bends" or propagates toward matter or mass, i.e., in the direction of an increasing gravitational field, or in the direction of increasing gravitational distortion. We also know that matter, which is basically composed of electromagnetic radiation, is also drawn or attracted in the direction of an increasing gravitational field.

Thus, within the context of the relational-matrix model, the attractive nature of the gravitational field or force can be understood as the result of the fact that electromagnetic radiation always propagates in the direction of increasing gravitational distortion. In other words, as described in chapter 1, the linear component of the linear-radial distortion complex always has its direction of propagation altered toward the direction in which the radial component is increasing.[12]

[11] Both the observed rate of passage of time for an object and the mass of that object vary with material velocity, and so both are said to be relative, because both exist in relation to material velocity.
[12] See part I, chapter 1, subsection 7.23, figure 29.

The gravitational distortion isn't an attractive force in and of itself. Rather, because the gravitational distortion always propagates in the form of a radially distributed distortion gradient, it functions as an attractive force. In other words, the gravitational-distortion gradient that always exists around electromagnetic radiation and matter (matter being composed of interacting EMR-gravitation complexes) is what makes gravitation function as an attractive field or force. *What we observe as gravitational attraction is simply the consistent alteration of the direction of propagation of electromagnetic radiation in the direction of increasing gravitational distortion.* Were there no gravitational-distortion gradient—i.e., if the gravitational distortion was uniformly, rather than radially distributed—the gravitational distortion would be unable to alter the direction of propagation of the electromagnetic component, and so there'd be no apparent gravitational attraction.

Thus, it's not the gravitational distortion itself that's attractive; rather, it's how the gravitational distortion is always radially distributed around electromagnetic radiation and matter that makes the gravitational distortion function as attractive. In other words, gravitation doesn't attract electromagnetic radiation or matter by pulling on it from a distance; rather, it attracts electromagnetic radiation and, thus, matter by simply altering the direction of propagation of electromagnetic radiation in a consistent manner. Since the spatial distribution of the gravitational distortion is consistent (i.e., radially propagating from its point or axis of origin), and since the alteration of the direction of propagation of electromagnetic radiation is also consistent (i.e., always occurring in the direction of increasing gravitational distortion), what we observe as the always-attractive nature of gravitation is nothing more than the consistent result of this consistent interaction between the complementary electromagnetic and gravitational components of different primary distortion processes.

Therefore, when two primary distortion complexes come into proximity, the direction of propagation of each's linear electromagnetic component may be mutually and simultaneously altered by the other's radial gravitational component, as depicted in **figure 41** (which is identical to figure 29). As we will explain more fully in the next subsection, this scenario forms the basis of stable repetitive interactions between primary distortion processes. Furthermore, the radially distributed gravitational distortion forms the basis of, and is the force underlying, the stable repetitive interactions between distortion processes that compose the dynamic structures we observe as matter.

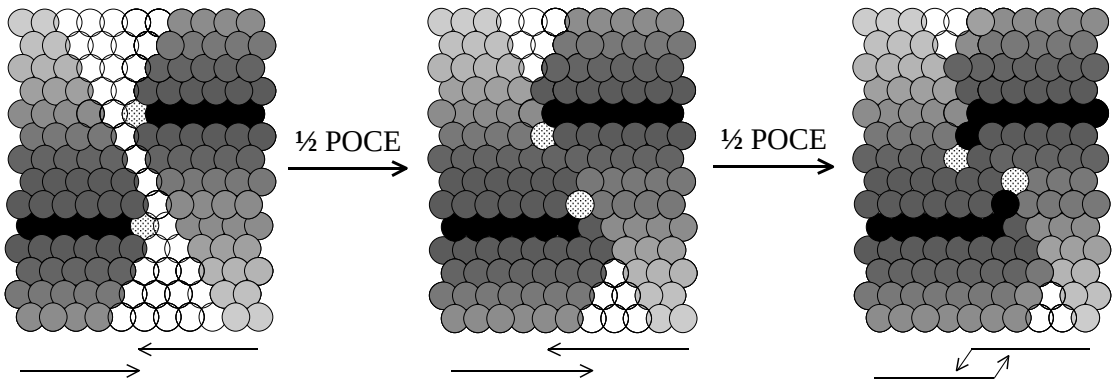


Figure 41 The gravitational basis of primary-distortion-process interaction, depicted here as the mutual alteration of the direction of propagation of each primary distortion process' linear electromagnetic component by the other's radial gravitational component. Depicted here are two primary distortion processes, each composed of a linear electromagnetic distortion (black areas) and a coexistent radial gravitational distortion (gray areas). The electromagnetic distortion propagates linearly through the relational structure of space-time, leaving a radially propagating gravitational "wake" in its path. When two primary distortion processes come into proximity, each's direction of propagation can be affected by the other's gravitational "wake," such that the direction of propagation of each's linear electromagnetic component is altered toward the direction of propagation of the other's.

The direction of propagation of each's linear electromagnetic component is always altered in the direction of the other's because the linear component of the primary distortion process—i.e., the maximal distortion—always propagates into the next adjacent reality cell that first reaches the level of maximal distortion. As long as the gravitational distortion around the linear component is balanced (as in the drawing on the left), the maximal distortion propagates into the next adjacent reality cell in linear progression, resulting in the linear propagation of the electromagnetic component. However, when the surrounding gravitational distortion is unbalanced, such as when the gravitational "wake" from another primary distortion process is encountered (as in the two drawings to the right), the next adjacent reality cell that first reaches the level of maximal distortion isn't the one that's in linear progression, but rather is the one in the direction from which the encountered gravitational "wake" is coming—i.e., in the direction of increasing gravitational distortion. This is why gravitation seems "attractive"—because electromagnetic radiation always has its direction of propagation altered in the direction of an increasing gravitational-distortion gradient, and that gradient always increases in the direction from which it originates as part of a primary distortion process.

This mutual and simultaneous alteration of the direction of propagation of each's electromagnetic component by the other's gravitational component forms the basis of the stable repetitive interactions between the primary distortion processes that compose the dynamic structures we experience as matter. Therefore, the gravitational distortion is the force that's primarily responsible for bringing and holding electromagnetic energy together in the form of matter.

In summary, electromagnetic radiation and matter are affected by a gravitational distortion (i.e., by having their direction of propagation altered) for the same reason that primary distortion processes stably and repetitively interact so as to form matter in the first place. Because the structure of space-time is uniform and consistent at all levels of scale, forces can act in the same way at all levels of scale. Thus, the force that holds a planet in orbit around a star (i.e., gravitation) is the same as the force that holds electromagnetic wavicles in mutual orbits around each other to form matter.

Buckminster Fuller's recognition that "all the conditions of energy be everywhere the same" led him to search for a spatial structure that was consistent throughout and at all levels of scale, and

what ultimately led him to develop the isotropic-vector matrix as the representation of such a structure.[13] Again, the isotropic-vector matrix is the vector representation of the relationships that exist between spheres in a cubic-closepacking array, as well as a representation of the relationships between the reality cells that make up any relational level of reality within the relational matrix.

We will now discuss how primary distortion processes can engage in stable repetitive interactions. We will then examine the properties of the compound distortion processes that exist as the result of those repetitive interactions.

6.3 *Repetitive primary-distortion-process interactions (interactive-process stability and pattern integrity)*

As explained in the previous subsection, when two primary distortion processes come into proximity, the radial gravitational distortion associated with each can alter the direction of propagation of the other's electromagnetic component. We can then imagine at least two scenarios that might occur when two primary distortion processes come into proximity, or approach intersection, as depicted in **figure 42**.

In the first scenario, the two primary distortion processes might interact in a way that alters each's direction of propagation, but not repetitively. In this scenario, as the two primary distortion processes approach one another, each's direction of propagation is altered. After this interaction, each primary distortion process propagates away from the other with a new linear direction of propagation that's a result of their interaction.

In the second scenario, the two primary distortion processes again might interact in a way that alters each's direction of propagation, but repetitively. In this scenario, each primary distortion process has its linear direction of propagation repetitively altered by the other's radial gravitational distortion. After their initial interaction, however, the two primary distortion processes don't propagate away from one another; rather, each becomes caught up in the other's gravitational "wake," a situation we will call *interactive-process stability*, thereby creating a twisting pattern of interaction.[14]

[13] Amy C. Edmondson, *A Fuller Explanation: The Synergetic Geometry of R. Buckminster Fuller*.

[14] Note that, since each primary distortion process is traveling at the speed of light, in order for them to get caught in each other's gravitational wake, there would need to exist a third such process to initially facilitate or mediate the interaction. For two primary distortion processes to get caught in each other's gravitational "wake," they would need to be "slowed down" (i.e., made to propagate nonlinearly) so that the gravitational distortion could pass on ahead, allowing each primary distortion process to alter the direction of propagation of the other. The facilitator process, once it has performed this initial ceremony, would continue on its way, leaving the two distortion processes twisting, dancing, or orbiting around each other in the marriage we call matter. For simplicity, we will ignore the necessity of this third facilitator process, since we're concerned primarily with what happens once the distortion processes are interacting stably and repetitively as matter.

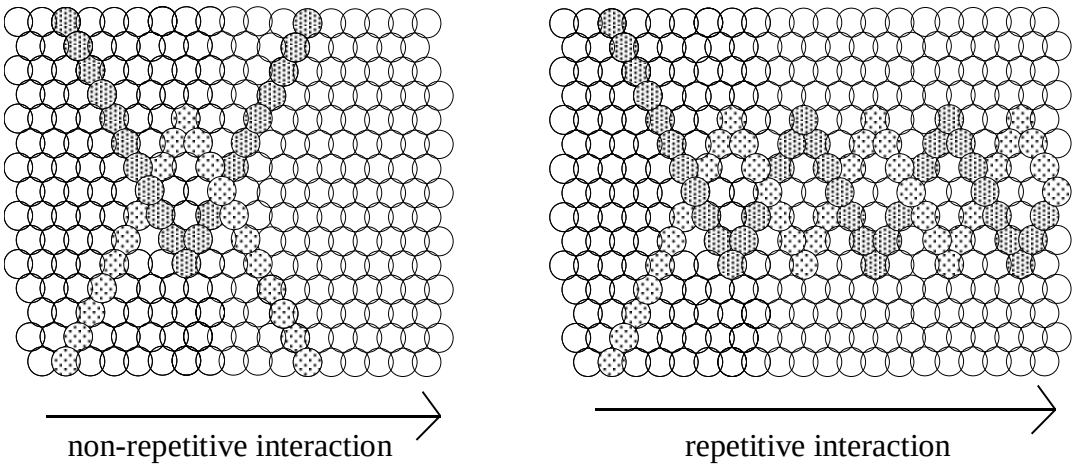


Figure 42 Two possible types of interactions that can occur when two primary distortion processes come into proximity. Only the electromagnetic or maximal-distortion component of the primary distortion processes are shown here (two different shades of stippling). (Left) The gravitational distortion (not shown) associated with each primary distortion processes alters the direction of propagation of the other's electromagnetic component, but not repetitively. (Right) The gravitational distortion associated with each primary distortion process alters the direction of propagation of the other's electromagnetic component repetitively, creating a twisting pattern of primary-distortion-process interaction. This stable repetitive interaction that can occur between two or more primary distortion processes, which we will call a compound distortion process, represents the basic form of the dynamic structure of matter.[15]

"Interactive-process stability" is defined as the interaction of two or more primary distortion processes in such a way that a stable repetitive pattern of interaction is formed. In interactive-process stability, the gravitational distortion associated with each primary distortion process alters the other's direction of propagation in a way that maintains their stable repetitive interaction. In interactive-process stability, the pattern of distortion propagation of each primary distortion process simultaneously alters the other's pattern of distortion propagation, creating a stable repetitive pattern of interaction between them.

Such stable repetitive interactions between two or more primary distortion processes represent what we will call a *compound distortion process*, or simply a *compound process*. A compound process composed of just two interacting primary distortion processes we will call a *compound process of the first order*. Compound processes of the first order represent the most basic form of matter. That is, since matter is composed of the stable association of energy processes, two energy processes are the minimum required for forming such an association.

[15] Note that all of the diagrams which we will use to depict compound processes represent a kind of "timelapse" drawing, in that they show multiple positions along the path of propagation of each primary distortion process, showing both where it is and where it has been, to make the patterns of distortion propagation clear. The same is true for most of the diagrams in this book that are used to depict propagating distortions.

This type of primary-distortion-process interaction creates a very powerful feedback mechanism, whereby the gravitational environment created by the pattern of distortion propagation of one primary distortion process, by affecting the direction of propagation of another primary distortion process, itself helps to create the gravitational environment that alters its own pattern of distortion propagation. In this way, the two primary distortion processes continue to propagate, twisting around or orbiting one another in a stable repetitive interaction, each locked or knotted into that pattern of distortion propagation by the other and by itself. In interactive-process stability, each primary distortion process acts simultaneously and interchangeably as both cause and effect, in a self-perpetuating, self-sustaining pattern of distortion propagation.

Such a stable repetitive interaction will continue indefinitely until something disturbs it—i.e., until another distortion process comes along that's able to alter the gravitational environment that's sustaining the interaction.

Buckminster Fuller understood matter to represent stable patterns of interaction between energy processes, and so he referred to matter as a *pattern integrity*. Fuller used this term to stress the dynamic structure of matter; that matter isn't something static but, rather, is a dynamic pattern of interaction, a set of stable relationships, between always-moving energy processes. Compound distortion processes are a special type of pattern integrity.

Again, structure is relationship, and the structure of matter is composed of stable relationships between energy processes. How can consistent or stable relationships be formed between processes that are always moving? Through each process locking or knotting the other process(es) into a pattern of movement that's also integral to its own pattern of movement, thus creating a pattern integrity, an integrated (whole) pattern of movement, wherein the pattern of movement of each component process is integral to the pattern of movement of the other(s) and so, through feedback, to its own pattern of movement as well.

Pattern integrities in general and compound processes in particular are both the result of interactive-process stability. To illustrate the relationship between the dynamic structure and the underlying process, we will use Fuller's method of illustrating the concept of pattern integrity. To illustrate a pattern integrity, Fuller would use the example of a simple overhand knot in a rope.[16] The knot appears to be an object, but it's actually nothing more than a pattern the rope has in a certain area, owing to a relationship it has formed with itself. However, this pattern isn't just any pattern, but is self-sustaining. Not all patterns are pattern integrities, only those that are self-sustaining—i.e., only those formed as a result of interactive-process stability, as depicted in **figure 43.**

[16] Amy C. Edmondson, *A Fuller Explanation: The Synergetic Geometry of R. Buckminster Fuller.*

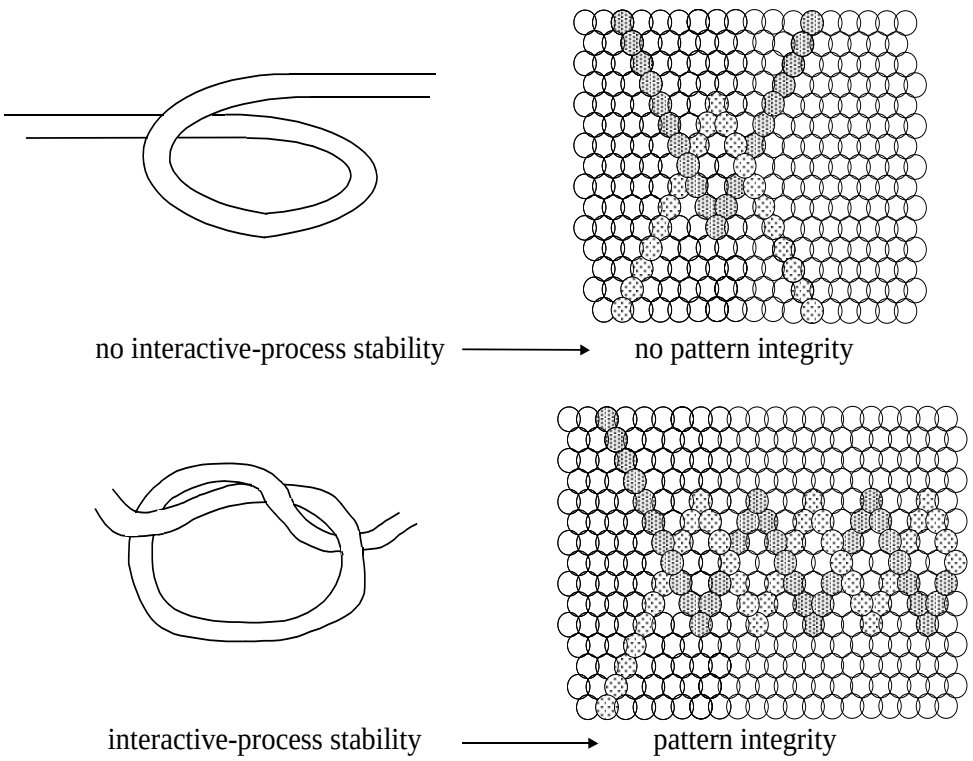


Figure 43 The relationship between interactive-process stability and pattern integrity, showing how the pattern integrity we call a knot is maintained by interactive-process stability. The two diagrams at the top show patterns that aren't pattern integrities, because they don't have interactive-process stability. The two diagrams at the bottom show patterns that are pattern integrities, because they have interactive-process stability. In the diagram at the bottom left, the rope is knotted as an example of a pattern integrity. In the diagram at the bottom right, two primary distortion processes are caught up in each other's gravitational "wake," forming the pattern integrity that's referred to as a compound distortion process. If we pull on the ends of the rope in the diagram at the top left, the pattern disappears, because this isn't a pattern that has interactive-process stability. If we pull on the ends of the rope in the diagram at the bottom left, the knot (i.e., the pattern) remains, because this is a pattern that has interactive-process stability, inasmuch as *each part of the knot is binding the other parts of the knot into a position that's simultaneously binding upon itself*. In the diagram at the bottom right, although they aren't depicted, the gravitational distortions are what's responsible for interactive-process stability, because they act to "knot" the electromagnetic components together, *with each distortion process binding the others into a pattern of distortion propagation that's simultaneously binding upon itself*, thereby creating the pattern integrity, the self-sustaining, self-perpetuating pattern of distortion propagation, defined as a compound distortion process. Thus, both the knot and the compound process (i.e., matter) are examples of pattern integrities formed through interactive-process stability.

Understanding the structure of matter in this way, we can see that matter is composed of compounded or associated energy in the form of interacting EMR-gravitation complexes. Thus,

the relational-matrix model provides a context for understanding the basis of the equivalence of matter and energy, as stated in Einstein's famous equation $E = mc^2$.

Because matter represents a stable relationship between energy processes, matter has unique properties which exist as a function of that relationship and which vary as that relationship varies. Two of those material properties are time and mass. We will examine how time and mass come to exist as a result of the stable relationship between energy processes that exists as matter, and how time and mass vary as this relationship varies.

By relating energy to the structure of space, and matter to the structure of energy, we have now provided the basis for relating matter to the structure of space. Because matter is compounded energy, and because the properties of energy exist as extensions of the dynamic structure of space, we will be able to demonstrate the connection between matter and space, showing how the *variable* structural and dynamic properties of matter extend from, and exist in relation to, the *invariant* structural and dynamic aspects of space. In making this connection, it will become apparent why both time and mass exist relative to, or as a function of, material velocity as a percentage of the speed-of-light constant. However, before we can examine this connection in detail, we first need to discuss certain aspects of the pattern integrities that are compound distortion processes.

Section 7 The Anatomy of Compound Processes

Because compound processes of the first order represent the simplest or most basic form of matter, we will examine compound processes in general primarily in terms of compound processes of the first order, with the understanding that, owing to the uniform and consistent structure of space-time, such an analysis is also applicable to higher-order compound processes, i.e., those made up of more than two primary distortion processes.

