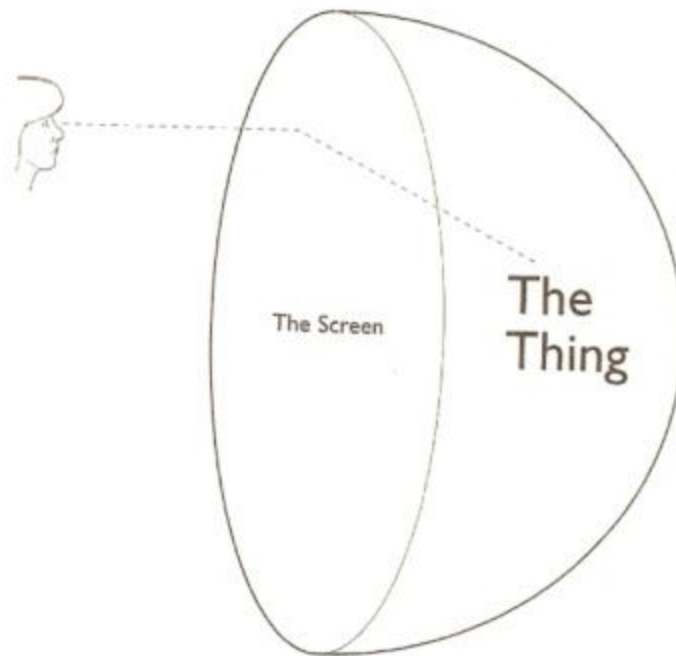


All Movies Are A Footnote To The Matrix

The Matrix isn't just an exciting sci-fi/fantasy action/adventure movie. The Matrix is a very serious philosophical discussion of the nature of reality. The Matrix is very much in the tradition of Plato's Allegory of the Cave. The essential question that was asked in the Matrix "What is real?" can now be answered scientifically in terms of modern physics. The answer of course is "Nothing is real". Alfred North Whitehead remarked that all philosophy is a footnote to Plato for the simple reason that all philosophical arguments about the nature of reality must make reference to Plato's Allegory. Along the same lines of reasoning, all movies that attempt to make philosophical arguments about the nature of reality are a footnote to the Matrix.

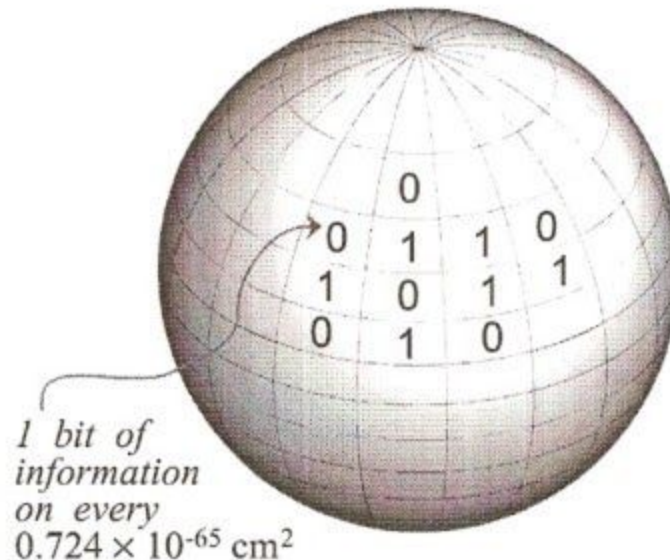
There is a huge irony here that most people just don't get. What most people call reality is perceivable reality in the sense that *perception is reality*. The vast majority of people who are now or who have ever been alive on planet Earth define reality as what they can perceive. The irony that they just can't seem to get is that perceivable reality is no more real than a movie that they are watching. This is not just a metaphor or an analogy. In a very accurate scientific sense that can be mathematically defined by modern physics, perceivable reality is a movie.



The Observer, the Screen and the Thing

In modern physics, there is a very exact mathematical sense in which perceivable reality is a movie, which is called the holographic principle of quantum gravity that results from unification of quantum theory with relativity theory. This fundamental principle tells us that everything

perceivable in the world is defined by bits of information encoded on a two dimensional holographic screen, just like bits of information encoded on pixels on a computer screen. With the holographic principle, the screen is understood as an event horizon that arises in an observer's accelerated frame of reference. The observer's event horizon is a bounding surface of space that limits the observer's observations of things in space, but when the holographic principle is in effect, that bounding surface acts as a holographic screen that encodes bits of information, just like a computer screen, with one bit of information encoded per pixel on the screen.