7.1 *Compound-process periods*

The basic pattern of association of two primary distortion processes, as they stably and repetitively interact to form what we have defined as a compound process of the first order, is that of a twist or spiral, as depicted in figures 40, 42, and 43.

Before such interaction, the electromagnetic component of each primary distortion process propagates linearly through the relational matrix—i.e., space-time—at the speed of light. However, once two primary distortion processes stably and repetitively interact to form a compound distortion process, the propagation of each primary distortion process becomes relatively nonlinear.

Although the individual electromagnetic components of the primary distortion process that make up a compound process still propagate through space-time at the speed of light, because their propagation is relatively nonlinear, the compound process as a whole then propagates linearly through space-time at *less* than the speed of light. The precise velocity of a compound process

depends on the *degree of linearity of propagation* of the electromagnetic components of the primary distortion processes that make up the compound process.

This situation is analogous to three cars going the same speed, one on a straight road, one on a curvy or snaky road, and another on an even curvier or snakier road. To a distant observer, the car on the straight road will seem to be going faster than the other two cars, since the speed of the cars is determined by their linear progress, which is less for the car traveling the snaky road, and even less for the car traveling the even snakier road.

The basic pattern of association by which two primary distortion processes interact to form a compound process of the first order is both repetitive and symmetrical. Each component process must propagate through space-time with the same degree of nonlinearity, or else they couldn't interact, because one primary distortion process would bypass the other, since they both continue to propagate through space-time at the speed of light, albeit nonlinearly.

That this basic pattern of association is both repetitive and symmetrical allows us to define the existence of a compound process in terms of a cycle or period, as we also did with regard to the reality-cell period of content exchange (POCE). As the electromagnetic components of the primary distortion processes twist around or orbit one another, when they return to an identical point in their relationship, this cycle is defined as one *compound-process period* (CPP), as depicted in **figure 44**.

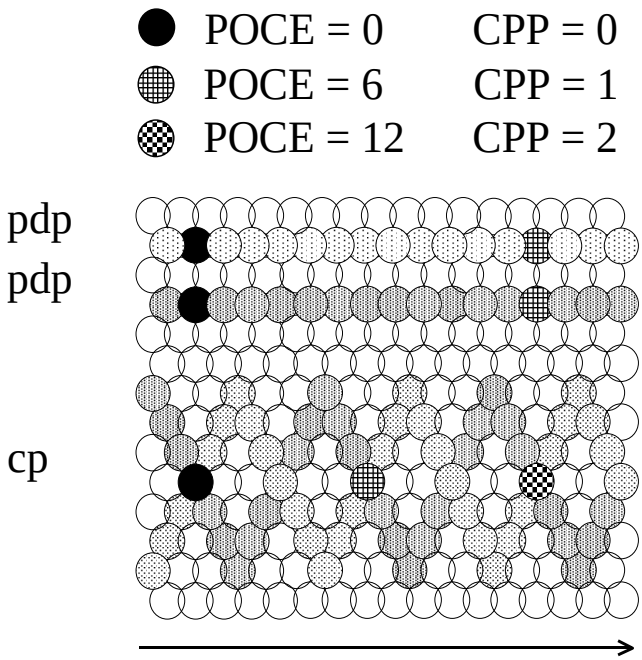


Figure 44 The concept of a compound-process period (CPP), as well as the relationship of the CPP to the reality-cell period of content exchange (POCE). In the lower part of this diagram, a compound process (cp) of the first order composed of two interacting primary distortion processes is depicted. In the upper part of this diagram, the

electromagnetic components of two noninteracting primary distortion processes (pdp) are depicted.

The basic pattern of association by which two primary distortion processes stably and repetitively interact to form a compound process of the first order, has been described as the electromagnetic components twisting around or orbiting each other, owing to the influence of their associated gravitational components. This pattern of interaction is both repetitive and symmetrical and so is periodic in nature. A single CPP period is defined as one full cycle of interaction between the component processes that make up the compound process. In the compound process in this figure, the blue circle is referenced as the starting point, and the green and red circles represent one and two CPPs, respectively.

As defined in chapter 1, a distortion propagates linearly two reality cells in each POCE. A compound process requires multiple POCEs for linear propagation. Because the primary distortion-process interactions that form a CPP are driven by the reality-cell POCE, there's always more than one reality-cell POCE for each CPP.

Comparing the linearly propagating distortions in the upper part of the diagram with the compound process in the lower part, the cross-hatched circle marks six POCEs for each primary distortion process, which together make up a single CPP for the compound process as a whole. In other words, for this particular compound process, it takes six POCEs to complete one CPP. This comparison shows the difference in the degree of linearity of propagation within the same number of POCEs between noninteracting primary distortion processes and primary distortion processes interacting to form a compound process.[17]

The relationship of the CPP to the POCE is what we will later show to be the link between time and the speed-of-light constant.

7.2 *Compound processes of the second order and beyond*

When two compound processes of the first order interact in such a way that they achieve interactive-process stability, there then exists a *compound process of the second order*. The primary distortion processes that make up a compound process of the second order interact for the same reason, and have the same basic pattern of association, as the primary distortion processes that make up a compound process of the first order. That is, compound processes of the second order are formed as two compound processes of the first order get caught up in each other's gravitational "wake," resulting in another level of pattern integrity that has the same twisting pattern of association as do the component processes. However, in a compound process of the second order, that twisting pattern of association now takes place at a larger interactive scale, as depicted in **figure 45**.

[17] Note here the use of the phrase "in the same number of POCEs" rather than "in the same amount of time," for, as we will show, time is a function and manifestation of the periodic nature and activity of compound processes that has as its basis the dynamic spatial structure. Thus, dynamic comparisons between primary distortion processes and compound processes must be made in terms of the POCE rather than in terms of time, since the concept of time can't be applied to a primary distortion process.

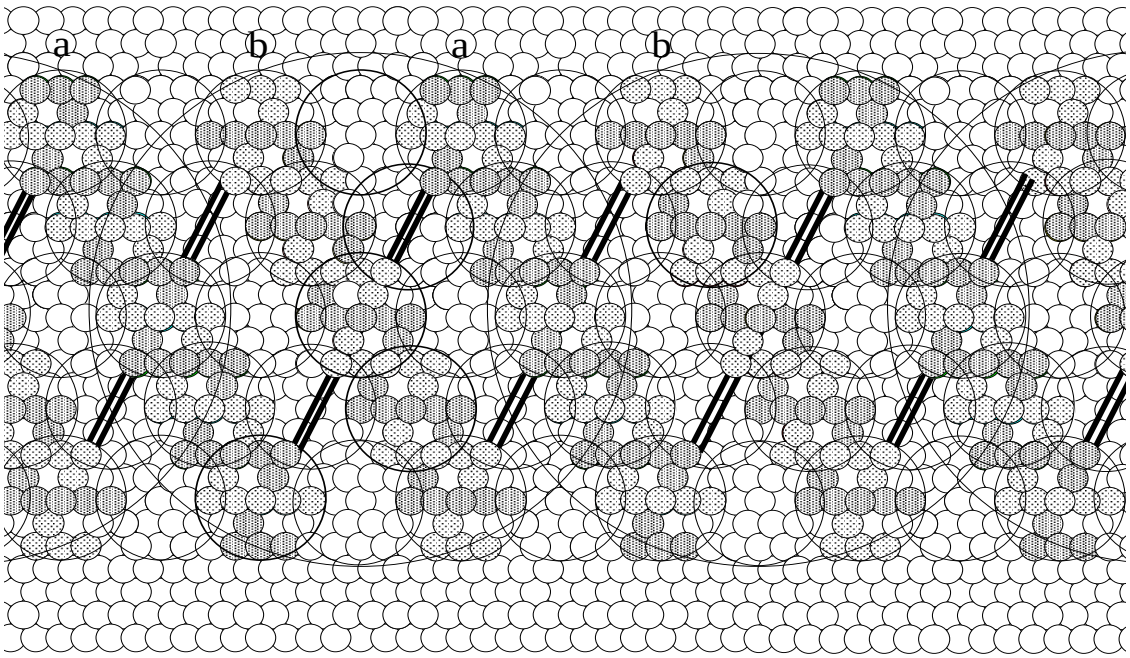


Figure 45 Two compound processes of the first order (a and b) interacting to form a compound process of the second order. Just as the stable repetitive interaction between two primary distortion processes occurs in a twisting pattern, so too does the stable repetitive interaction between two compound distortion processes. (To make the diagram less cluttered, while still showing the twisting pattern of interaction, the upstroke of each compound process of the first order is depicted as two straight lines.)

A compound process of the third order could be formed by two compound process of the second order stably and repetitively interacting, again in a twisting pattern. As interacting distortion processes become more compounded, the twisting pattern of association remains essentially the same, with only the scale of the interaction changing. The uniformity and consistency of the spatial structure at all scales, or at all relational levels of reality, is what allows for the repetition of this basic pattern of association.

Each scale of distortion-process interaction or compoundment provides the raw material for the next. Thus, once such a basic pattern of association exists, one distortion process can then interact with another distortion process to form a higher-order compound process, which can then interact with another distortion process to form an even higher-order compound process, and so on. In this way, existence continues to evolve into more elaborate structures through a process of repetitive and progressive self-relation, with each level of structure and relationship providing the raw material for the next.

Note that, although the basic pattern of association of distortion processes—i.e., twisting around or orbiting each other—remains the same at all interactive scales, the interaction can become and appear progressively more convoluted, the more compounded those distortion processes become. This situation is somewhat analogous to what happens when a string is twisted repetitively upon

itself until it eventually begins to bunch up upon itself in various ways. Likewise, as distortion processes become more compounded, with their patterns of interaction becoming increasingly twisted, it's possible, likely, and probably inevitable that the gravitational field generated by the compound process as a whole will act to attract itself, causing the compound process to bunch up or acquire a structural configuration with an appearance of more than just a simple twist.

In this way, EMR-gravitation complexes interact to form subatomic or quantum particles, subatomic particles interact to form atoms, atoms interact to form molecules, and molecules interact to form organisms.[18] Although at larger scales the particular patterns of association may vary, the interactions themselves always have as their basis interactive-process stability, i.e., the existence of mutually supportive and mutually binding environments between interacting distortion processes.

With increasing scale of distortion-process interaction or compoundment, the rate of propagation through the relational matrix—i.e., through space-time—for that higher-order compound process becomes a smaller and smaller percentage of the speed of light. Although each primary distortion process is still propagating within the compound distortion process at the speed of light, with each successively higher order interaction these primary distortion processes must propagate more and more nonlinearly, as their interactions become increasingly twisted. Thus, the primary distortion processes have farther to go, more reality cells to traverse, in order for the higher-order compound process as a whole to propagate linearly. At the interactive scale depicted in figure 45, a compound process of the second order is traveling at a velocity that's one-fourth the speed of light—i.e., at one-fourth the rate of propagation of the primary distortion processes that compose it.

This point is vital, and so we will repeat it. Primary distortion processes don't actually slow down when they stably and repetitively interact to form a compound distortion process. Rather, they continue individually to propagate at the rate-of-penetration constant, which, as we have already described, is equivalent to the speed-of-light constant. However, because primary distortion processes must propagate nonlinearly in order to stably and repetitively interact, they then appear individually to propagate at less than the speed of light, and the compound process as a whole also must propagate at less than the speed of light. As we will show, this concept is central to understanding why temporal relativity exists and, more specifically, why it exists in relation to, and as a function of, the speed-of-light constant.

7.3 *Compound-process propagation*

How the rate of propagation of a compound process through the relational matrix (i.e., the velocity of matter through space-time) relates to the degree of linearity of propagation of the

[18] At higher orders of distortion-process interaction, there are other forces that are also acting to maintain the pattern integrity of interacting compound processes. The unified model of reality presented in this book deals only with the electromagnetic and gravitational forces, which are two of what are now considered to be the four fundamental fields or forces responsible for all material interactions. The other two fundamental forces, the strong and weak nuclear forces, are thought to mediate or hold quantum particles together to form atomic nuclei. As explained previously in part I, chapter 2, subsection 4.4, all fields, all forces, all energy, must represent some distortion of the uniform pattern of spatial content. Thus, these other forces may represent different primary patterns of distortion, or they may represent secondary patterns of distortion that exist only as a result of more fundamental distortion-process interactions.

primary distortion processes which make up that compound process is depicted in **figures 46** and **47.**

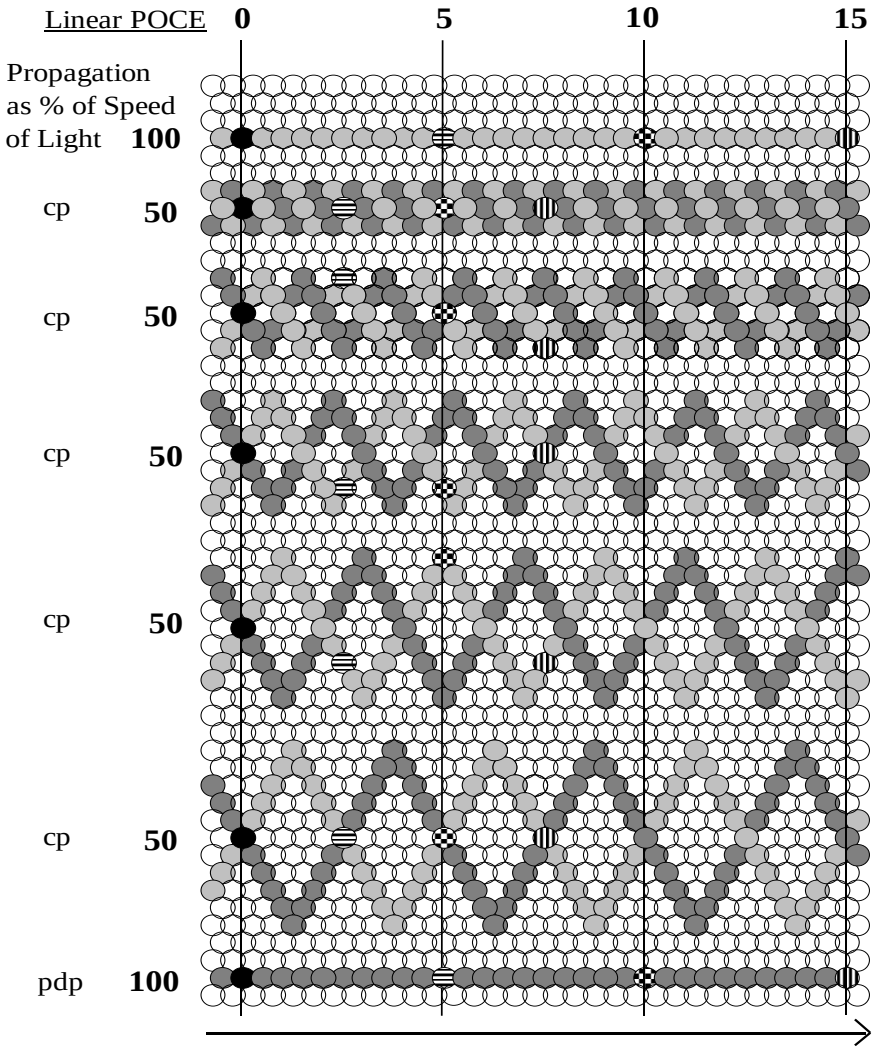


Figure 46 The relationship between the pattern of primary-distortion-process interaction and the rate of compound-process propagation when there is complete nonlinearity of propagation. What this figure shows is that variation of the nonlinear component in a compound process (cp) (i.e., the varying up or down slope of the electromagnetic component of the primary distortion processes (pdp's)) doesn't alter the rate of compound-process propagation, inasmuch as it remains 50 percent of the speed of light regardless. The differently patterned reality cells (vertically striped, checkerboard, and horizontally striped) show how far a distortion would propagate within a given number of periods of content exchange (POCEs), when it's propagating linearly and varyingly nonlinearly. As previously described and defined, a distortion propagates two reality cells every POCE. The compound processes depicted in this diagram travel only one-half the linear distance that the linearly propagating pdp's do within the same number of POCEs. Since the linear propagation of the pdp's occurs at

the speed of light, the propagation of the compound processes is occurring at one-half the speed of light.

To use a car analogy, what figure 46 shows is that if any number of cars going the same speed travel on different curvy roads that have no linear sections, they all end up going half the linear distance that a car traveling the same speed goes on a road with no curves in the same amount of time, regardless of the size of those curves.

Now, let's see what happens when linear sections of different lengths are added to those curves, as depicted in figure 47.

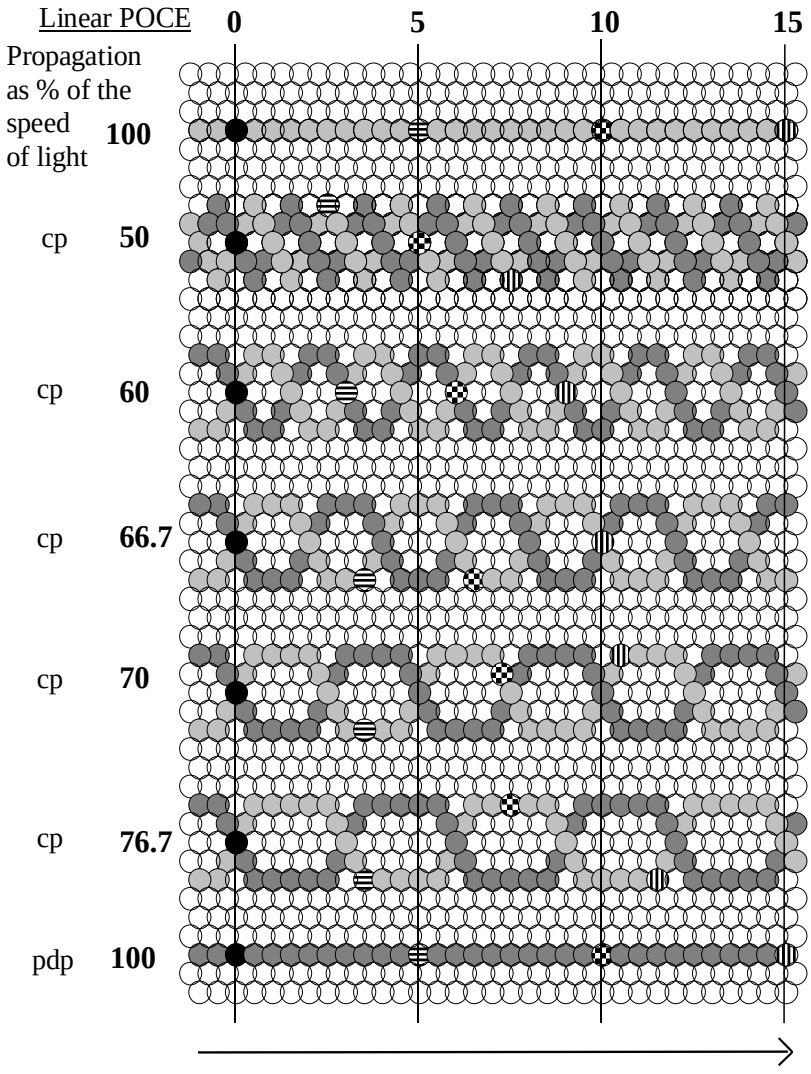


Figure 47 The relationship between the pattern of primary-distortion-process (pdp) interaction and the rate of compound-process (cp) propagation when there is a varying degree of linearity of propagation, with nonlinearity (up and down slope) held constant. The compound processes depicted in this diagram each have an increasing degree of linearity of propagation from top to bottom. In the compound process at the top, the

> component processes are propagating completely nonlinearly. What this diagram shows is that, as the degree of linearity of propagation of the component processes increases, the rate of propagation of the compound process as a whole also increases, bringing it ever closer to the speed of light. Again, the differently patterned reality cells (vertically striped, checkerboard, and horizontally striped) show how far a distortion propagates within a given number of periods of content exchange (POCEs), when it's propagating completely linearly (pdp) and with varying degrees of linearity (cp). As previously described and defined, a distortion propagates two reality cells every POCE. Note that, as the degree of linearity of propagation of the component processes becomes relatively greater or less, the periodic activity intrinsic to the compound process as a whole is altered. This alteration of compound-process periodicity that accompanies changes in material velocity forms the basis of temporal relativity.

The patterns of distortion propagation depicted in figures 46 and 47 are those that are permitted by the dynamic structure of space-time. An important feature regarding variations in the degree of linearity of propagation of the component processes, as depicted in figure 47, is that these variations result in alterations of the periodicity intrinsic to the compound process as a whole. Thus, as the degree of linearity of propagation of the component processes becomes relatively greater, the periodicity intrinsic to the compound process as a whole becomes relatively less, meaning that it takes more periods of content exchange for the compound process to complete one full cycle or period of component-process interaction. Conversely, as the degree of linearity of propagation of the component processes becomes relatively less, the periodicity intrinsic to the compound process as a whole becomes relatively greater, meaning that it takes fewer periods of content exchange for the compound process to complete one full cycle or period of component-process interaction.

Matter is a dynamic structure, composed of interacting distortion (i.e., energy) processes that are propagating nonlinearly through space-time at the speed of light. As material velocity varies, the interactive material structure varies, i.e., the periodicity intrinsic to the matter itself must also vary, because material velocity is a function of the degree of linearity of propagation of the component processes, just as the periodicity intrinsic to a compound process is also a function of the degree of linearity of propagation of the component processes.

This unbreakable connection between material velocity and compound-process periodicity is the basis of temporal relativity. The connection between material velocity and interactive material structure is the basis of the relativity of mass. Both temporal and mass relativity exist because any change in material velocity must be accompanied by some change in the dynamic structure of the matter—i.e., by some change in the relationship between the energy processes that are interacting to form the matter. These two topics, temporal and mass relativity, will be discussed in greater detail in a later section.

The speed of light is observed to exist when there's complete linearity of distortion propagation through the relational matrix. When primary distortion processes interact to form a compound process of the first order, the degree of linearity of propagation of the component processes becomes relatively less. That relative nonlinearity of propagation results in the compound

process as a whole traveling through space-time at less than the speed of light, although the component processes continue to propagate at the speed of light, albeit nonlinearly.

To summarize, material velocity is purely a function of the interactive structure of the component processes that make up matter. The less the degree of linearity of propagation of the component processes that make up the matter, the lower the material velocity will be. Conversely, the greater the degree of linearity of propagation of the component processes that make up the matter, the higher the material velocity will be.

According to Einstein's relativity theory, an infinite amount of energy would be required to accelerate matter to the speed of light, and if a material object did attain a velocity equal to the speed of light, it would have an infinite mass. Since these conditions can't exist, according to relativity theory, matter can't travel at a velocity that's equal to or greater than the speed of light.

The way we have described matter within the context of the relational-matrix model explains in terms of the dynamic spatial structure why matter cannot travel at a velocity that's equal to or greater than the speed of light. The only way a compound process (i.e., matter) could travel at the speed of light would be if there were complete linearity of propagation of the component processes. However, if there's complete linearity of propagation of the component processes, then there can be no interaction of the component processes, and so therefore there wouldn't be an existent compound process—i.e., there'd be no matter, no material object, as such.

The points made in the last paragraph make moot the issue of whether or not matter can travel at a velocity *greater* than the speed of light, but for completeness we will address this issue anyway. How can a material object travel at a velocity that exceeds the maximum and constant velocity of the processes which compose it? It can't, and so it doesn't.

To summarize, the nature of matter as being fundamentally composed of interacting distortion (i.e., energy) processes, which in order to interact are propagating to some degree nonlinearly, precludes matter from existing as such in a state in which those distortion processes can't interact, i.e., in a state where there's complete linearity of propagation of the component processes—as would need to be the case for matter to travel at the speed of light. Matter is a dynamic structure, and it can't exist as such in the absence of the relationships—i.e., in the absence of the nonlinear primary-distortion-process interactions—of which its dynamic structure is composed. Thus, the relational-matrix model is both consistent with, and explains the basis of, the aspect of relativity theory which holds that matter cannot travel at a velocity equal to or greater than the speed of light.

7.4 *Compound processes and the spatial distribution of the gravitational distortion*

The purpose of this subsection is to describe, in terms of both degree of distortion content and spatial distribution of distortion content, how the gravitational components of primary distortion processes are affected when primary distortion processes interact to form a compound process.

One effect upon the gravitational component of a primary distortion process when it stably and repetitively interacts with another primary distortion process is an alteration of the spatial relationship between the electromagnetic component and the gravitational component of both distortion processes.

In a noninteracting primary distortion process (i.e., one that's propagating with complete linearity), the linear electromagnetic component propagates ahead of the radial gravitational component. Conversely, when a primary distortion process stably and repetitively interacts with another primary distortion process to form a compound process, the gravitational components are then able to propagate ahead or in front of the electromagnetic components. It's in this way and for this reason that matter, as a compound distortion process, becomes associated with a surrounding gravitational field, as depicted in f**igure 48**.

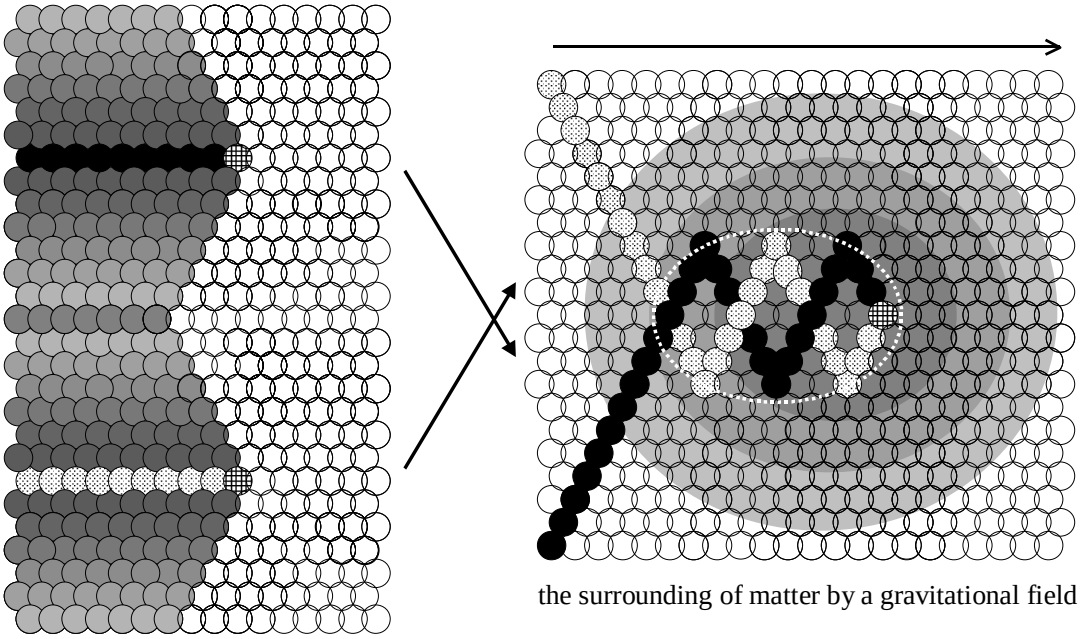


Figure 48 What happens to the relationship between the electromagnetic and gravitational components of a primary distortion process when it stably and repetitively interacts with another primary distortion process to form a compound process. (Left) The gravitational components (gray) of two linearly propagating primary distortion processes fan out behind the electromagnetic components (black and stippled circles). Note that in these drawings the next reality cell in sequence that will become maximally distorted is represented by a crosshatched circle. (Right) In two primary distortion processes interacting to form a compound process (i.e., matter), the gravitational component, still propagating radially at the speed of light, is able to propagate out ahead or in front of the interacting electromagnetic components, resulting in the compound process being surrounded by a gravitational distortion gradient—i.e., a gravitational field. Thus, the diagram on the right depicts the fundamental mechanism by which matter becomes associated with a surrounding gravitational field, and so depicts the fundamental reason why matter and gravitation are always found in association.

The relationship of the electromagnetic component to the gravitational component can be compared to the relationship of a boat to its wake, where the boat represents the electromagnetic component and the wake represents the gravitational component. As long as the boat travels linearly at a rate equal to the speed of water waves, the wake will remain behind the boat. If the boat begins to zigzag, so that its rate of linear travel is less than the speed of water waves, then the wake or waves created by the boat will catch up to and pass ahead of the boat.

Likewise, as long as the electromagnetic component (the boat) is propagating linearly at the speed of light, the associated gravitational component (the wake) fans out behind it. However, once the electromagnetic component becomes part of a compound process and begins to propagate relatively nonlinearly, its rate of linear travel as part of that compound process is less than the speed of light. This lower velocity allows the gravitational component, which propagates with diminishing distortion content radially at the speed of light, to propagate out ahead or in front of the compound process, surrounding the compound process with a radial or oblong gravitational-distortion gradient—i.e., a gravitational field.

Another effect that primary-distortion-process interaction has upon the associated gravitational distortions is to bring the gravitational distortions from different primary distortion processes into proximity, causing a gravitational overlap. This gravitational overlap causes an additive effect, in which the compound process then radiates around itself a stronger gravitational distortion than any individual primary distortion process alone could generate or radiate.

In a linearly propagating, noninteracting primary distortion process, the gravitational component propagates radially away from its point or axis of origin with a decreasing distortion content. When a primary distortion process stably and repetitively interacts with another primary distortion process to form a compound process, the gravitational components still propagate radially with a decreasing distortion content. However, owing to the additive effect of overlapping gravitational distortions, the compound process becomes surrounded by a relatively stronger gravitational distortion than that which is associated with either primary distortion process alone.[19]

It's in this way and for this reason that matter becomes associated with a surrounding gravitational field whose strength (i.e., attractiveness) increases as the number of primary distortion processes composing the matter increases. For, as we will describe in an upcoming section, the number of interacting primary distortion processes composing matter is directly related to the mass of the matter. All other things being equal (i.e., with no variation in the parameters that are responsible for the relativity of mass, which we will discuss later), the more primary distortion processes interacting to compose a material object, the greater its mass, and the stronger its associated gravitational field.

7.5 *Gravitation's attractive nature*

[19] See part I, chapter 1, subsection 7.22.

The purpose of this subsection is to explain, in terms of the relational matrix, the mechanism of gravitational attraction as it applies to compound processes or matter. We have already discussed this subject to some extent in chapter 2, subsection 6.2. To summarize what was stated there, the attractive nature of the gravitational field or force can be understood as the manifestation of the fact that the electromagnetic component of a primary distortion process always propagates in the direction of increasing gravitational distortion.[20]

Owing to the diminishment or dilution of distortion content that accompanies the radially distributed gravitational distortion that is a gravitational field, gravitation is always encountered in the form of a distortion gradient that has a consistent orientation, inasmuch as the distortion content always increases in the direction of the matter or mass from which it radiates. Therefore, any matter that encounters gravitation does so in such a way that there's always an increasing gravitational distortion in the direction of the matter which is radiating or generating the encountered gravitational-distortion gradient or gravitational field. This gradient was depicted in figure 48 as lighter shades of gray surrounding the compound process.

When one material object is attracted to another by gravitation, what's really happening is that the electromagnetic components of the primary distortion processes which form the one material object are having their direction of propagation altered in the direction of increasing gravitational distortion by the gravitational-distortion gradient surrounding the other material object. Since the gravitational-distortion content always increases in the direction of the matter from which it radiates, the direction of propagation of the electromagnetic components of a primary distortion process is always altered in the direction of that matter, causing the gravitational distortion, which always exists in a gradient, to function as an attractive force on both energy processes and material objects. However, the gravitational distortion isn't itself attractive; rather, the consistent way in which the gravitational distortion is spatially distributed around energy and matter in the form of a gradient is what causes the gravitational distortion to function in a consistently attractive manner. We will now use this concept to explain why and how matter accelerates in a gravitational field.

7.6 *Gravitational acceleration*

"Gravitational acceleration" refers to what happens to material velocity when matter encounters a gravitational field. For example, if a rock is dropped from a tall building, the velocity of the rock increases incrementally as it falls, as it's attracted to the Earth by the Earth's gravitational field. This incremental increase in material velocity caused by the gravitational field or force is called gravitational acceleration.

[20] To review, the electromagnetic component of a primary distortion process always propagates in the direction of increasing gravitational distortion because the electromagnetic or maximal-distortion component of the linear-radial distortion complex always propagates into the next adjacent reality cell that reaches the level of maximal distortion. When there's no other gravitational distortion present, that propagation occurs in linear sequence, resulting in linear propagation of the electromagnetic component. However, when another gravitational distortion is encountered, the next adjacent reality cell that first reaches the level of maximal distortion is always one that's on the side with the greatest gravitational distortion, causing the maximal distortion to propagate into a reality cell not in linear sequence, resulting in the alteration or bending of the direction of electromagnetic propagation.

One of the most interesting things about gravitational acceleration is that all material objects, regardless of their weight, size, or shape, accelerate at the same rate when they encounter the same gravitational field. That is, a large rock doesn't accelerate or fall to earth any faster than would a feather (if such things were dropped in a vacuum where the effects of air resistance are eliminated).[21] This feature of the gravitational field or force was discovered at the beginning of the 17th century by the Italian physicist and astronomer Galileo Galilei. We are now, several hundred years later, going to find out why this is so.

In this subsection, we will show the mechanism of gravitational acceleration to have as its basis the same simple mechanism as that which is responsible for gravitational attraction. That is, we will show that, like gravitational attraction, gravitational acceleration exists as a result of the consistent alteration of the direction of propagation of the electromagnetic components of the primary distortion processes that make up a compound process in the direction of increasing gravitational distortion. In other words, the gravitational-distortion gradient, by altering the direction of propagation of the electromagnetic components of a compound process, also accelerates or incrementally increases the rate of propagation of the compound process as a whole.

There's no way to cause a primary distortion process to propagate faster than the speed of light, because the speed of light is itself a manifestation of the dynamic structure of space-time. Therefore, a gravitational-distortion gradient can't accelerate electromagnetic radiation that's propagating linearly at the speed of light; all it can do is alter its direction of propagation.

However, when electromagnetic radiation is part of a compound process (i.e., matter), the individual electromagnetic components propagate nonlinearly at the speed of light, but the compound process as a whole propagates linearly at less than the speed of light. Again, the rate of propagation of a compound process through the relational matrix is a function of the degree of linearity of propagation of the primary distortion processes that make it up.

The gravitational-distortion gradient, by altering the direction of propagation of the electromagnetic components of a compound process (i.e., matter), can increase their degree of linearity of propagation and so cause the compound process as a whole to propagate through space-time at an increased rate— i.e., at a higher velocity.

The gravitational field, because it always exists in a gradient of lesser to greater distortion content, increases this degree of linearity of propagation incrementally, and so the rate of propagation of the compound process also increases incrementally, since the closer the compound process gets to the attractive mass, the greater becomes the gravitational distortion. As the gravitational distortion increases, the degree of linearity of propagation of the electromagnetic components of the compound process also increases, thus increasing incrementally the velocity of the compound process as a whole.

[21] Under normal conditions, a feather falls more slowly than a rock not because its acceleration due to gravity is less but because air resistance slows it more. The force of air resistance varies with the surface area of an object, and so a material object that spreads its weight over a greater area meets more resistance and thus drops more slowly, although the gravitational acceleration is really the same.

In a way, acceleration represents a vicious cycle. Gravitation "bends" the direction of propagation of the component processes that make up matter toward the source of the gravitation, causing the matter to move at an increased velocity. This "bending" brings the matter closer to the source of gravitation, putting it in a stronger gravitational field, thereby "bending" the direction of propagation of the component processes even more, causing the matter to move even faster while being subjected to an ever-stronger gravitational field, "bending" the direction of propagation of the component processes even more, and so on. Gravitational acceleration, then, is what is observed as the incremental increase in material velocity that occurs as the result of the increasing degree of linearity of propagation of matter's component processes, owing to that matter moving in the direction of increasing gravitational distortion, i.e., into an ever-stronger gravitational field, as depicted in **figure 49.**

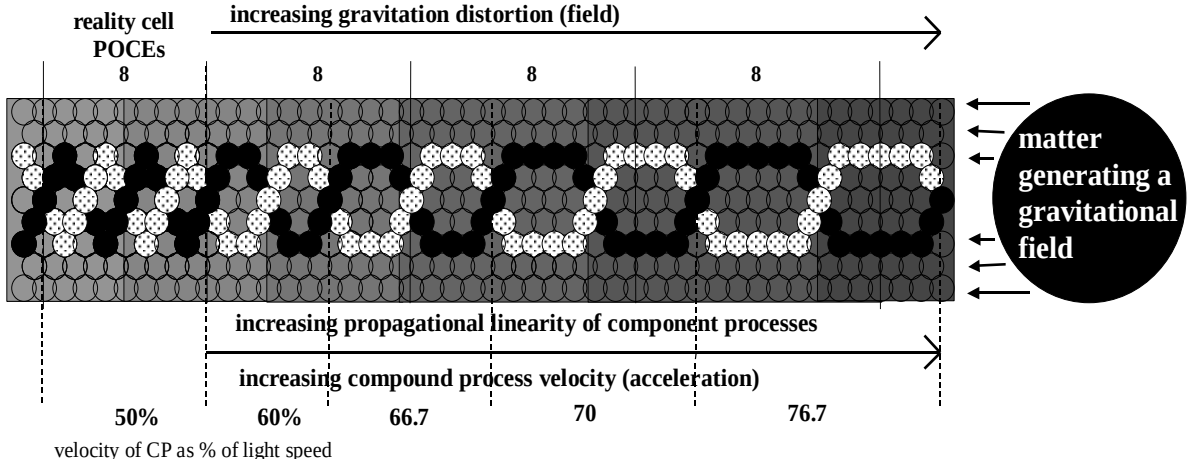


Figure 49 A compound process (CP) that is accelerating, owing to a gravitational field that's being generated by, and exists in association with, the matter on the right. As the CP encounters the gravitational field, the direction of propagation of its component processes (black and stippled circles) is altered in the direction of increasing gravitational distortion (increasingly dark shades of gray from left to right), increasing the degree of linearity of propagation of the component processes, and thus both increasing the velocity of the CP as a whole and attracting it in the direction of the matter that's generating the gravitational field. This increase in velocity (i.e., acceleration) moves the CP into an even stronger gravitational distortion, further increasing the degree of linearity of propagation of the component processes, again both increasing the velocity of the CP as a whole and attracting it in the direction of the matter that's generating the gravitational field, and so on. The continuous repetition of this cycle is what we observe as gravitational acceleration.

In this way, the alteration of the direction of propagation of the component processes causes both the attraction and the acceleration of the CP as a whole toward the matter that's generating the gravitational field. The attraction of matter to other matter due to gravitation is a function of the alteration of the direction of propagation of the component processes in the direction of increasing gravitational distortion. The acceleration of matter due to gravitation is a function of

the increased degree of linearity of propagation of the component processes which accompanies that alteration in their direction of propagation.

The component processes always propagate at the speed of light. However, interacting to form a CP, they propagate nonlinearly. The velocity of the CP as a whole is determined by the degree of linearity of propagation of the component processes. As the degree of linearity of propagation of the component processes increases, the velocity of the CP as a whole also increases. Basically, the less zigzaggy the path of the component processes, the farther they and the CP they make up propagate within a given number of periods of content exchange (POCEs). In later sections, we will demonstrate that this variation in the dynamic structure of matter is responsible for the relativity of time and mass as a function of material velocity.

This way of understanding the mechanism underlying gravitational attraction and acceleration also explains why the gravitational force acts independent of the mass of the matter it's acting upon—i.e., it explains why a pebble, a boulder, and a feather are all accelerated by the Earth's gravitational field at the same rate in a vacuum.