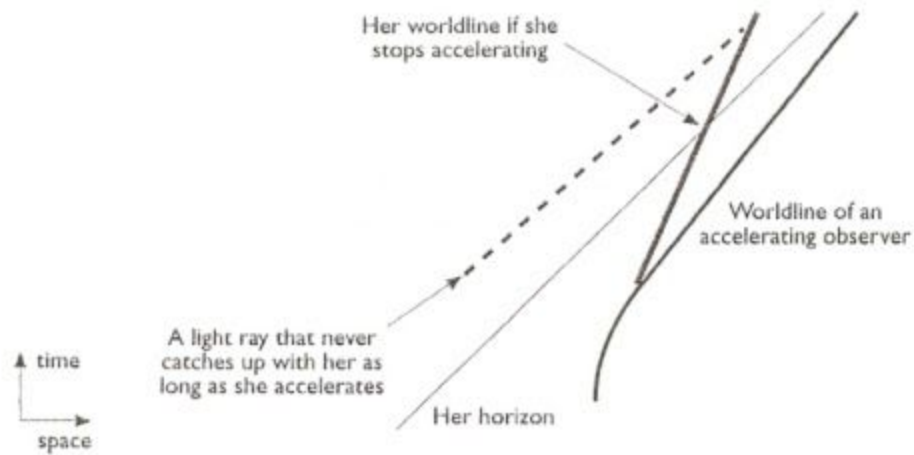


The Holographic Principle

With the holographic principle, the perceivable world is defined by bits of information encoded on a holographic screen, which is a bounding surface of space that arises as an event horizon in the observer's accelerated frame of reference. The observer's perceivable world is defined by the way bits of information are encoded on the screen. The screen is a two dimensional bounding surface of space that defines the bounded three dimensional space of the observer's perceivable world. Everything the observer can perceive in that perceivable world is a form of information that is projected from the screen like a movie image to the point of view of an observer outside the screen. In relativity theory, we understand the observer as the central point of view that arises at the origin of a coordinate system that defines that three dimensional space.

Every observer in an accelerated frame of reference has its own event horizon that limits its observations of things in space. An accelerating observer is always surrounded by an event horizon. When quantum theory is unified with relativity theory, that event horizon becomes a holographic screen that encodes information for everything the observer can observe in that bounded region of space. The observer's holographic screen projects all forms of information for

everything perceivable in that bounded region of space to the observer's central point of view, which is the origin of the coordinate system that defines that bounded region of space.



Accelerating Observer's Event Horizon

In relativity theory, we say the accelerating observer follows a world-line through that bounded region of three dimensional space, which implies that the observer itself is only a point of view. Only a mathematical point can trace out a world-line. The observer's event horizon is a two dimensional bounding surface of space that limits the observer's observations of things in space. With the holographic principle, that bounding surface of space becomes a holographic screen in the sense of encoding bits of information for everything the observer can observe in space.

In the sense of relativity theory, the observer always exists in a higher dimension outside the screen. The screen is the observer's event horizon that arises in the observer's accelerated frame of reference, but the observer always exists at the central point of view of the screen, which is the origin of that coordinate system. Perceivable reality is defined on the screen, but the observer isn't defined on the screen. The observer can only be defined as the perceiving consciousness that is present at a point of view outside the screen to which those perceivable images are projected.

The holographic principle is telling us that perceivable reality is defined on a two dimensional holographic screen, but the observer isn't. The observer always exists in a higher dimension, which is the point of view at the center of the screen. Perceivable reality is defined by the images projected from the screen, but the observer isn't. Everything perceivable is a part of the movie that the observer is perceiving, but the observer isn't. The observer can only be understood as the perceiving consciousness that exists at the central point of view in relation to the screen. The observer itself isn't part of the perceivable reality that it is perceiving. The reality of the observer is the perceiving consciousness that is perceiving those projected perceivable images. The reality of the observer can only be called perceiving consciousness, which in-and-of-itself, is nothing

perceivable. Everything perceivable is a part of the movie that the observer is perceiving, but the perceiving consciousness of the observer isn't. The observer isn't something perceivable.