The equivalence of material acceleration with regard to the same gravitational field acting upon different material objects occurs because gravitation isn't acting upon the matter as a whole, at a level where there exists some structural difference. Rather, gravitation is acting at the level of the individual fundamental constituents of matter, at the level of the primary distortion processes, at the level of the EMR-gravitation complex, where there's no structural difference—i.e., where there's structural equivalence.

Specifically, gravitation is acting upon the individual electromagnetic components of the primary distortion processes that interact to compose a material object, increasing their degree of linearity of propagation. Regardless of how many primary distortion processes are interacting to compose a material object, gravitation is acting upon the electromagnetic component of each primary distortion process individually and equally, altering its direction of propagation in the same way, while also increasing its degree of linearity of propagation by the same amount. Gravitation doesn't care whether the electromagnetic component of the primary distortion process it's affecting is part of a large or a small material object, because it affects all electromagnetic components in the same way, to the same degree, resulting in gravitational acceleration that acts independent of the mass of the matter.

So, whether a compound process is composed of two or two billion primary distortion processes—i.e., whether it has a small or a large mass—the change induced by the gravitational-distortion gradient in the direction of propagation of each of the electromagnetic components is equivalent, resulting in the equivalence of acceleration for different masses in the same gravitational field. This is why Galileo so many years ago observed that different material objects fall to earth at the same rate.

7.7 *Gravitation's functional (but not actual) curvature of space*

Although Einstein in his relativity theory treated the effect of gravitation upon space-time as an actual geometric curvature of the spatial structure, this subsection is intended to point out that the effect of gravitation is to create a *functional*, rather than *actual*, curvature of the spatial structure. That is, the consistent radial distribution of the gravitational distortion around matter, through its consistent effect upon the direction of propagation of the electromagnetic components of primary distortion processes, causes space to *function as if it were curved* in the area of a gravitational field, and thus creates the appearance that gravitation causes an actual bending or curvature of the spatial structure.

The existence and effects of gravitation can be fully explained through the previously described mechanisms of gravitational attraction and acceleration, i.e., the consistent alteration of the direction of propagation of the electromagnetic components of primary distortion processes in the direction of increasing gravitational distortion. Within the context of the relational-matrix model, where gravitation is understood to represent a radially distributed and diminishing distortion of spatial content, there's no need to introduce the concept of an actual curvature or bending of the spatial structure, because the effects of gravitation can be consistently accounted for without such a concept.

To reiterate, gravitation causes space to function as if it were curved, relative to areas of space that don't contain a strong gravitational field, but gravitation doesn't actually curve or bend the spatial structure. Again, the dynamic structure of space is composed of relationships between reality cells. Those relationships don't change, although they're intrinsically dynamic. That is, as we have previously described, the relational matrix has a structural uniformity and consistency within the context of a continuous dynamic flux of spatial content.

However, because gravitation is always radially distributed around matter in a gradient of decreasing distortion content, space functions as if it were curved, because electromagnetic radiation, or matter composed of electromagnetic radiation, traveling through such a gravitational gradient always has its direction of propagation altered toward the source of the gravitational field, and so it seems to be "bent" by that field. However, this "bending" isn't the result of an actual curvature or bending of the spatial structure but is simply due to the consistent alteration of the direction of propagation of the electromagnetic components toward the source of the radially distributed gravitational distortion.

Since the spatial structure can't be experienced directly, it must be inferred through the way energy functions in space. So, when electromagnetic energy curves or bends in a gravitational field, space is then observed, through inference, to function as if it were structurally (i.e., geometrically) curved. An area of space that contains a strong gravitational field does indeed function as if it were curved, relative to other areas of space that don't contain a strong gravitational field. However, it isn't the spatial *structure* but the spatial *content* that's curved, as it's distributed in a radially diminishing pattern of distortion content around matter, as depicted in **figure 50**.

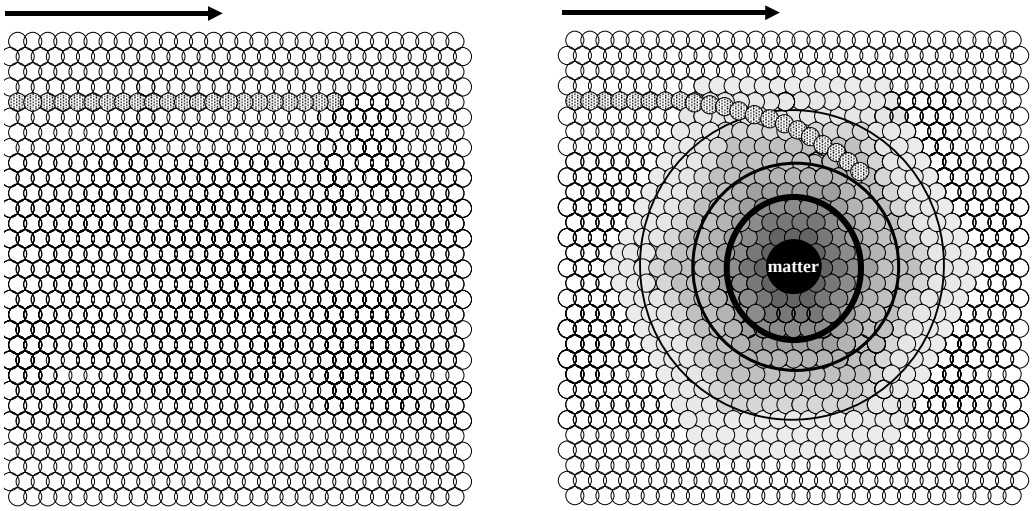


Figure 50 The functional curvature of space that's created by the radially diminishing distribution of the gravitational distortion around matter. (Left) There's no external gravitational distortion encountered by the electromagnetic component (stippled circles) of a primary distortion process, and so it propagates through space linearly, with no bending or curvature in its path. (Note that the gravitational component of the primary distortion process is not shown.) (Right) Gravitational distortions of diminishing distortion content (progressively lighter shades of gray) are radially distributed around matter as denoted by the superimposition of the black circles of decreasing thickness. Note that these circles don't represent curvatures of the spatial structure but represent curvatures of distortion content, as that distortion content is distributed in a radially diminishing pattern.

In the figure on the right, the radially distributed gravitational-distortion gradient consistently alters the direction of propagation of the electromagnetic component (stippled circles) of the primary distortion process in the direction of increasing gravitational distortion. This alteration occurs as the gravitational distortion gradient causes the electromagnetic component to propagate into the next reality cell that's not in linear progression. Since the electromagnetic component always propagates into the next adjacent reality cell that first reaches the level of maximal distortion, and since this level is always reached first by a reality cell that's on the side of greater gravitational distortion, the direction of propagation of the electromagnetic component is consistently altered toward the source of the gravitational field. As shown here, this alteration of the direction of propagation decreases the degree of linearity of propagation of the electromagnetic component, "bending" its path to appear as if it were somehow traveling along curved or bent space.

However, this nonlinearity or bending of the path of electromagnetic radiation by a gravitational field isn't the result of the actual bending or curvature of the spatial structure but is simply due to the consistent alteration of the direction of propagation of the electromagnetic component toward the source of the radially distributed gravitational gradient. Thus, the apparent curvature that space is observed to have due to a gravitational field isn't due to an actual curvature of the spatial structure but rather represents a radial distribution of distortion content, because the gravitational

distortion is always distributed in a radially diminishing pattern. When that pattern of distortion distribution is encountered by electromagnetic radiation, space then appears to function as if it were actually curved.

To summarize, the consistency of the radial distribution of the gravitation distortion around matter consistently alters the direction of electromagnetic propagation, causing space around matter to function as if it were curved. This functional curvature is the result of the radially diminishing distribution of the gravitational distortion, not the result of an actual bending or alteration of the relationships between the reality cells that compose the spatial structure. This functional curvature, this consistent alteration of the direction of electromagnetic propagation, is the same mechanism through which gravitation functions to create interactive-process stability, and so it's the same mechanism by which compound processes are created and sustained.

Thus, Einstein's treatment of gravitation as a geometric curvature of the spatial structure works because it's functionally correct. That is, Einstein's equations describing gravitation as a geometric curvature of space-time work because they correctly describe the functional reality, although they don't describe the actual underlying reality. Since we're here concerned with developing a unified model of space-time that can consistently show how the spatial structure relates to how physical reality is observed to function as an extension of that structure, we needed to point out how the apparent curvature of space around matter can be accounted for within the context of the relational-matrix model, within the context of an underlying reality that has no actual curvature of spatial structure but only a radially diminishing distribution of distortion content.

Section 8 Time and the Relational Matrix

According to Einstein's relativity theory, the temporal existence of a material object is related to its velocity.[22] In other words, time isn't invariant, isn't a constant process, but is somehow linked to how fast matter is moving through space. The temporal aspect of relativity theory holds that time slows down for an object as its velocity increases, and that time speeds up for an object as its velocity decreases.

Our discussion of compound processes within the context of the relational-matrix model is, in effect, a discussion of the dynamic structure of matter in relation to the dynamic structure of space. In this section, we will examine how the variation in the patterns of distortion-process interaction that must accompany any alteration in material velocity accounts for the relativity of time as a function of material velocity. In demonstrating how time exists as a function of the dynamic structure of matter in relation to the dynamic structure of space, the simplicity of the unnecessarily abstract concept of time will be revealed.

[22] Einstein developed two distinct theories of relativity: the special theory of relativity, proposed in 1905, and the general theory of relativity, proposed in 1916. The special theory of relativity is concerned primarily with the relativity of time and mass as a function of material velocity, whereas the general theory of relativity was developed to explain apparent conflicts between the laws of relativity and gravitation.

8.1 *Time is a measurement, not what is being measured*

Time has remained a highly abstract concept, one that we have trouble grasping, because we haven't known what it is that time measures. As a consequence, time, which we will show to be a measurement, has been mistaken for what's being measured. It's as if we knew of an inch but didn't know what an inch measured. In this case, the inch itself then would become the reality, rather than the spatial measurement of reality.

This is what has occurred with the concept of time. Time measures a certain aspect of reality—i.e., its dynamic aspect— but because we've been unaware of that dynamic aspect of reality (because we've been unaware of the dynamic structure of space), we've been unaware of what time measures. For this reason, time itself has come to be mistakenly thought of as the dynamic aspect of reality, when in fact it's a measure of the dynamic aspect of reality. Once we understand what time measures, the nature of time will be much less abstract and mysterious—in fact, the nature of time will become downright obvious.

An inch is a unit of measure, and an hour is also a unit of measure. Both of these units, the inch and the hour, are conceptual abstractions that have no correlate in reality: they are reference points we've established to give measurements meaning. The inch allows us to measure spatial distance or structural dimensions. The hour allows us to measure something, and that something is expressed in units of what we call time.

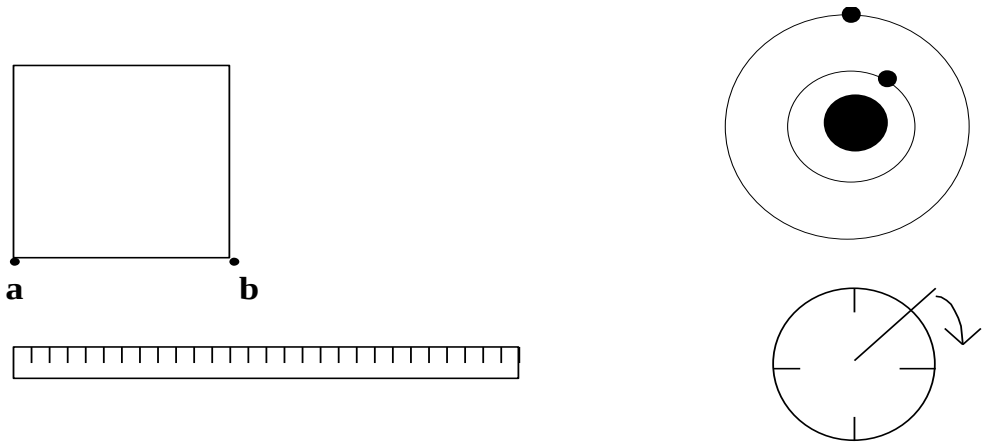
Most people would say the hour allows us to measure time, but this is where we make our mistake. Time is a measurement, not what's being measured. However, because we're unaware of what time is actually a measurement of, we equate the form of the measurement with what's being measured, and in so doing we grant time an objective existence that it doesn't deserve.

A ruler allows us to measure spatial distance in terms of units of length. Because we can see what the ruler measures, i.e., units of length, we don't confuse the measurement—for example, the inch—for what's being measured, i.e., spatial distance. A clock allows us to measure something in terms of units of time. The clock doesn't actually measure time; rather, time is itself the measurement of something else. However, because we don't see or know directly what time measures, we confuse the form of the measurement for what's being measured.

You wouldn't say, "I'm going to measure an inch," because you know that the inch is itself the measurement, and what you're measuring is spatial distance. But when we say, "I'm going to measure the time it takes," what is it we're really measuring that we then express in units of time?

To answer this question, let's examine a clock, the old kind with hands on it. It's simply a circle divided into sectors. A ruler, yardstick, or meterstick is a straight line divided into segments. A ruler is used to measure spatial distance or structural dimensions—the distance from here to there—and so it's linear. A clock is used to measure temporal change or dynamic activity, and

since the dynamic activity that time measures occurs in repetitive cycles or periods, the clock is circular,[23] as depicted in **figure 51**.



measure of structural relationship measure of dynamic relationship

Figure 51 Spatial distance or structural dimensions are measured in terms of units of length—inches, meters, etc. Since spatial distance is measured between two points, a and b, the measuring device is a segmented line, as in a ruler or meterstick, as depicted on the left. Temporal change or dynamic activity is measured in terms of units of time—hours, minutes, seconds, etc. Since dynamic activity occurs in repetitive cycles or periods, the measuring device is a sectored circle, as depicted on the right.

We don't measure inches; we measure spatial distance or structural dimensions, using the inch as a unit of measure. In the same way, we don't measure hours; we measure temporal change or dynamic activity, using the hour as a unit of measure. The ruler is a structural measuring device, and the clock is a dynamic measuring device. In the case of a ruler, the structural existence of an object is referenced to the structural existence of the ruler, and that measurement is expressed in units of length. In the case of a clock, the dynamic existence of an object is referenced to the dynamic existence of the clock, and that measurement is expressed in units of time. Thus, if both of the spheres that orbit the central sphere in the diagram on the right are moving at the same velocity, then the sphere closer to the central sphere completes a cycle or period sooner, i.e., in less time, time being a measure of the varying dynamic or periodicity of matter.

What we will demonstrate in this section is that *time is a measure of the varying dynamic or periodicity of compound processes*—i.e., matter or material objects—no more, no less. Length is a measure of spatial structure; time is a measure of material dynamic. As the periodicity intrinsic to matter varies, so the measurement of time also varies. The periodicity of matter varies as a function of material velocity, and so the measurement of time also varies as a function of material velocity. That is the basis of temporal relativity, in a nutshell.

Space is a dynamic structure. Compound processes—i.e., matter or material objects—extend as another level of relationship from the dynamic structure of space, and so compound processes

[23] Even modern digital clocks are circular; however, they display only one point in the cycle at any given moment.

possess both structural and dynamic aspects that are inseparable from the dynamic structure of space. The dynamic aspect of compound processes is expressed in terms of the compound-process period, which we have previously defined in subsection 7.1.

However, whereas the dynamic structure of space is invariant, the dynamic structure of matter varies. This variation in the dynamic structure of matter is what's responsible for the relativity of time and mass as a function of material velocity. Variations in the structural aspects of matter are measured in terms length, whereas variations in the dynamic aspect of matter measured in terms of cycles or periods—i.e., in terms of time.

Because the structural and dynamic aspects of matter are coexistent, one aspect can't be altered without altering the other. Material velocity can't be altered without altering the interactive material structure. The interactive material structure can't be altered without altering the material dynamic or periodicity. Therefore, when material velocity is altered, material dynamic or periodicity is also altered, and so time, as a measure of material dynamic or periodicity, is also altered. This interdependence of material structure and dynamic is the basis of both temporal and mass relativity.

8.2 *Time as a clockwork mechanism*

In this subsection, we will examine in more detail how variations in the periodicity of compound processes are measurable in terms of time. We will also discuss the relationship between what's being measured as time, and the dynamic aspect of the relational structure of space-time, which dynamic aspect manifests as the speed-of-light constant.

Time is a measurement that's derived from the mechanical interactions going on within compound processes (i.e., matter or material objects). The dynamic structure of space, along with the primary and compound distortion processes that exist as extensions of that dynamic structure, function like a clockwork mechanism—i.e., as an interconnected framework of interlocking wheels or gears. The turning of those gears is what's ultimately responsible for the movement of the hands of any clock, which observed movement we call the measurement of time, as depicted in **figure 52**.

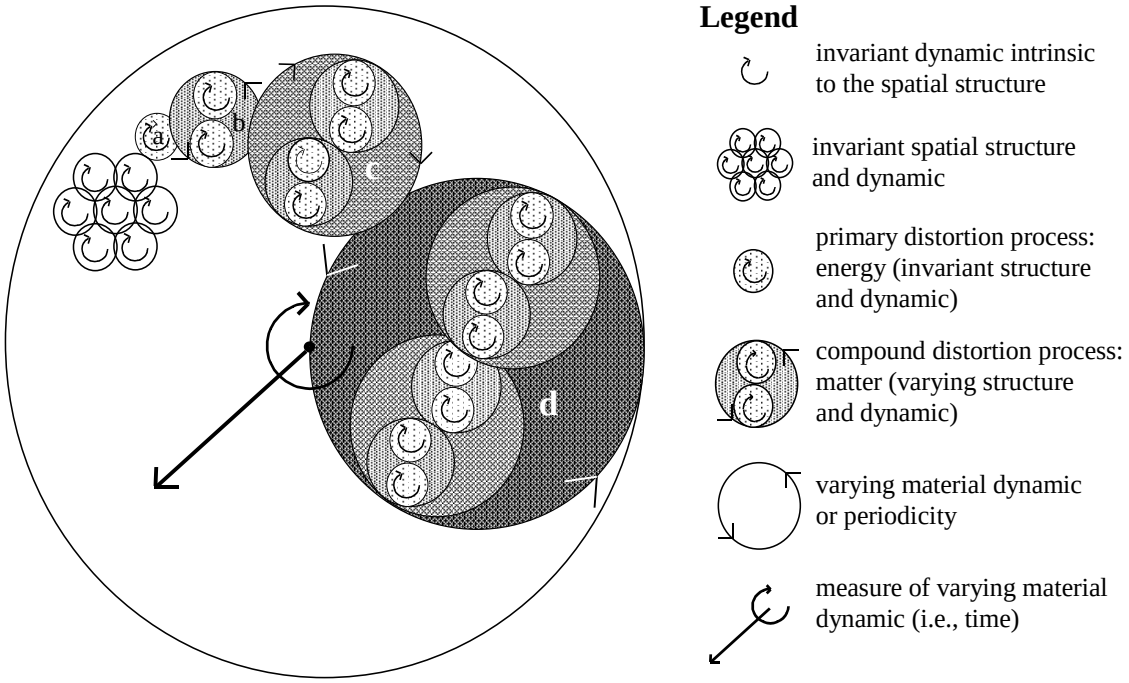


Figure 52 The unbreakable linkage between the invariant dynamic intrinsic to the spatial structure and the varying material dynamic or periodicity, as manifested in the movement of the hands of a clock, which we observe as the measurement of time. Ultimately, this diagram also depicts how time exists simply as a relative measure of material dynamic or periodicity, and shows how that material dynamic or periodicity is driven by the invariant dynamic intrinsic to the spatial structure.