Everything perceivable is a part of the movie the observer is perceiving as defined on a two dimensional screen, but the observer itself is nothing perceivable. The observer always exists in a higher dimension outside the screen. The observer's holographic screen is observer-dependent since it can only arise as an event horizon in the observer's accelerated frame of reference. The images of the movie are projected from the screen to the observer in the movie audience. The observer doesn't exist inside the movie. The observer always exists outside the movie in a higher dimension, which is the nature of the movie audience. There is only an illusion that the observer exists inside the movie when the observer identifies itself with its character in the movie.

Plato addressed the issue of why the observer in the movie audience would identify itself with its character in the movie to create the observer's illusion that the observer exists inside the movie. Plato called the observer a prisoner precisely because the observer is identifying itself with its character in the movie. In reality, the movie only consists of animated images projected from the movie screen to the observer's point of view in the movie audience. The projected movie images are always defined on a two dimensional screen and the observer always exists in a higher dimension in the movie audience outside the screen. The observer can only have an illusion about itself that it exists inside the movie when it identifies itself with its movie character.



Plato addressed this issue of why the observer identifies itself with its movie character. The movie images are not only projected from the movie screen to the observer's central point of view as the observer perceives those images, but the movie images are also animated in the flow of energy that animates the movie. Each projection of images is like a screen output from a computer screen, and the projected images are animated over a sequence of screen outputs in the flow of energy that energizes the computer. We call the flow of energy that animates the form of a body emotional energy. Emotional energy is the flow of energy that animates the embodied form of the observer's movie character. The observer not only perceives the projected images of

its movie character with each screen output, but also perceives this flow of emotional energy that animates the behaviors of its movie character's form over a sequence of screen outputs.

The observer is not only perceiving the form of things that arises with the projection of forms of information that are projected like images to the observer's point of view with each screen output, but the observer is also perceiving the flow of energy that animates those forms over a sequence of screen outputs. That sequence of screen outputs arises in the flow of energy that animates the computer screen. The flow of energy that animates the form of the observer's movie character is emotional energy. Emotional expressions are always self-limited to the embodied form of the observer's movie character because that is the flow of energy that is animating the behaviors of that particular animated form. The observer's perception of that emotional energy is what makes the observer feel self-limited to the animated form of its character.

We might ask why self-limiting emotional expressions arise in the first place. Biology has pretty much answered this question with the idea of environmental selection pressures and the survival of the fittest body. A body only appears to survive in the world if its form is self-replicated in form in a recognizable way over a sequence of events that arise in the flow of emotional energy that animates the body. It turns out that for a variety of reasons that have to do with the balance between potential and kinetic energy that a body can only self-replicate its form if attractive potential energy is added to the body. The addition of attractive potential energy to a body alters the balance between the tendency for random disorganization of form to occur, which physicists call an increase in entropy, and the tendency for coherent organization of form to occur, which can either be understood in terms of the attractive forces that hold forms together or the quantum entanglement of the bits of information inherent in those coherently organized forms. At the level of physics, either attractive forces have to hold forms together or quantum entanglement of information has to be at play to result in the coherent organization of information inside forms. Entangled bits of information naturally tend to align together over a sequence of perceivable events, which results in the coherent organization of information inside forms. The potential energy of attractive forces that hold forms together is an inherent aspect of this organization.

The upshot is the form of a body is only self-replicated in form in a recognizable way if potential energy is added to that form. We call the addition of potential energy to a body the process of eating. The big question is where can a body find the potential energy that it needs to eat in order to self-replicate its form and survive in the world? The answer is that potential energy is found in other bodies. This is the fundamental reason why bodies can only survive in the world if they eat other bodies. Bodies must eat other bodies so that they can add potential energy to their forms, which allows that form to become self-replicated in form in a recognizable way. Even plants must eat the photons that arrive from the sun in order to self-replicate their forms and survive.

As previously stated, there is always a balance between the tendency for entropy to increase and the flow of random kinetic energy to disorganize the form of the body and the tendency for the potential energy of attractive forces to hold the form of the body together and maintain that coherent organization of information. If the balance favors an increase in entropy and the flow of random kinetic energy, then the body falls apart and becomes disorganized. If the balance favors the potential energy of attractive forces, then the body holds together as its form is self-replicated in form and that coherent organization of form is maintained. The only way this second scenario can occur is if the body adds potential energy to its form, which requires the body to eat other bodies. A body can only self-replicate its form and survive in the world if it eats other bodies.

Bodies only survive in the world because they eat other bodies. There is a natural selection pressure called *the survival of the fittest body* that basically says that those bodies that are best able to eat other bodies and avoid being eaten by other bodies are the bodies that are most likely to self-replicate their forms and survive. Self-replication of form is always emotionally driven, since the survival of the fittest body is inherently dependent on emotional expressions by bodies. The coherent organization of information inside a body that allows for self-replication of form in a recognizable way inherently requires the coherent organization of the flow of emotional energy that allows for that self-replication of form as the form of the body is animated.

The natural selection pressure of the survival of the fittest body tells us that those bodies that are best able to eat other bodies and avoid being eaten by other bodies are the bodies that are most likely to survive and self-replicate their forms. This natural selection process is always emotionally driven by the expression of emotions that have no other purpose than the survival of the body. These survival emotions are expressed as the desire to eat and the fear of being eaten. The bodies that are best able to survive in the world are those bodies that are best able to express the desire to eat other bodies while they also express the fear of being eaten by other bodies.

This discussion of biology brings us back to the essential problem of why the observer in the movie audience would identify itself with the animated form of its character in the movie it is watching. The answer is the observer's self-identification with its character is always emotionally driven by those survival emotions that allow the embodied form of the character to survive in the world. The observer emotionally identifies itself with the embodied form of its character as it perceives the survival emotions of the desire to eat and the fear of being eaten that emotionally animate that embodied form. These survival emotions of desire and fear are absolutely necessary for that embodied form to self-replicate its form in a recognizable way and appear to survive in the world that the observer is perceiving. The perception of these self-limiting survival emotions of desire and fear by the observer are what makes the observer feel self-limited to the embodied form its character as that form is emotionally animated. That emotional perception is what leads the observer to emotionally identify itself with that embodied form as that form is self-replicated in form in a recognizable way and appears to survive in the world that the observer is perceiving.

The observer not only perceives that embodied form, but also recognizes that form as itself. The self-replication of form in a recognizable way leads the observer to recognize that form as itself.

The observer emotionally identifies itself with the emotionally animated embodied form of its movie character because the observer really feels self-limited to that particular animated form as it perceives the flow of that self-limiting emotional energy. That's how the observer's illusion of embodied existence is created. This illusion is created from perception. The illusion of embodied existence arises from the observer's perception of that flow of emotional energy that makes the observer feel self-limited to that particular embodied form. In reality, the observer is always outside the forms of information it perceives, just like an observer in a movie audience is always outside of the movie it perceives. The observer doesn't really exist inside the movie. That kind of existence can only be created as an illusion. The observer always exists in the movie audience.

This discussion of biology naturally leads to a discussion of *self and other*. The concept of *self and other* can only arise in a subject-object relation of an observer observing some observable thing. The observer is the *subject*, which fundamentally is the perceiving consciousness of the observer. The *object* is whatever the observer observes, which modern physics tells us is a form of information. The holographic principle tells us that form of information is projected like a movie image from a holographic screen to the point of view of the observer that is out in the movie audience. In reality, everything the observer can observe is external to the observer's point of view since everything is a form of information projected like an image from the observer's holographic screen to its point of view. Nothing is really internal to the observer.

The problem is that when the observer emotionally identifies its with the embodied form of its character in the movie it is watching, that emotional self-identification creates an illusion that the observer exists inside the body of its movie character. In reality, the observer exists at the central point of view of its own holographic world, but when the observer emotionally identifies itself with its character, an illusion is created that the observer exists inside the body of its character.

This illusion is created by the emotional expressions of fear and desire that are necessary for the survival of the embodied form of the observer's character as that form is self-replicated in form in a recognizable way, which leads the observer to recognize itself as that embodied form. Once the observer recognizes itself as the body of its character and emotionally identifies itself with that embodied form, the surface of the body creates an illusion of *self and other*. *Self* is defined as internal to the body and *other* is defined as external to the body. These definitions of *self and other* seem very appropriate in a world where bodies must eat each other in order to survive. If the priority is the survival of the body, then it seems necessary and appropriate to defend the survival of the body by expressing the desire to eat other bodies and the fear of being eaten by other bodies. After all, that is the only way bodies can survive in the world.