The cluster of seven small circles represents the invariant spatial structure and dynamic. The small stippled circles (a) represent primary distortion processes, which have the same invariant structure and dynamic as the spatial structure itself, represented by the curved vector within the small circles. The larger stippled circles (b, c, d) represent increasingly higher-order compound processes, all of which are composed of interacting primary distortion processes. However, in contrast to the *invariant* dynamic of the primary distortion processes whose stable repetitive interactions compose them, the compound processes have a *varying* dynamic, or, more specifically, a varying periodicity, which depends on the pattern of interaction of the component processes. That varying periodicity of the compound processes is represented by the curved vectors which make up the periphery of the larger stippled circles.

This diagram is set up as a clockwork mechanism, to show how the movement of the hands of a clock, which movement we call the passage of time, is accomplished through spatial, energetic, and material relationships that function in a way which is directly analogous to the way mechanical gears turn to move the hands of a clock. This spatial "clock" doesn't need to be wound because its energy, its dynamic, is intrinsic to its structure. The primary distortion processes are the primary gears, driven by the invariant spatial structure and dynamic. Matter, or material objects, represent secondary, tertiary, quaternary, etc., gears. The pattern of primary-distortion-process interaction is what determines the periodicity of the secondary, tertiary, quaternary, etc., gears—i.e., what determines how fast they turn. The turning of the material

gears, i.e., their periodicity, is what determines the rate at which the final gear turns (small black dot at center), to which final gear is attached a stick. The movement of this stick is what we observe as the passage of time, which is nothing more than the measure of the varying dynamic or periodicity of the matter that composes the clock. Nothing abstract, nothing mysterious—just the result of a simple mechanical interaction driven basically by the invariant dynamic intrinsic to the spatial structure from which matter extends.

Temporal relativity exists because, although the movement of the hands of a clock is ultimately driven by the invariant dynamic intrinsic to the spatial structure, this movement is a material dynamic, and so it will vary, depending on the periodicity of the compound processes, the gears, to which the hands are connected and which exist between those hands and the primary gear, i.e., the invariant dynamic intrinsic to the spatial structure.

For example, if the velocity of compound process d were to increase, its periodicity would decrease (because the interactions between primary distortion processes would have to become relatively more linear), and the movement of the hands of the clock would slow down, correlating to a relative expansion or dilation of time for that accelerated process. Conversely, if the velocity of compound process d were to decrease, its periodicity would increase (because the interactions between primary distortion processes would have to become relatively less linear), and the movement of the hands of the clock would speed up, correlating to a relative contraction or shrinking of time for that decelerated process.

Whereas the movement of the hands of any clock measures the varying dynamic or periodicity of compound processes, that movement is ultimately driven by, and so remains unbreakably linked to, the invariant dynamic intrinsic to the spatial structure, with that linkage manifested as the rate of passage of time for an object existing relative to, or as a function of, that object's velocity as a percentage of the speed-of-light constant.

Without knowledge of the dynamic structure of space, we can't know the basis of the measure we call time. Without knowledge of the dynamic structure of space and its connection to the dynamic structure of matter, the movement of the hands of a clock is mysterious and unknown, and time itself is mysterious and unknown. This situation has resulted in a general confusion regarding the nature of time, wherein time has itself become thought of as an object, rather than as the measure of the dynamic structure of an object.

It's as if we knew of fish but knew nothing of water or the ocean. Within that context, all kinds of theories to explain the nature of fish would be developed. Once we came to the ocean, however, and saw the fish within the context of their environment, the nature of fish as creatures existing in relation to the ocean would become obvious, eliminating the need for the previously established theories developed when the fish were known only in relation to the unknown.

Likewise, once the dynamic structure of space is known, we can see the connection between the dynamic aspect of space and the movement of the hands of a clock, and within that context, the nature of time is no longer mysterious and unknown. Rather, within that context, the nature of time becomes knowable as nothing more than the measure of the periodicity intrinsic to the dynamic structure of matter, periodicity that must vary as the velocity of matter varies. Since the

connection between time and the dynamic structure of space can be demonstrated, there's no need to conceive of time as an abstract and unknowable "fourth dimension." Within the context of the relational-matrix model, time can be seen as the measure of a variable dynamic that itself extends from the invariant dynamic intrinsic to the spatial structure. Time isn't a place to be; it's not an object but a measurement.

8.3 *Temporal relativity and the interactive material structure*

Once the nature of time is understood, temporal relativity also becomes much less difficult to understand. Understanding temporal relativity involves nothing more than understanding why any change in material velocity must be accompanied by changes in material periodicity, along with the understanding of how that material periodicity is directly related to the movement of the hands of a clock, i.e., to the rate of the repetitive cycles or periods displayed by the clock.

Referring back to figures 47 and 49, we can see that for an individual compound process, as the degree of linearity of propagation of the component processes increases, the compound process as a whole travels through the relational matrix at a higher velocity, and also has relatively fewer periods of content exchange, than if it were traveling at a lower velocity (i.e., with less linearity of component process propagation) through the relational matrix. Thus, a compound process traveling at a higher velocity has relatively less periodicity and so the movement of the hands of a clock connected to that compound process would be slower, thus expanding or dilating the passage or measure of time as it exists for a faster-moving object.

The relationships between compound-process velocity, compound-process periodicity, degree of linearity of propagation of component processes, and relativity of temporal frame are summarized in **figure 53**.

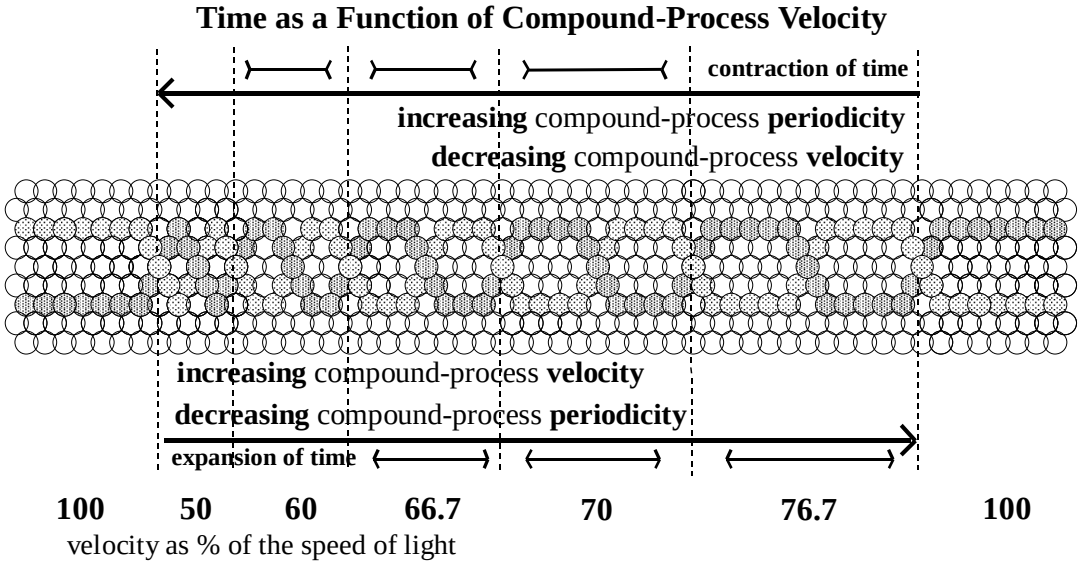


Figure 53 The relationship between compound-process velocity, compound-process periodicity, degree of linearity of propagation of component processes, and relativity of temporal frame. Depicted here is a compound process composed of two interacting electromagnetic components (two different shades of stippling), which can be seen either as accelerating as it propagates to the right, or, in reverse, as decelerating as it propagates to the left. (Bottom) As the velocity of a compound process (i.e., matter) increases from left to right, the degree of linearity of propagation of the primary distortion processes that compose it increases, thereby decreasing the periodicity of the compound process as a whole, thereby decreasing the rate of passage of time that exists as a function of, and so as a measure of, its material periodicity. (Top) As the velocity of a compound process (i.e., matter) decreases from right to left, the degree of linearity of propagation of the primary distortion processes that compose it decreases, thereby increasing the periodicity of the compound process as a whole, thereby increasing the rate of passage of time that exists as a function of, and so as a measure of, its material periodicity.

Our understanding of the relationships depicted in figure 53 hinges upon our understanding that the electromagnetic components of the primary distortion processes, which stably and repetitively interact to compose matter, always propagate at the speed of light—no more, no less. Therefore, the only way to change material velocity is to change the degree of linearity of propagation of matter's component processes. Any change in the degree of linearity of propagation of the component processes also changes the interactive structure of the compound process as a whole, and this change in interactive structure then exists as a change in the periodicity intrinsic to the compound process as a whole, which then is observed or measured as a change in the rate of passage of time expressed by that compound process (as depicted in figure 52). Thus, time is relative because time is a measure and, thus, a function of the varying dynamic or periodicity of matter.

Therefore, the relational-matrix model is consistent with the temporal aspect of relativity theory, which holds that the rate of passage of time for an object decreases as its velocity increases, while, conversely, the rate of passage of time for an object increases as its velocity decreases. The relational-matrix model also provides us with a straightforward explanation of why temporal relativity exists, one that's directly linked to the dynamic structure of space and, more specifically, one that shows the unbreakable linkage of time itself to the dynamic aspect of the spatial structure.

The measure of time exists relative to, or as a function of, material velocity as a percentage of the speed-of-light constant because all material dynamic or periodicity ultimately extends from the dynamic intrinsic to energy processes. Because the dynamic intrinsic to energy processes is itself ultimately an extension of the invariant spatial dynamic, which manifests as the speed-of-light constant (i.e., the rate-of-penetration constant), what we measure as time is unbreakably linked to that invariant spatial dynamic, with that linkage manifesting in the form of time existing in relation to, or as a function of, material velocity as a percentage of the speed-of-light constant.

Putting it another way, because all the gears of any clock are ultimately driven by the invariant spatial dynamic, the movement of the hands of any clock also is unbreakably linked to that

invariant spatial dynamic. This unbreakable linkage between the varying periodicity of the clock and the invariant spatial dynamic which ultimately drives that clock is the reason why the measure of time exists relative to, or as a function of, material velocity as a percentage of the speed-of-light constant.

Space doesn't have a fourth dimension that's time; rather, three-dimensional space has an intrinsic dynamic aspect. That intrinsic and invariant dynamic aspect drives the varying dynamic or periodicity of the compound processes which exist as extensions of space's dynamic structure. Time is simply how that varying dynamic or periodicity manifests materially and so becomes measurable.

The relativity of time is a result of the alteration of material dynamic or periodicity that must occur for material velocity to change. As material velocity changes, along with this alteration of material dynamic or periodicity there must also occur an alteration of interactive material structure, i.e., an alteration of the spatial relationships that exist between the component processes which make up matter, as depicted in figures 47, 49, and 53.

In the next section we will examine the spatial relationships that exist between component processes which make up matter, and we will relate those spatial relationships to the measure of matter's *mass*, as well as to the property of matter called *inertia*. Once we have described mass and inertia within the context of the relational-matrix model, we will then be in a position to examine how the alteration of the interactive material structure that must accompany changes in material velocity is also responsible for the relativity of mass.

Section 9 Mass, Inertia, and the Relational Matrix

In the preceding section, we described how changes in material velocity are accompanied by alterations of material dynamic or periodicity. As we pointed out, an alteration in material dynamic or periodicity represents an alteration of interactive material structure as well. In this section, the alteration of interactive material structure that must accompany changes in material velocity will be related to the relativity of mass and the concept of inertia.

More specifically, in this section we will discuss the following topics: (1) the nature of inertia and mass within the context of the relational-matrix model; (2) the underlying unity of the gravitational and inertial forces; and (3) why mass, like time, exists relative to material velocity. First, we will review the concepts of mass and inertia.

9.1 *Background*

mass (mas) n. 8. Physics: the quantity of matter as determined from its weight or from Newton's second law of motion. Abbr.: m. Cf. weight (def. 2), relativistic mass, rest mass.[24]

[24] *Random House Dictionary, 2nd ed cd-rom version*

in•er•tia (in ûr,sh*ƒ*, i nûr,-) n. 2. Physics a. the property of matter by which it retains its state of rest or its velocity along a straight line so long as it isn't acted upon by an external force.[25]

Mass, in physics, is the amount of matter that an object contains. Mass is a measure of the inertial property of an object, that is, of its resistance to change of motion. Mass is different from weight, weight being a measure of the attraction of the Earth for a given mass. Gravitational mass and inertial mass are identical. Although weight is proportional to mass, weight varies with the position of a given mass relative to the Earth. For this reason, equal masses that have the same location in relation to a gravitational field will have equal weights. Einstein's theory of relativity altered the traditional concept of mass as being invariant for a given object. In modern physics, the mass of an object is understood to be a quantity that changes as the velocity of that object changes, relative to the speed of light.
Inertia is the property of matter that causes it to resist any change of its motion in either direction or speed. This property is described by Sir Isaac Newton's first law of motion: An object at rest tends to remain at rest, and an object in motion tends to continue in motion in a straight line, unless either is acted upon by an outside force.

Inertia is generally related to mass. A greater force is needed to accelerate a large rock than is needed to accelerate a small pebble. This relationship is expressed by Newton's second law of motion: force = mass × acceleration. Mass, however, is usually measured by its gravitational property, i.e., the attractive force it exerts on other masses. That both the inertial force and gravitational force are directly proportional to mass was first realized and demonstrated by Galileo Galilei in about 1590. According to Galileo, a heavy weight and a light weight dropped simultaneously from the top of a tower must both strike the ground simultaneously.

Einstein theorized that the gravitational and inertial forces are identical and that it is impossible to distinguish between them. This equivalence between the gravitational and inertial forces is the basis of Einstein's theory of general relativity. Although the theory of general relativity hasn't been fully accepted, the few experiments that scientists have been able to conduct to test the theory have, so far, tended to confirm the theory.

Having reviewed the concepts of mass and inertia, we will now show how these concepts fit into the relational-matrix model.

9.2 *Inertia and the relational matrix*

Compound processes (i.e., matter) are composed of interacting primary distortion processes. These primary distortion processes have both a linear (electromagnetic) and a radial (gravitational) component. Matter exists when the linear components of primary distortion processes interact stably and repetitively with each other. The radial gravitational distortion associated with each linear electromagnetic component is what causes these linear components to twist around or orbit each other, each simultaneously altering the other's direction of propagation, each binding the other into a position that then, through feedback, binds itself.

[25] *Random House Dictionary, 2nd ed cd-rom version*

Let's look at the situation of a compound process of the first order, consisting of two interacting primary distortion processes, as its velocity increases or decreases. To change the velocity of a compound process as a whole, the pattern of interaction of the component processes making up the compound process (i.e., matter) must change so that each primary distortion process can propagate more or less linearly, yet still stably and repetitively interact. What we will show is that inertia is simply the difficulty in changing the pattern of interaction of the component processes and that the change in their pattern of interaction causes the change in mass that must accompany a change in material velocity.

The stable repetitive interaction between two primary distortion processes is mediated by the gravitational distortion. For the velocity of the compound process as a whole to increase or decrease, this stable repetitive interaction must be altered. However, this stable repetitive interaction is resistant to change because the pattern of propagation of each primary distortion process continuously reinforces the pattern of propagation of the other and, through feedback, then continuously reinforces its own pattern of propagation. This situation has been defined as *interactive-process stability*, and the compound process (i.e., matter) that exists as a result of this situation has been likened to the *pattern integrity* that is created by tying a rope into an overhand knot.

Inertia is simply the difficulty in changing the self-binding and mutually reinforcing pattern of primary-distortion-process interaction. In other words, inertia is essentially the manifestation and result of interactive-process stability. The self-binding and mutually reinforcing pattern of primary-distortion-process interaction is what tends to keep compound processes traveling at the same velocity in the same direction. Putting it another way, matter tends to travel through space-time at the same velocity in the same direction because its internal structure is mutually reinforcing. That mutual reinforcement of material structure, caused or mediated by the gravitational distortion, is what we perceive as inertia.

Inertia, then, which is the property of matter that causes it to resist any change in either velocity or direction, is defined, within the context of the relational-matrix model, as the resistance of matter to any change in the self-binding and mutually reinforcing relationships between the component processes that make up matter.

The patterns of propagation of all the primary distortion processes that are stably and repetitively interacting to form a material object are interconnected, since each pattern of propagation helps to create the environment that causes the patterns of propagation of all the others, and, through feedback, also helps to cause its own pattern of propagation. Therefore, because of interactive-process stability, because of this interconnection between primary distortion processes that are stably and repetitively interacting to form a material object, the pattern of propagation of even a single one of those primary distortion processes can't be changed without a concomitant change in the patterns of propagation of all the other primary distortion processes to which that one primary distortion process is connected.

Thus, overcoming inertia means overcoming all of these self-binding and mutually reinforcing patterns of propagation simultaneously. The more primary distortion processes that are stably

and repetitively interacting to compose a material object, the greater the number of these self-binding and mutually reinforcing patterns of propagation there are that must be overcome, and thus the greater the inertia of that matter. As we shall see, the mass of matter is directly proportional to the number of primary distortion processes that are stably and repetitively interacting to compose it. This is why, in general, larger masses have greater inertia, because they have more self-binding and mutually reinforcing patterns of distortion-process interaction that must be overcome for the velocity or direction of the compound process as a whole to be altered.

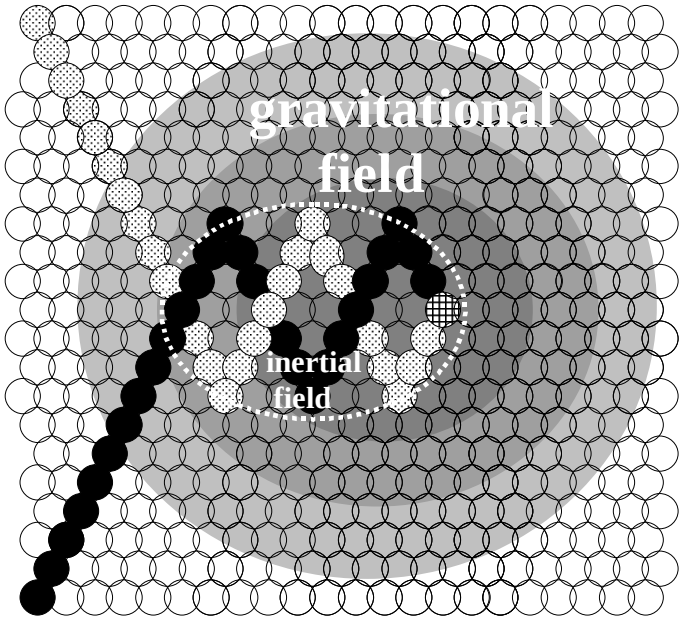
Having examined the concept of inertia within the context of the relational-matrix model, we are now in a position to examine and understand why Einstein was once again correct when he proposed in his general relativity theory that the gravitational and inertial forces are identical.

9.3 *The basis of gravitational and inertial equivalence*

To understand the singular identity or unity of the gravitational and inertial forces, we must first examine the differences in the effects these two forces have upon matter. The inertial force keeps matter moving at the same velocity in the same direction, whereas the gravitational force causes matter to change its velocity and direction. So, the inertial force is the force of stability, and the gravitational force is the force of change. Therefore, according to Einstein and our own observation, the force that stabilizes the motion of matter, and the force that changes the motion of matter, are identical.

But how can the same identical force exert apparently opposite effects upon matter? Putting it another way, how can two seemingly different forces that affect matter in opposite ways actually be the same identical force? Because how matter is affected depends on how it is approached.

As shown in **figure 54**, the gravitational gradient, acting upon matter *from the outside in*, is what changes matter's velocity and direction; whereas the gravitational gradient, acting upon matter *from the inside out*, is what stabilizes matter's velocity and direction. Thus, both gravitation and inertia are a function of the radial component of the linear/radial distortion complex, i.e., a function of the gravitational component of the EMR-gravitation complex.