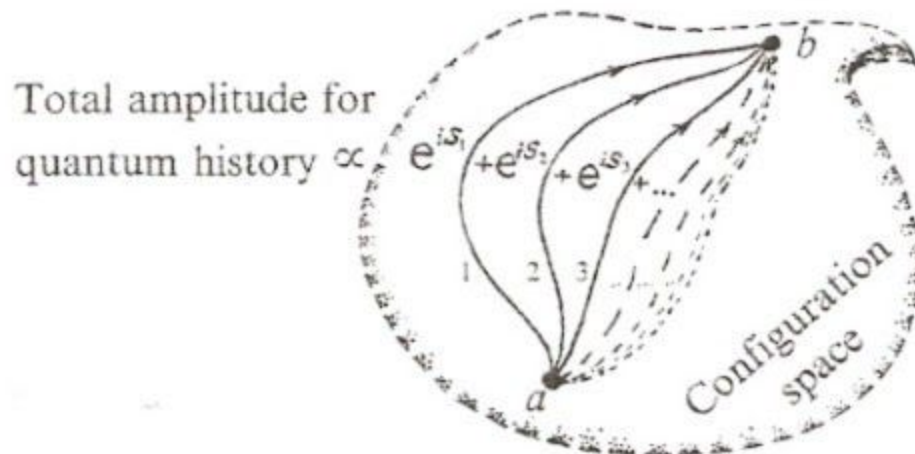
Once the observer emotionally identifies itself with the form of a body, the surface of the body creates a boundary between *self and other*, with *self* internal to the body and *other* external to the body. It then seems very appropriate to express the self-defensive survival emotions of fear and desire in order to defend the survival of the body. The expression of these self-defensive survival emotions are what makes the observer feel self-limited to the form of its body and perpetuates its emotional self-identification with its body. The observer is recognizing its body as itself.

In reality, nothing is internal to the observer. The observer is only a focal point of perceiving consciousness that arises in relation to a holographic screen. Everything perceivable is a form of information projected like an image from the screen to the observer's point of view. There is only an illusion of *self and other* based on the mistaken assumption that the surface of the body creates a boundary between *self and other*, with *self* internal to the body and *other* external to the body. That illusion is a necessary part of living an embodied life in the world, which is emotionally driven by the expression of the survival emotions of fear and desire. In reality, the body is just another thing that is external to the observer's point of view. Organs of sensory perception in the body are only transmitting information about the external state of the world, which the observer perceives as sight and sound, and the internal state of the body, which the observer perceives as emotional body feelings. The observer feels self-limited to the form of the body when it perceives emotional body feelings, which creates the illusion of *self and other*.

This discussion of the illusion of *self and other* is very relevant for a discussion of whether or not there is really such a thing as objective reality. Does objective reality really exist, or is it all a big illusion? We've pretty much already answered this question since what we call objective reality is only a perceivable reality that arises in a subject-object relation as an observer observes some observable thing. The holographic principle settles this question since it tells us the observer is only a focal point of perceiving consciousness and everything perceivable is only a form of information projected like an image from the observer's holographic screen to its point of view.

There are many who will insist that perceivable reality is an objective reality that has its own observer-independent existence, but that kind of idea is based on a logically inconsistent paradox of self-reference. This logical inconsistency is perfectly demonstrated in quantum theory, where the entire observable world is described by a quantum state of potentiality. The quantum state of the world can always be described by a sum over all possible observable states of the world. In any observation of the world by an observer, that quantum state must be reduced to some actual observable state. The reduction of the quantum state of potentiality of the world to an actual observable state is always a choice that reduces the sum over all possible observable states to an actual observable state. In quantum theory, this sum over all possible observable states of the world is represented by a sum over all possible paths in some information configuration space.

Quantum theory tells us that each possible observable state of the world arises in some possible path through this information configuration space. Quantum theory tells us that each possible observable state is weighted with a probability factor that physicists call the wave-function. The wave-function in turn depends on a quantity called the action, which is like a distance measured along some path in the information configuration space. As long as choices are made in an unbiased way, the most likely path in the sense of quantum probability is the path of least action, which is like the shortest distance between two points in the information configuration space.