The Unity of the Gravitational and Inertial Forces

Figure 54 The unity of the gravitational and inertial forces, depicting both of those forces as the same identical force, i.e., as the gravitational distortion, acting upon matter (a compound process) from opposite orientations: from within, as inertia, and from without, as gravitation. Here, two primary distortion processes (black and stippled circles) are stably and repetitively interacting to form a compound process (i.e., matter), defined by the dotted white line. As in all compound processes, the electromagnetic components twist around or orbit one another, each bound into that pattern of propagation by the other's gravitational component (gray areas). The gravitational distortion, acting from within the matter to stabilize its dynamic structure, is observed as the force of inertia (shown here as the inertial field). Also, as the electromagnetic components twist around or orbit one another, the compound process becomes surrounded by a radially dissipating gravitational distortion gradient—i.e., by a gravitational field. The gravitational distortion that exists outside the matter is able to attract other matter, and is observed as the attractive force of gravitation. As depicted here, the forces of inertia and gravitation are both manifestations of the gravitational component of the EMR-gravitation complex, as that gravitational component exists, respectively, internal to and external to the compound process. There's really no definite boundary where one force stops and the other starts; there's only a continuum of distorted of spatial content. Thus, the difference between what we observe as the gravitational effect upon matter and what we observe as the inertial effect upon matter is simply in the orientation or direction of the gravitational distortion relative to the compound process it's acting upon. Acting from within, the gravitational distortion stabilizes the dynamic structure of matter, functioning then as the force of inertia. Acting from without, the gravitational distortion is attractive to other energy and matter, functioning then as the force of gravitation. We could then say that inertia is actually "internally applied gravitation" or, conversely, that gravitation is actually "externally applied inertia."

Thus, the same force can act upon matter in opposite orientations, from opposite directions, to produce an observationally opposite effect upon matter. That is, the force that changes the dynamic state of matter (gravitation), and the force that stabilizes the dynamic state of matter (inertia), are the same force, with the difference being in the direction from which that force is acting upon the matter. That is, if a gravitational distortion originating from outside the matter acts upon other matter, it acts as a gravitational field, as a force of change. However, if a gravitational distortion originating from inside the matter acts upon the matter, it acts as an inertial field, as a force of stability. Same force, different effects. In other words, in-ertia is gravitation, as that force is applied from with-in matter, rather than from with-out.

If mass A is drawn toward a larger mass B, this change in its motion is caused by the force of gravitation. In this case, the gravitational distortion is acting upon mass A from outside mass A, originating from mass B. Conversely, if we try to move a heavy object horizontally, we are resisted in our efforts by the force of inertia. In this case, the gravitational distortion that's acting upon the matter to stabilize its velocity and direction originates from within the matter itself. In both cases, that of change (gravitational force) and that of the resistance to change (inertial force), the same identical force—i.e., the radially propagating gravitational distortion—is what causes these opposite effects.

For an externally applied gravitational field to change the motion of matter, it must ultimately act within the matter, changing the internal gravitational environment of the matter. Once the matter's internal gravitational environment has been changed, thereby altering the stable repetitive pattern of primary-distortion-process interaction, that alteration is self-sustaining because it represents a new self-binding and mutually reinforcing relationship between the component processes that make up the matter. It takes nothing to keep matter going at the velocity and in the direction it's already going, because that velocity and direction are intrinsic to the dynamic structure of matter itself.

Changing the motion of matter means changing the pattern of component-process interaction. Such a change requires that the internal gravitational environment which currently sustains the matter must itself change. If the internal gravitational environment remains the same, there's no reason for the motion of the matter not to remain the same, i.e., for the matter to keep going at the same velocity in the same direction. Since the gravitational distortion is what binds the electromagnetic components of a compound process into the stable repetitive pattern of interaction that is matter, an alteration of the internal gravitational environment is then what's necessary to change that pattern of component-process interaction, thereby increasing or decreasing the velocity of the matter.

The gravitational force, as it's applied from outside matter, causes an acceleration or deceleration of the matter by altering the degree of linearity of propagation of the primary distortion processes that are stably and repetitively interacting to compose that matter. Once the degree of linearity of propagation of the primary distortion processes is altered, establishing a new pattern of component-process interaction, the external gravitational field can be withdrawn, and the compound process as a whole will continue to travel at its new velocity. An "applied from the outside" gravitational force is needed to alter the pattern of component-process interaction,

because it's needed to overcome the "applied from the inside" inertial force. The "applied from the outside" gravitational force is needed to change the internal gravitational environment (i.e., the inertial field) that's binding and sustaining the matter in its current velocity and direction.

However, that externally applied gravitational field isn't needed to maintain a pattern of component-process interaction once such a pattern of component-process interaction is established. That is, once an externally applied gravitational field has altered the motion of matter, that external field isn't needed to sustain the matter in its new velocity and direction. For, once established, any pattern of component-process interaction is self-binding and self-sustaining, since any pattern of component-process interaction must be one that's supported and reinforced by the gravitational distortions associated with the primary distortion processes themselves. That is, primary distortion processes can't be forced into a new pattern of interaction by an externally applied gravitational field unless such a pattern of interaction is one that's allowed and subsequently reinforced by their own associated gravitational distortions.

The concept presented in the preceding paragraph requires further elaboration. Let's say that we impose, from the outside, a gravitational field upon an object, increasing its velocity. Let's say that we then withdraw that field. The object will continue to travel at its new velocity. Why doesn't the object revert back to the velocity it had before the external application of the gravitational field, since the external gravitational environment has been restored to its previous state? Because the external application of the gravitational field has, by altering the self-binding and mutually reinforcing relationships of the component processes making up the matter, caused a persistent change in the internal gravitational environment (i.e., the inertial field) that now sustains the new pattern of component-process interaction.

Once the external gravitational field is removed, the velocity of the compound process will stop increasing—i.e., the matter will stop accelerating. However, now the compound process as a whole will continue on at the new velocity determined by the new pattern of component process interaction that was induced by the externally applied gravitational field. The compound process doesn't revert back to its old velocity (or pattern of component-process interaction) because the new pattern of component-process interaction is self-binding and self-sustaining. It takes the application of an external gravitational field to the compound process to change the internal gravitational environment that sustains the pattern of component-process interaction, but once a new pattern of component-process interaction is established, it's sustained by the new internal gravitational environment (i.e., the inertial field).

To summarize, the gravitational and inertial forces are the same identical force because they represent the same fundamental reality, i.e., the radial component of the linear/radial distortion complex, as it acts upon matter from complementary directions—i.e., from within as the stabilizing inertial force, and from without as the accelerating or decelerating gravitational force. It's the same force, the same field, the same distortion of spatial content, with the difference being in whether it's applied from inside or outside the compound process (i.e., matter). Applied from without, the gravitational field alters the degree of linearity of propagation of the component processes, resulting in acceleration or deceleration of the compound process. Applied from within, existing as the inertial field, the gravitational distortion is the force that stabilizes and reinforces, through interactive-process stability, whatever pattern of component-process

interaction currently exists, resulting in a constant velocity and direction for the compound process as a whole.

9.4 *Mass, the relativity of mass, and the relational matrix*

Until now in this book, compound processes have been referred to as "matter", rather than as "mass". To some degree, the term *mass* is synonymous with the term *matter*, yet they aren't precisely the same thing. All matter has mass, but the mass of the matter depends on the material velocity. This relativity of mass is part of Einstein's general relativity theory.

In this article, *matter* is used as a more general term, referring to the compound processes formed through the stable repetitive interaction of primary distortion processes. In this subsection, the particular attribute of compound processes that's responsible for the mass associated with matter will be described—as always, within the context of the relational-matrix model—as in some way related to material velocity.

Mass is defined as representing both the amount of matter that an object contains, and the inertial property of that object. The concept of *inertia* has already been related to the gravitational distortion. Therefore, we will describe mass as a reflection of the strength or size of the gravitational distortion associated with a compound process. As already described, the greater the distortion content of the radially distributed gravitational distortion surrounding the electromagnetic components of a compound process, the greater its associated gravitational distortion, both externally as a gravitational field and internally as an inertial field.
The strength or size of the gravitational distortion associated with a compound process is based on two factors: (1) the number of primary distortion processes interacting to form the compound process (i.e., matter), and (2) the degree of linearity of propagation of the component processes making up the compound process—i.e., the material velocity. We will now examine both of these factors to see how each contributes to the mass associated with matter.

It's fairly easy to understand why the gravitational distortion and, thus, mass would increase with an increasing number of component processes. As primary distortion processes twist around or orbit each other to form a compound process, their gravitational components overlap additively, and so increase the distortion content in the area where they overlap. Therefore, as more primary distortion processes interact to compose the matter, there's increasing overlap of the gravitational distortions, creating a larger total associated gravitational distortion, as depicted in **figure 55**.

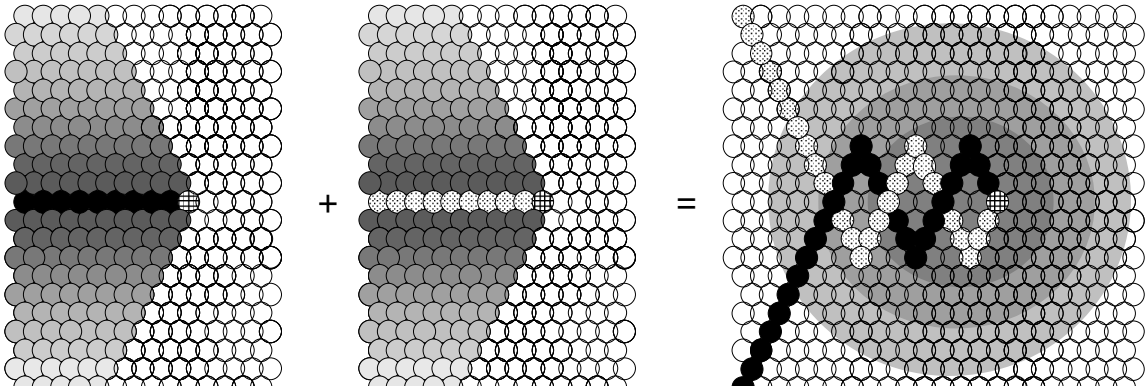


Figure 55 The mass of the matter is most obviously and directly related to the number of primary distortion processes that are stably and repetitively interacting to compose the compound process as a whole. The two drawings to the left show two linearly propagating primary distortion processes (black and stippled circles). As those two primary distortion processes stably and repetitively interact to form a compound process or matter, the gravitational distortions (gray areas) associated with each component process additively overlap, creating a relatively greater gravitational distortion, both internal and external to the compound process. The more primary distortion processes interact to compose the matter, the greater is the additive overlap of the gravitational distortions, internally increasing the inertial field and externally increasing the gravitational field, resulting in the measurement of a larger mass for the material object, since mass is a measure of the inertial property of matter. However, since mass varies with material velocity, mass must represent more than just the simple summation of the gravitational distortions associated with the component processes.

We have established that the mass which matter is measured to have is a function of the gravitational distortion associated with that matter, as that gravitational distortion functions external to the mass as a gravitational field and internal to the mass as an inertial field. Since a change in material velocity doesn't alter the number of component processes making up matter, the total gravitational distortion associated with matter can't be equivalent to the simple summation of the gravitational components, because mass is relative, varying with material velocity. For this reason, the total gravitational distortion associated with matter is directly related to, but not equivalent to, the summation of the gravitational components of all the primary distortion processes which are stably and repetitively interacting to form the matter.

Therefore, if mass is a function of the total gravitational distortion associated with matter, and mass varies with material velocity, then the total gravitational distortion associated with matter must be altered in some way by a change in material velocity. We will now explore how a change in material velocity alters the total gravitational distortion associated with matter, resulting in the observed relativity of mass.

To understand how a change in material velocity affects the distribution of the gravitational distortion associated with matter and so affects the mass of matter, we must first understand that the total gravitational distortion associated with matter consists of both the gravitational

distortion currently being radiated by the compound process (which is the simple summation of the component gravitational distortions previously discussed), as well as any residual gravitational distortion previously radiated by the compound process, which the compound process is now catching up to. How does matter, if it's traveling through space-time at less than the speed of light, catch up to previously radiated gravitational distortions that are propagating at the speed of light?

Matter is able to catch up to some of the gravitational distortion it previously radiated because, although those gravitational distortions propagate radially away from the matter at the speed of light, they also propagate in all directions, and so some gravitational distortion is always coming back toward the compound process and adds to the gravitational distortion currently being radiated. Distortion propagation is a function of the ongoing exchange of reality-cell content, which is occurring in all directions simultaneously. Therefore, although the gravitational distortion has been described as outwardly radiating, owing to the omnidirectional exchange of reality-cell content, some gravitational distortion propagates backward in the direction from which it came—i.e., back toward the matter. This situation is, in a limited way, analogous to what happens to a boat traveling so slow that its wake goes to the shore and is reflected back to rock or affect the motion of the boat. These two components making up the total gravitational distortion associated with matter are depicted in **figure 56**.

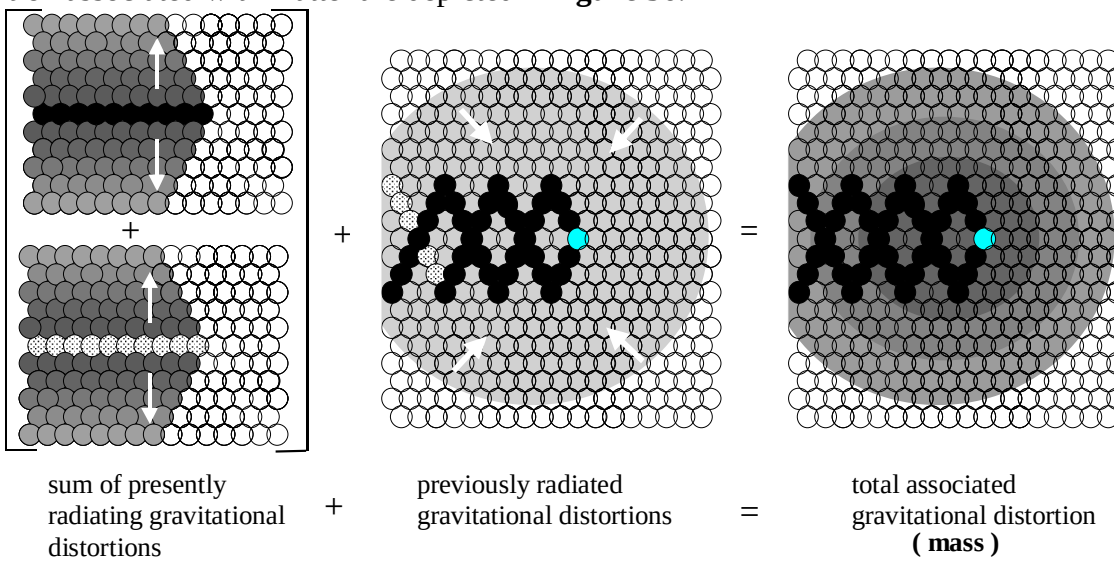


Figure 56 The two factors that contribute to the total gravitational distortion, both internal and external, associated with matter, depicting how those factors determine the mass of matter. The total gravitational distortion (i.e., mass) associated with matter (far right) is the sum of the gravitational distortions presently being radiated by the component processes (far left), plus the now-dissipating gravitational distortion previously radiated by the matter, which the matter is now propagating into (center).

The contribution to the total gravitational distortion made by the simple summation of the gravitational distortions associated with the component processes (left) is independent of material velocity, since the number of component processes doesn't change with changes in material velocity. The contribution to the total gravitational distortion made by the encountered

previously radiated gravitational distortion (center) is what varies with material velocity, and it's this component of the total gravitational distortion associated with matter that's responsible for the relativity of mass as a function of material velocity.

How does a change in material velocity alter the amount of previously radiated gravitational distortion encountered, and so alter the mass of the matter? In general, the higher the material velocity, the greater the distortion content of the previously radiated gravitational distortion when it's encountered, because it has had fewer periods of content exchange (i.e., less "time") in which to dissipate or become diluted, resulting in overall greater distortion content associated with the matter and, therefore, relatively more mass, as a measure of the relative increase in the inertial and gravitational fields associated with the matter. Conversely, the lower the material velocity, the less the distortion content of the previously radiated gravitational distortion when it's encountered, because it has had more periods of content exchange (i.e., more "time") in which to dissipate or become diluted, resulting in overall less distortion content associated with the matter and, therefore, relatively less mass, as a measure of the relative decrease in the inertial and gravitational fields associated with the matter. The relationship between material velocity and the distortion content of the previously radiated gravitational distortion encountered by the matter is, then, the basis of the relativity of mass, as depicted in **figure 57**.

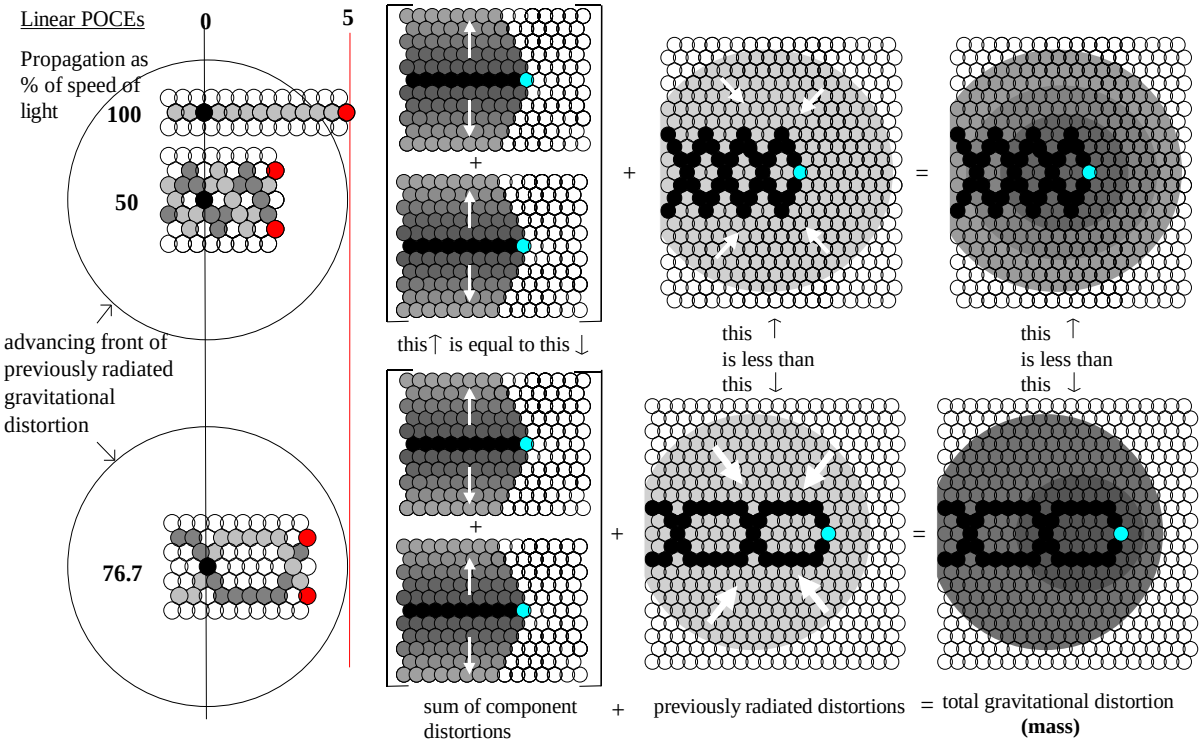


Figure 57 The relationship between material velocity and the gravitational distortion associated with matter, measured as mass—more specifically, the relationship between material velocity and the distortion content of the previously radiated gravitational distortion encountered by matter. In these diagrams, two otherwise-identical compound processes with only different material velocities are compared, with the compound process at the top having a lower velocity than the compound process at the bottom. The

> diagram on the left shows that the matter with a higher velocity (bottom left) stays much closer to the advancing front of the gravitational distortion that it previously radiated. The large circles represent the advancing front of the gravitational distortion after five periods of content exchange (POCEs). The compound process propagating at 50% of the speed of light is farther from its advancing front than is the compound process propagating at 76% of the speed of light after those five POCEs. What this means is that the compound process with a higher velocity is catching up to its previously radiated gravitational distortion with that distortion in a state of less dilution (i.e., a state of greater distortion), because the previously radiated gravitational distortion has had fewer POCEs (i.e., less "time") in which to dissipate or become diluted. Thus, previously radiated gravitational distortion with greater distortion content is added back to the matter traveling at a higher velocity, giving it a relatively greater total associated gravitational distortion—i.e., relatively more mass. Here, then, is depicted the basis of Einstein's relativity of mass, which holds that the mass of a material object increases as material velocity increases.