Quantum State of Potentiality as the Sum Over all Possible Paths

Quantum theory implicitly assumes that an observer must exist to measure the observable states of the observable world that are observed when the quantum state of potentiality is reduced to an actual observable state. Quantum theory has nothing to say about the nature of the observer, only that the observer must exist to measure the observable state of the world when the quantum state is reduced to an actual observable state. The holographic principle unifies quantum theory with relativity theory and takes quantum theory to its logical conclusion. The observable world is always defined by the bits of information encoded on a holographic screen that can only arise as an observer-dependent event horizon in an observer's accelerated frame of reference. The observer's observation of anything in that observable world can only be understood in the sense of holographic projection of forms of information projected like images from the screen to the observer's central point of view. The observer itself can only be understood as the perceiving consciousness that exists at the central point of view to which those images are projected.

The holographic principle tells us that the quantum state of potentiality of the world is always defined on a holographic screen that encodes bits of information in all possible ways, which defines an information configuration space. Any observation of the world by an observer must choose an actual observable state of information defined on the observer's holographic screen. This tells us that the observation of the world by an observer is always a projection of a form of

information encoded on that holographic screen to the observer's central point of view. The holographic screen can only arise as an observer-dependent event horizon in the observer's accelerated frame of reference. There is no such thing as an observer-independent objective reality out there that an observer can measure for the simple reason that observable reality is always observer-dependent and can only arise in the observer's accelerated frame of reference. Quantum theory and relativity theory taken to their logical conclusion in the form of the holographic principle tell us that an observer-independent objective reality cannot really exist.

This conclusion is really not such a big surprise since observable reality is always experienced in a subject-object relation of an observer observing some observable thing. The true nature of the subject can only be understood as perceiving consciousness, while the objective nature of things can only be understood in terms of the forms of information being observed. The holographic principle takes this subject-object relation to its logical conclusion since it identifies the observer with the perceiving consciousness that exists at a point of view in relation to a holographic screen that projects the images of the form of all things from the screen to the observer's point of view. The subject is the perceiving consciousness that exists at a point of view and the object is a projected form of information. The observer's holographic screen is always observer-dependent since it can only arise as an event horizon in the observer's accelerated frame of reference.

Where is the so-called observer-independent objective reality that an observer can observe and measure if that objective reality isn't being observed by an observer? Quantum theory tells us it's nowhere since it can only exist as an unobserved state of potentiality. There really is no such thing as an observer-independent objective reality out there that the observer can observe, only an observer-dependent observable reality that in some sense the observer must create for itself in its own accelerated frame of reference. If the observer does not observe that observable reality, then nothing appears to exist from the observer's own point of view. The paradox of this statement is that the reality of the observer can continue to exist even when nothing appears to exist since the reality of the observer is pure consciousness, which is nothing perceivable. When everything perceivable disappears from existence from the observer's own point of view, the reality of the observer can continue to exist as the formless nothingness of pure consciousness.

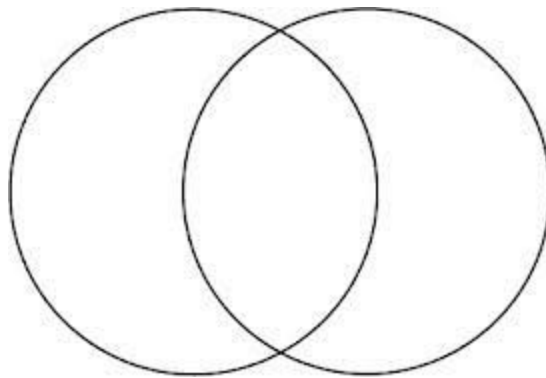
In the language of modern physics, nothing appears to exist from the observer's own point of view when the observer is no longer in an accelerated frame of reference since that observer no longer has an event horizon that acts as a holographic screen. Everything the observer can observe from its own point of view is defined on its own holographic screen, but the observer no longer has a holographic screen when the observer is no longer in an accelerated frame of reference. That non-accelerated frame of reference is called a freely-falling frame of reference, in which nothing is observable since the observer has no holographic screen. The observer's holographic screen can only arise as an event horizon in the observer's accelerated frame of reference. The observer's event horizon is a bounding surface of space that limits the observer's

observations of things in space. When that acceleration comes to an end and there is no event horizon, the observer's observations become unlimited, but paradoxically, there is also nothing to observe since all the observer's observations of things must arise from its holographic screen.