To summarize, the compound process with higher velocity has relatively more total associated gravitational distortion than the compound process with a lower velocity, giving the matter with a higher velocity more mass, since mass is a measure of the total associated gravitational distortion as manifested in the matter's gravitational and inertial properties.

This way of understanding why mass is relative to material velocity also helps to explain why the relativity of mass becomes significant only at material velocities that approach the speed of light. That explanation is as follows. The gravitational distortion diminishes in distortion content exponentially as it propagates. This exponential diminishment or dilution of distortion content can be inferred from the fact that the attractive force of gravitation decreases as the square of the distance from its point of origin. For example, doubling the distance between two particles will make the force of gravitational attraction between them one quarter as great as it was; quadrupling the distance between two particles will make the force of gravitational attraction between them one-sixteenth as great as it was, and so on. Therefore, at very low material velocities—i.e., far less than the speed of light—the dissipating distortion content the matter catches up to would be exponentially less, and so the previously radiated gravitational distortions would compose an exponentially smaller percentage of the total gravitational distortion associated with the matter, thereby having an exponentially decreasing effect upon the mass of the matter as a reflection of that total gravitational distortion.

However, as material velocity increases, approaching the speed of light, the dissipating distortion content the matter catches up to would increase exponentially. Therefore, as material velocity increases, the previously radiated gravitational distortions would compose an exponentially larger percentage of the total gravitational distortion associated with the matter, thereby having an exponentially increasing effect upon the mass of the matter as a reflection of that total gravitational distortion. For this reason, the effect of the relativity of mass varies exponentially as a function of material velocity as a percentage of the speed of light. Here, once again, the relational matrix model provides us with a relatively simple explanation of a seemingly complex phenomenon.

According to Einstein's relativity theory, if the velocity of a material object were to reach the speed of light (which it can't and still remain matter), the matter would have an infinite mass. This prediction is consistent with the model of mass presented here, because at the speed of light, the component of the total gravitational distortion that is the sum of the gravitational distortions radiated by the component processes would be the same as the previously radiated gravitational distortion, creating an endless feedback of the radiating gravitational distortion into itself, in theory causing the total gravitational distortion to be infinite, thereby causing the mass to be infinite. Again, however, for reasons previously discussed relating to the dynamic structure of matter, such a situation is also impossible, because matter can't travel at the speed of light and remain matter.

All of these different aspects of material reality—i.e., mass, time, and velocity—are interrelated and are thus said to be relative, because they're all different aspects of the dynamic structure of matter, which itself extends from the underlying and unifying dynamic structure of space. We can't change one aspect without changing the other aspects, because, although we may give them different names, they remain inseparable as different aspects of the same interconnected whole. To understand why and how changing one aspect of material reality causes a change in the other aspects, we must understand the dynamic structure of matter. To understand the dynamic structure of matter, we must first understand how matter exists as an extension of the dynamic structure of space, and such an understanding has been provided here by modeling space as a relational matrix.

Section 10 The Underlying Unity of the Spatial Structure

Space-time, being composed of existence that has formed relationships with itself, is inseparable from itself. Although we have defined the relational matrix in terms of reality cells, which themselves have been depicted as spheres or circles, it's important to understand that these reality cells don't really have a truly defined or circumscribed existence. That is, even though a reality cell is defined by a circular line or boundary, that line doesn't actually serve to separate existence on one side of the line from existence on the other side of the line. Rather, that line serves only to denote that a relationship exists between dualized aspects of relative existence.

Relative existences, though different, aren't separably existent, inasmuch as they're mutually coexistent. Thus, the relational structure of space-time is constructed out of inseparable existence, out of relative existences that may be spatially separate but aren't existentially separable.

In relative existence, each relational pole of a relational pair contains part of the other relational pole. This sharing of existence between relative realities is represented in the *T'ai-chi T'u*, where within the yin there's yang, and vice versa. The yin doesn't exist as such except in relation to yang; the yang doesn't exist as such except in relation to yin. Therefore, implicit in the existence of each relational pole is also the existence of the other. In this way, each relational pole also contains its opposite or complementary pole.

If we apply this principle of shared existence between relative realities to the relational matrix, it becomes possible to see how two reality cells that are separated by spatial distance can share a common existence and thus have a connection that transcends spatial distance, as depicted in **figure 58**.

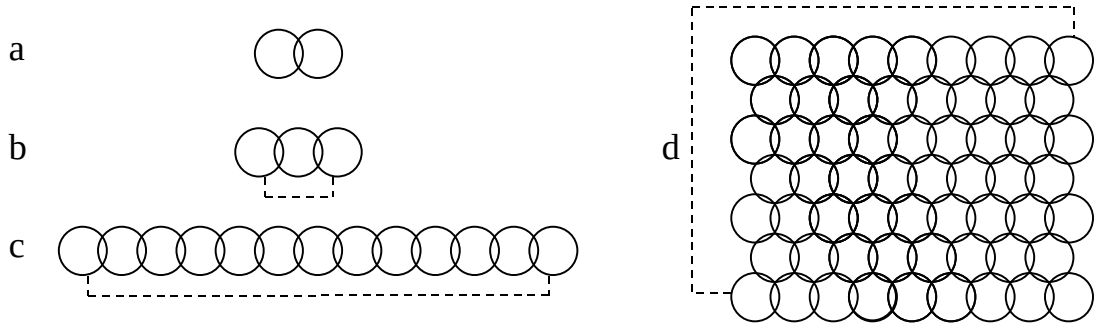


Figure 58 How reality cells that are spatially separate have a connection that transcends spatial distance. Implicit in the existence of each reality cell is the existence of the reality cells it exists in relation to. This shared existence between adjacent reality cells is depicted by the overlap between adjacent reality cells. In figure a, it's evident that each reality cell shares part of its existence with the adjacent reality cell. However, because of this shared existence between adjacent reality cells, there's also a shared existence between reality cells that aren't directly adjacent to one another, as depicted in figure b. That is, the reality cell on the far left in figure b contains part of the existence of the reality cell on the far right, because the reality cell between them, which seems to separate them, contains some of the existence of each. Essentially, what exists here also exists there, although there seems to be something else in between. This logic can then be extended to reality cells that have many intervening reality cells between them, as depicted in figure c. In figure c, the two reality cells at each extreme share part of their existence, because all of the reality cells between them contain some of the existence of all the others. Again, what exists here also exists there, although there seems to be something else in between. This shared existence between reality cells implies an underlying unity that defies the apparent spatial separation between them. In figure d, this logic is applied to the two-dimensional relational-matrix diagram to show that all reality cells share existence and thus are connected in a way that defies spatial separation.

Throughout this discussion, as the pieces of reality are brought together in the form of a unified whole, it's important to remember that the pieces we're talking about ultimately represent existence which has formed relationships with itself, and although forming these relationships requires that existence become differentiated within itself, such differentiation doesn't actually separate existence from itself.

In Articles 4 & 5 of this work, we will examine how existential self-relation, or differentiation, creates our experience of existence as divisible or separable from itself. For now, all we can do is point out that what we experience as the apparent separability of existence from itself is an

artifact of the experiential process, a byproduct of the experiential level of existential self-relation, and that the more fundamental reality is one of existential unity or inseparability.

Therefore, although we may perceive spatial separation between the apparently separate parts of physical reality, the underlying reality is one of nonseparation. That is, although at one level we can perceive spatial separation, at another level the reality of that perception doesn't operate, because at that level the operant reality is one of unity.

This existential connection, this nonspatial connection, is real, it exists, but by its nature it can't be experienced; it can only be understood to exist as a natural consequence of the relational nature of the spatial structure, including the existence of that spatial structure as the product of the successive dualization of a singular existence, as depicted in **figure 59.**

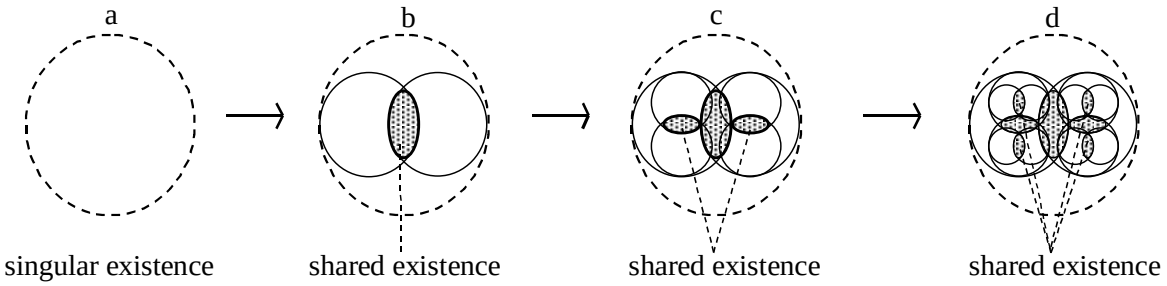


Figure 59 How the successive dualization of a singular existence creates an existential connection that defies spatial separation. As existence successively dualizes, thereby forming the relational structure of space-time, reality cells are created that are spatially separate—i.e., they appear to have spatial distance or "space" between them. Yet if we consider the distribution of spatial content as this successive dualization occurs, we can see that spatial content must be shared by reality cells which appear to have "space" between them.

As singular existence (a) dualizes into relative realities (b), there's a shared existence (stippled area), a nonseparation, between these relative realities. As these relative realities themselves dualize (c), each new relative reality itself contains some of this shared existence. As these relative realities again dualize (d), again each new relative reality itself contains some of this shared existence. At the level of dualization depicted in figure d, although spatially separate reality cells can be identified, a sharing of spatial content can also be identified. This sharing of spatial content is what connects reality cells, thereby transcending and defying the apparent spatial separation between them.

Regardless of how many times existence dualizes as it forms higher order relationships with itself, thereby evolving into different levels of reality, existence remains throughout singular and interconnected, inseparable from itself. Although we experience reality in apparently separate pieces, the more fundamental reality from which that perception arises is one of singularity, connection, and nonseparation. Each part of the spatial structure, each reality cell, contains some of the existence of all the other reality cells. So, in a very real way, each part of the relational structure of space-time is a reflection of the unified whole from which it extends.

10.1 *The extension of physical reality from the spatial structure*

In part II of this book, we will explain the experiential process, detailing how compound distortion processes come to be experienced as defined physical-material realities. However, at this time, we will continue to ignore the role that the experiential process plays in the formation of what we experience as physical reality, and for simplicity treat matter and compound distortion processes as synonymous.

Physical reality is inseparable from space-time. What we observe as matter is space-time that has formed a relationship with itself. Matter, as a compound distortion process, represents another level of existential self-relation, another way in which existence forms a relationship with itself.

Each level of existential self-relation forms the basis for the next level of existential self-relation. By repetitively and progressively existing in relation to itself, existence has evolved stagewise into what we experience as physical reality, as summarized in **figure 60**.

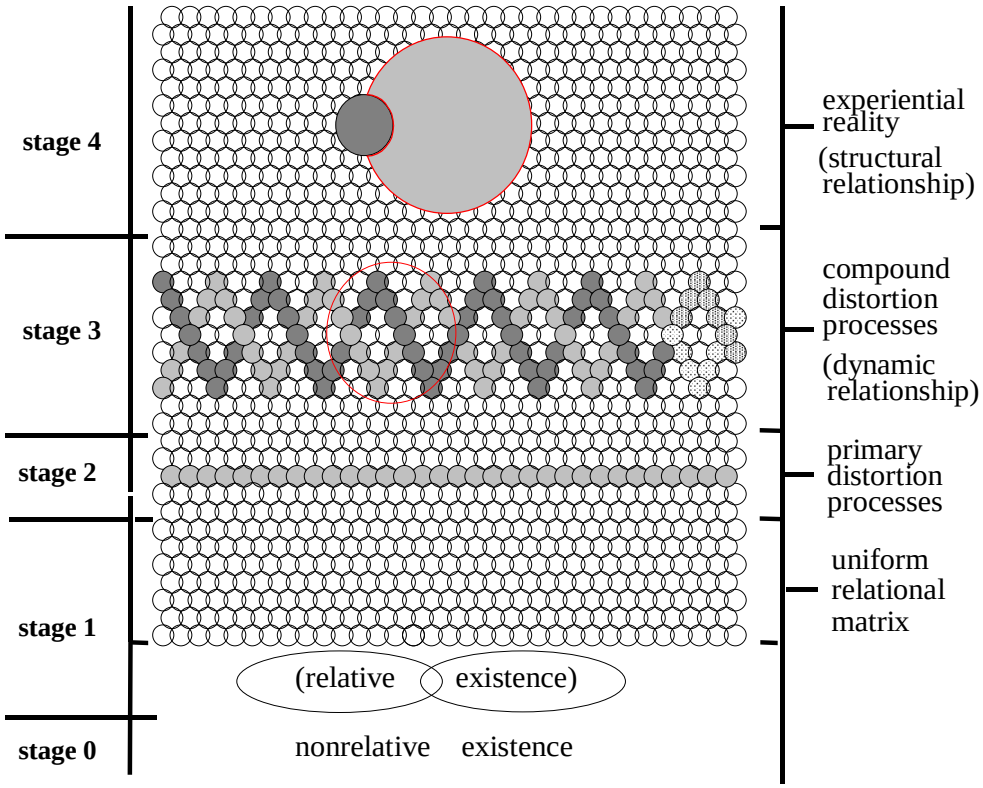


Figure 60 From the bottom up, the stagewise evolution of existence through a process of repetitive and progressive self-relation, leading ultimately to existence's experience of itself. In the first stage, existence successively dualizes, or repetitively and progressively exists in relation to itself, creating the relational structure of space-time.

> In the second stage, existence as this dynamic structure of space then exists in relation to itself again, forming the uniformity/distortion duality, or the nonenergy/energy duality. In the third stage, existence forms another relationship with itself, as primary distortion processes stably and repetitively interact with one another, creating the compound distortion processes we call matter or material objects. In the fourth stage, another level of existential self-relation is formed, as compound distortion processes interact with other distortion processes, thereby creating the experiential level of reality, including what we experience as physical reality. How experiential reality is formed in this fourth stage will be discussed in detail in part II of this book. This experiential relationship is depicted as the compound process (large stippled circle) being impacted by a primary distortion process or another compound distortion process (smaller stippled circle).

What we experience as physical reality represents a differentiation of the spatial structure. This differentiation occurs as a result of that spatial structure repetitively and progressively existing in relation to itself. Differentiation doesn't mean division; rather, differentiation means difference in the context of underlying unity. Your body is differentiated, having different aspects that are parts of the unified whole which is you. Your arm extends from your trunk. Your arm is different from your trunk, yet nowhere is there any real separation of one from the other. Likewise, physical reality is different from the spatial structure, yet not in any way separable from that structure. In this way, what we experience as physical reality exists as an extension of the spatial structure, as depicted in **figure 61**.

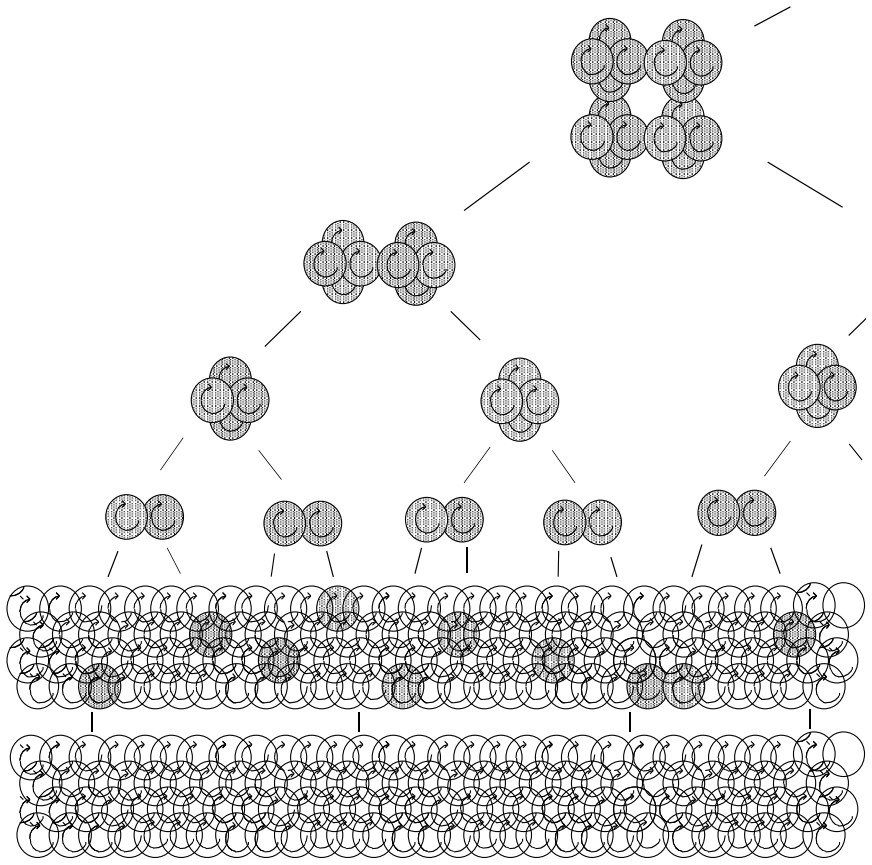


Figure 61 Physical reality as an extension of the spatial structure. Physical reality represents another level of existential self-relation, extending from the foundation of previous levels of existential self-relation. This point is being made to stress that physical reality is in no way separable from the relational structure of space-time, because physical reality is not other than space-time that has formed relationships with itself, and space-time is not other than existence that has formed relationships with itself.

From the bottom up: (a) the uniform relational matrix or spatial structure ; (b) the relational matrix with primary distortion processes, which have the same invariant structure and dynamic as the spatial structure itself, represented by the curved vector within the small stippled circles; (c) primary distortion processes interacting to form higher-level compound processes (i.e., matter), depicted as extending from the spatial structure.

For reasons to be explained in part II of this book, we experience physical reality in the form of material objects, with those forms appearing to exist separate and independent of each other. Although this apparent separation between material objects is experientially real, it's not ultimately real. That is, at one relational level of reality, at the level of our normal sensory experience, the apparent separation between material objects is the functional reality. However, at other relational levels of reality, at the relational levels of reality that precede the experiential level and that are the foundation of our experience of physical reality, the apparent separation between material objects doesn't exist and doesn't operate.

Since physical reality is inseparable from the spatial structure and space-time is inseparable from itself, physical reality, though appearing to exist in separate parts, can't exist in the form of truly or ultimately separable parts or objects, because all physical reality must be interconnected through the underlying unity of the spatial structure from which it extends. In the next section, we will examine how this unbreakable connection may be responsible for some of the strangeness encountered in quantum theory.

Section 11 Quantum Theory and the Relational Matrix

In the preceding sections, we have related structure to function. Specifically, we have related the dynamic structure of space-time to some of the ways in which physical reality is observed to function. Within that context, we have described space-time as a kind of machination, the operation of which produces what we eventually experience as physical reality.

Machines are dynamic structures; they have parts that work together to do whatever it is the machine as a whole does. Space-time has been described as a dynamic structure; it has parts called reality cells, and those reality cells work together to form what we experience as physical reality. However, the reality cells, unlike the parts of physically experienced machines, have no existence independent of the spatial structure of which they're a part, no existence independent of the other parts of the spatial structure. In this way, while space at one level functions as a

machine, at another level it has qualities that transcend the concept of a machine and defy machine-like, or cause-and-effect, descriptions.

Both the classical physics of Newton and the relativistic physics of Einstein mathematically describe the machine-like aspects of physical reality. That is, they describe those aspects of physical reality that exist as the manifestation of the machine-like functioning of the spatial structure, wherein there are assumed to be independently existent parts.

In classical physics, the relationship between physical reality and space is analogous to the relationship of billiard balls to a pool table. Material objects are envisioned as existing in an ether, separate from space and separate from each other. In classical physics, the behavior of physical reality is described as the interactions of these billiard balls, where the only relationship of the balls to the table is that the table gives the balls a place to be.

In relativistic physics, the inseparability of physical reality from the spatial structure is taken into account. In relativistic physics, the behavior of physical reality is still described to be like the interaction of billiard balls, of separately existent material objects. However, in relativistic physics, a connection is made between the material structure of the billiard balls and the material structure of the pool table upon which the game is being played. The balls are seen to move not independently of the table but as extensions of the table. What were previously thought to be absolute and independent physical characteristics, such as time and mass, are seen to be relative and dependent on each other through the underlying spatial structure from which all material objects extend.

Because the treatment of space-time and physical reality as a machine does have a limited validity, the classical and relativistic descriptions of physical reality also have a limited validity—i.e., they don't tell the whole story. Enter quantum theory.

While quantum theory may or may not tell the whole story, what it does do is take the whole story, the description of physical reality, to the next level. In quantum theory, the ultimate inseparability of existence from itself comes into play. In this section, we will make the case that quantum theory is the strange theory it is because it deals with the level of existence at which the ultimate interconnection and underlying unity of reality become unavoidable.

Quantum theory is the most accurate method physicists now have of predicting the behavior of physical reality. Yet quantum theory is a very strange theory, indeed, in that what it says about the nature of physical reality makes little sense, inasmuch as it doesn't correspond to our normal sensory experience.

This strangeness includes wave/particle duality, whereby the state of an object depends on how it's observed. It also includes the uncertainty principle, or the inability to precisely define complementary aspects of an object, such as position and momentum, simultaneously. And it also includes nonlocality, what Einstein called "spooky action at a distance," whereby observing the state of one particle instantaneously determines the state of another, distant particle, as if they were a single entity. These and other seemingly strange phenomenon, predicted by quantum

theory and verified by experiment, aren't fully explainable in mechanistic, cause-and-effect terms.

The meaning of quantum theory—i.e., what it implies with regard to the nature of physical reality—is still a matter of great debate over which there's little agreement. In the most widely accepted view of quantum theory, called the Copenhagen interpretation, it's held that what we experience as physical reality doesn't exist in a definite or determinate state before observation and that it's the act of observation itself that somehow defines or determines the state of physical reality. For instance, according to the Copenhagen interpretation, before we measure the spin of an electron, it has no definite spin state. The relational-matrix model is in agreement with this aspect of the Copenhagen interpretation, as we shall see in part II of this book, where we discuss the basis of wave/particle duality and the uncertainty principle.

As mentioned at the beginning of this book, modern physics is moving toward understanding the universe as an interconnected whole. Concepts associated with quantum theory, such as nonlocality, point toward an underlying level of reality wherein what we experience as the separate objects of physical reality are really inseparable and so must be connected or interconnected. In addition, the concept of wave/particle duality associated with quantum theory points toward a level of existence at which the experiencer is inseparable from the experienced reality.

The relational-matrix model depicts an undivided, differentiated, interconnected reality wherein no part truly exists separate from any other part. In the next section, the aspect of quantum theory known as nonlocality will be explained as an expression of that underlying unity, of the unity intrinsic to the relational structure of reality. If we understand the fundamental framework of reality to be a relational matrix, a unified, interconnected, inseparable whole, then although we may not be able to fully grasp the nature of that reality, we can, within the context of understanding the underlying unity that exists as the foundation of reality, more clearly appreciate why quantum theory correctly describes physical reality as ultimately nongraspable, undefinable, and indeterminate.

11.1 *Nonlocality and the relational matrix*

As mentioned previously, quantum theory predicts a phenomenon called nonlocality, whereby observation and determination of the state of one particle simultaneously affects the state of another, distant particle, no matter how far apart those particles are. Thus, even though there's an apparent spatial separation between the particles, quantum theory predicts a more subtle level of interconnection, a nonspatial, or nonlocal connection. This theoretical nonlocal effect was experimentally demonstrated in what are called the Aspect experiments, after the French quantum physicist Alain Aspect.

Quantum particles, when observed, display certain characteristics. One of those is a spin state. These characteristics generally come in complementary pairs, such as an up or a down spin state. If two particles in a quantum system together have a zero spin state, then each particle must have the opposite spin state, although the precise state of each particle is indeterminate unless and

until it's observed. Yet, since they must have opposite spin states, determining the spin state of one of the particles through observation then theoretically determines the spin state of the other particle, since it must be the opposite.

This seems logical until we remember that, according to quantum theory, neither particle actually has a spin state until that spin state is observed. In quantum theory, the spin states don't just exist to be revealed by observation but are in some way the product of observation. So, observation and determination of the spin state of one particle then gives the other particle the opposite spin state.

Before the initial observation, neither particle exists in what could be called a definable spin state. Before the initial observation, each particle has only a potential spin state, which, when determined, has to be the opposite of the other particle's. In the experiments done to test the theory of nonlocality, the two particles are separated a relatively great distance, and the spin state of one particle is determined. The second particle, then, is always observed to be in the opposite spin state, demonstrating some kind of nonlocal connection between the particles.

The strange thing is that observation and determination of the spin state of one particle *instantaneously* determines the spin state of the other particle, no matter how far apart those particles are. The crux of the strangeness is, how does the second particle instantaneously "know" what the spin state of the first particle was determined to be, thereby "causing" it to be in the opposite spin state? How is information transferred between two apparently separate particles faster than the speed of light?

Many explanations to mechanically account for this phenomenon have been proposed. Most are so-called hidden-variable theories, which attempt to come up with some type of unseen cause-and-effect mechanism whereby one particle affects the other. These explanations, however, avoid the most obvious conclusion, which is that the apparent separateness of the particles is itself an illusion, isn't ultimately real, and that nonlocality is simply a manifestation of the ultimate unity underlying what we observe as separate physical objects.

The strangeness and unexpectedness of the phenomenon of nonlocality is predicated upon the assumption that the particles are, in fact, separate entities. While this assumption seems valid, since it corresponds to our normal sensory experience, it's nonetheless still just an assumption. In fact, it's an assumption that quantum theory itself defies.

The question is and remains, how does determining the spin state of one particle simultaneously determine the spin state of another, distant particle, one that's nonlocal? The answer lies in the unity implicit in the relational spatial structure, and, thus, in the unity implicit in physical reality as an extension of that relational structure.

Sometimes, in order to answer a difficult question, the question itself must be rephrased. Sometimes the difficulty in finding an answer lies in the form of the question, which implies the existence of a nonexistent state of reality and thereby precludes one from ever finding a valid answer.

For instance, we could ask, which came first, the chicken or the egg? The form of this question implies a linear cause-and-effect relationship between the chicken and the egg, and the question seeks to find the order of that relationship. The question in this form has no valid answer, because the relationship of the chicken and the egg isn't actually linear, or cause and effect; rather, it's cyclic, or relational. The chicken comes from the egg, and the egg comes from the chicken. Although this relationship appears in time as linear, as a whole the chicken exists in relation to the egg, and the egg exists in relation to the chicken, and so neither chicken nor egg exists as such except in relation to each other. The form of the question is invalid because it's based on a false assumption, one of linear causality. Therefore, the question in that form has no valid answer. The question is born of our perception, but our perception is illusory—i.e., it doesn't correspond to the underlying reality. Therefore, the question can't produce an answer that corresponds to the underlying reality.

The same situation exists when we try to understand nonlocality by asking, "How does determining the spin state of one particle affect the spin state of another, distant particle?" The question in this form implies and assumes that our observation of the two particles as separate entities is the total reality, the "whole picture." While this separation may be real at one level of reality, at the experiential level, if space-time is a relational matrix, as this book sets out to demonstrate, then that separation isn't ultimately real because it doesn't exist at the more fundamental level of reality from which physical reality extends.

If we approach the phenomenon of nonlocality with this understanding, we can understand why nonlocality exists and occurs. Instead of assuming that the particles are actually separate, let's assume the opposite, that they're not actually separate, but only appear separate because we can't perceive the unified structure from which they extend and to which they're connected, and which thereby unites them. This approach is based on what has been presented in this book to demonstrate that space-time functions as a relational matrix and that one of the properties of the relational matrix is an underlying unity and interconnection between its relational parts.

In order to understand nonlocality within the context of the underlying unity of the spatial structure, we will ask, "How can particles that appear separate be connected, and thus function as a single unit, thereby demonstrating nonlocal behavior?" Within this context, the question is also the answer. Nonlocality exists because what we observe as separate particles aren't ultimately separable entities, and so they can function in some ways as a single unit, as depicted in **figure 62.**

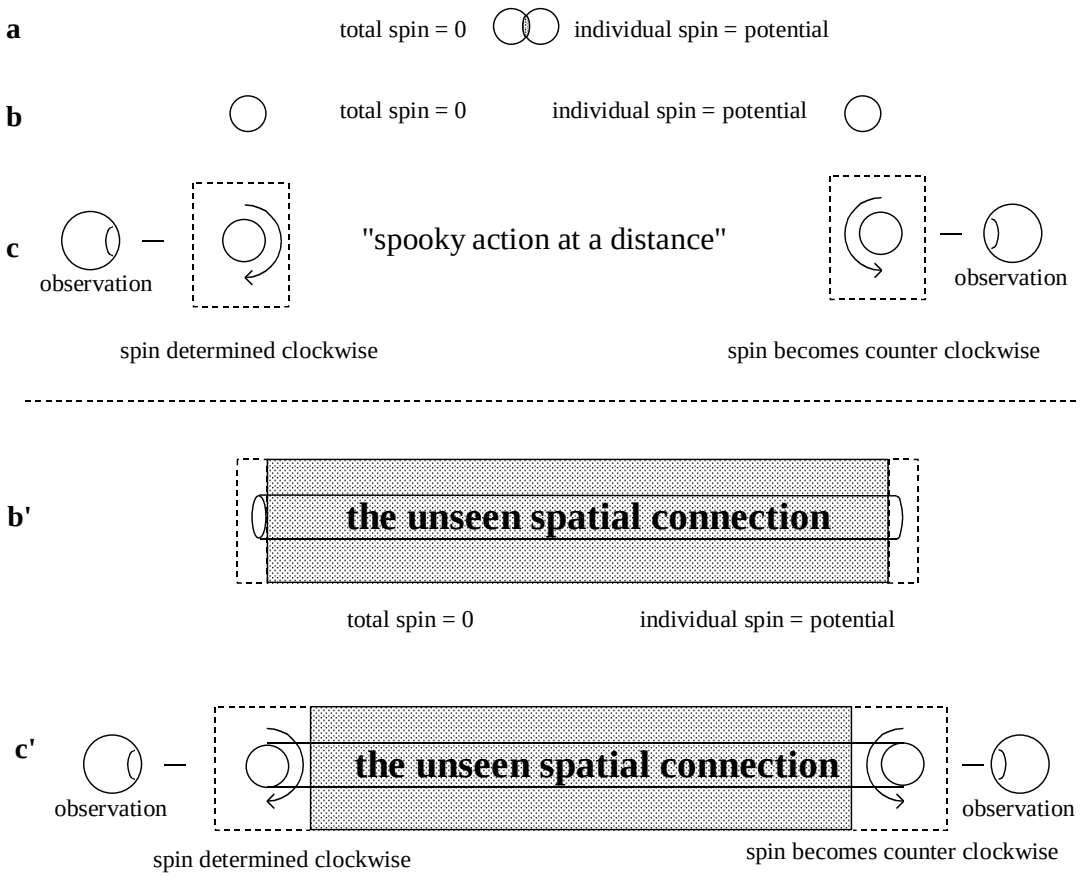


Figure 62 The unity underlying physical reality that's responsible for the phenomenon of nonlocality. There are two related factors to consider in the analysis of nonlocality: (1) that physical reality as it's observed to exist in any definite state, such as a certain spin state, is a product of observation; and (2) that what exists as a particle in our experience is inseparable from the relational structure of space-time and so is inseparable from other particles.

In figure a, two particles in a quantum state have indeterminate but opposite spin states. Those particles are separated (b), the total spin remains zero, and the spin state of each particle remains indeterminate—not only unknown but also nonexistent, only a potential. The spin state of one particle is determined, and simultaneously the other particle takes on the opposite spin state (c). If these particles are seen as separate physical entities, with no real connection between them, this effect is mysterious, or, as Einstein saw it, "spooky action at a distance."

However, if we take into account the underlying unity implicit in the relational structure of space-time, considering the separation of the particles to be ultimately an illusion, and therefore treat and model the particles as a single unit (b'), this nonlocal effect is understandable as the result of observation of the two complementary poles of a single unit (c'). Here, this is depicted as when one end of a rod is rotated clockwise, the other end is always seen to rotate counter clockwise. The stippled areas in both figures b' and c' represent the unseen spatial connection, the shared existence, between the particles implicit in the relational spatial structure. This unseen

spatial connection may be what allows the apparently separate particles to defy their observed spatial separation.

What are observed to be separate particles, separably existent material objects, are actually the complementary observational poles of an unobservable whole. If one observational pole is affected in one way, the other observational pole will simultaneously be affected in the opposite way. For instance, if the head of a coin is turned down, its tail is turned up. If the head faces north, the tail faces south. If one end of a rod is rotated clockwise, the other end is observed to rotate counter clockwise. This may be the basis of nonlocality.

Within the context of an underlying existential unity, nonlocality is neither spooky nor mysterious but both explicable and expectable, just as a magic trick is mysterious until we discover the nature of the illusion that was created to make the trick seem real. In this case, the illusion is the apparent separateness of physical reality imposed by the experiential process. How the experiential process functions to create the apparent separateness of physical reality will be the subject of chapter 1 of part II of this book.

11.2 *The meaning of quantum theory*

What's the true state of physical reality: the unity and indeterminacy that quantum theory implies, or the division and determinism that our experience implies? These seem to be incompatible states of being, yet they really aren't. Living on and experiencing the fourth floor of a building doesn't mean that the first, second, and third floors don't exist. Reality is structured in the same way. We live on the fourth floor of reality, the experiential level, which here has been defined as the fourth stage of existential self-relation (depicted in figures I, 2, and 60).

While on that experiential level, the reality of the preceding levels is obscured, yet they still exist, as they must exist in order to support the reality of the fourth floor. While we're on the fourth floor, the divisive quality of our experience is dominant. Yet this dominant divisive quality cannot and does not eliminate the existential unity that continues to exist on the first, second, and third floors of reality, from which existential unity the fourth floor extends.

Although we tend to think of reality in absolute terms, feeling that something must be either real or unreal, existent or nonexistent, with nothing in between, the relational nature of reality is such that what may be perfectly real at one level of existence may be unreal at another level.

Each level of existential self-relation is based on a prior level of existential self-relation that's more basic than the levels which extend from it. Each level of existential self-relation functions as a foundation from which the next level extends. Each level of existential self-relation is more basic than the next because, while each level exists in the absence of the levels that extend from it, the levels that extend from it don't exist in its absence.

A reality that exists as part of a relationship exists as such, as a reality, only within the context of that relationship. Beyond that relationship, the reality doesn't exist, although the existence that's

the foundation of the relationship continues to exist. In this way, while existence itself is always real, a given reality may not always exist.

Thus, there are degrees of reality. The most basic level of reality is absolute reality, the level from which all relational levels of reality extend. Absolute reality exists as it is regardless. The undifferentiated relational matrix is one relational level of reality. It's real, but not as real as the absolute reality from which it extends. The differentiated relational matrix is another relational level of reality; it's real, but not as real as the undifferentiated level of reality from which it extends. Physical reality is also real, but not as real as the undivided differentiated level of reality from which it extends.

The crux of the matter is that physical reality—the reality we hold so dear, the reality that to us seems the realest, and that for us defines what "real" is—is actually the least real state of reality. Physical reality is real, but it doesn't extend past the level of our experience into the undivided differentiated level of reality that is itself the foundation of the experiential level of reality.

Quantum theory is what we get when the reality of the fourth floor tries to poke its head into the reality of the third floor. In describing what it has found on the third floor, quantum theory must use terms native to the fourth floor. To paraphrase Neils Bohr, quantum theory is constrained by the necessity of the use of classical terminology (i.e., terminology derived from experiential reality, from living on the fourth floor). For this reason, quantum theory doesn't say what reality is (at the levels below the fourth floor), but quantum theory is what we can say about reality (as it's observed to exist from the fourth floor).

So, what quantum theory says about reality seems like non-sense—i.e., literally not like our normal sensory experience of reality on the fourth floor. The reality of the third floor simply can't be perfectly translated to the reality of the fourth floor.

The strangeness of quantum theory isn't in the theory itself or in what the theory says about the nature of physical reality. The strangeness of quantum theory is a function of how what the theory says about the nature of physical reality contrasts with what we experience physical reality to be. Quantum theory and experiment consistently present us with a reality that's inseparable from itself, while sensory experience consistently presents us with a reality that is separable from itself. The difficulty in understanding quantum theory is in reconciling these two apparently mutually exclusive experiences of reality.

The difficulty in accepting or understanding what quantum theory says about the nature of physical reality isn't a product of the theory itself but a manifestation of our refusal to let go of our prior conception of reality as determinable, as ultimately definable, as in some way separable from itself. Our prior conception of reality is the result of our normal sensory experience always presenting us with defined realities. It's therefore not surprising that we've found it difficult to let go of a deterministic view of reality, since this is the view we get from our normal sensory experience.

At one time, it seemed obvious that the Earth was at the center of the universe; at that time, it must have seemed very strange to consider that the Earth wasn't at the center of the universe. At

one time, it seemed obvious that the Earth was flat; at that time, it must have seemed very strange to consider that the Earth wasn't flat. These observations seemed obvious, and their opposite observations strange, because the general experience was of a flat Earth and an Earth around which other things revolved. However, further and deeper experience showed these experiences to be essentially illusory, presenting humanity with false conclusions regarding the true nature of reality.

At this time, it seems very strange to consider that physical reality isn't quite what we experience it to be. However, the deeper experience of quantum reality has shown that our normal sensory experience presents us with an essentially illusory view of what physical reality is, a view that has led humanity to make a false assumption regarding the true nature of that reality.

At some time in the future, as humanity comes to more fully understand the means by which experience is created, and thereby comes to understand the nature of what we experience as physical reality, the deterministic and mechanistic conception of reality we now hold so dear will fade. At that time, what now seems strange for us to consider will have become obvious, while what we now accept as obvious will itself seem as strange to us as it now does to think that the Earth is flat.

It's now time to move on to an examination of the process by which our experiences of reality are created. We will do this by analyzing the basis of two fundamental phenomena associated with quantum theory, i.e., wave/particle duality and the uncertainty or indeterminacy principle. Through that analysis, we will come to an understanding of why and how experiential reality is presented to us as it is, and within that context it will be possible to see how an experientially real division can exist in the context of a more fundamentally real unity.

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