All the paradoxes of quantum theory arise from the mistaken assumption that multiple observers can exist in the same observer-independent objective reality as observers observe and measure different aspects of that observable reality. The holographic principle demonstrates the fallacy of this kind of assumption since the observer's observable reality can only appear to come into existence when the observer observes it. The observer's observable reality is observer-dependent and can only arise in the observer's accelerated frame of reference since that is how an event horizon arises that acts as a holographic screen. Everything the observer can observe in its observable world is a form of information defined on its own holographic screen.

Every observer has its own observable holographic world defined on its own holographic screen. Every observer exists at the central point of view of that surrounding holographic screen that can only arise in the observer's accelerated frame of reference. Everything the observer can observe in that world is a form of information projected like an image from the observer's holographic screen to its central point of view. In reality, the observer does not even exist in its own holographic world. It always exists outside that holographic world, at the central point of view.

There is still the possibility of a consensual reality shared by many observers that arise at many different points of view due to the kind of information sharing seen in an interactive network of screens like the internet. Every observer's holographic screen is a bounding surface of space, but those bounding surfaces can overlap in the sense of a Venn diagram and share information.



Overlapping Bounding Surfaces of Space Create the Appearance of a Consensual Reality

There are a few loose ends we need to tie up to finish this scientific discussion of the nature of reality. Just like the mistaken idea of an observer-independent objective reality, there is the mistaken idea that the laws of physics in some way represent ultimate reality. They do not, so where do the laws of physics come from? The holographic principle again gives a clear answer.

To begin with, the ultimate nature of reality is pure consciousness. Whenever the perceiving consciousness of an observer, which exists at a point of view, enters into an accelerated frame of reference, an observable world appears to come into existence. That observable world is defined on the observer's holographic screen, which can only arise as an event horizon in the observer's accelerated frame of reference. The observer itself is the perceiving consciousness that exists at the central point of view of that holographic world. Everything perceivable in that holographic world arises as a form of information that is encoded on the observer's holographic screen and is projected like an image from the screen to the observer's central point of view. Those perceivable images are naturally animated in the flow of energy that animates everything in the observer's world. The observer is not only perceiving the form of all things that appear in its world, but is also perceiving the flow of energy that animates the form of all things in its world. That flow of animating energy fundamentally arises in the observer's own accelerated frame of reference.

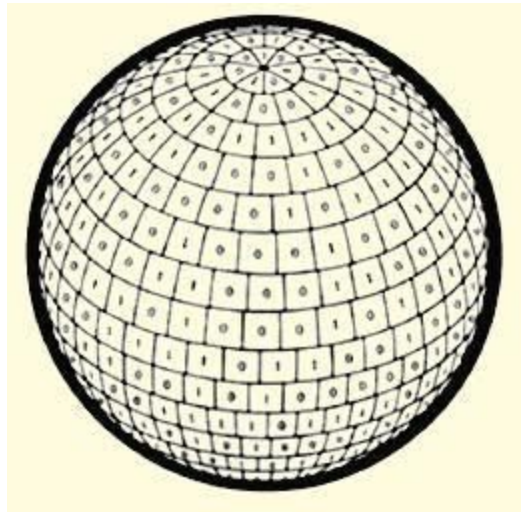


Normal Flow of Energy in the Observer's World

The holographic principle describes how bits of information become encoded on the observer's event horizon. In modern physics, the best way to understand the holographic principle is in terms of non-commutative geometry. Non-commutative geometry is that part of modern physics that best explains how space-time geometry is quantized. A similar explanation can be found in string theory, but string theory is really only a special case of non-commutative geometry.

Whenever non-commutative geometry is applied to a bounding surface of space, like an event horizon that arises in an observer's accelerated frame of reference, a finite number of quantized position coordinates are defined on the surface by the non-commuting variables defined on that bounding surface of space. The non-commuting variables are quantized position coordinates defined on the surface. These quantized position coordinates are smeared out into area elements like pixels defined on a computer screen. Each of these smeared out area elements encodes a bit

of information in a binary code of 1's and 0's, just like the bits of information encoded on the pixels of a computer screen. Non-commutative geometry explains this encoding of information.



Horizon Information

The holographic principle is automatically in effect whenever non-commutative geometry is applied to a bounding surface of space, like an event horizon. The non-commuting variables defined on the surface is the fundamental way in which space-time geometry is quantized. The way this usually works is to define the non-commuting variables in terms of a matrix, typically in terms of an $n \times n$ $SU(2)$ matrix, which represents rotational symmetry on the surface of a sphere. A 2×2 $SU(2)$ matrix represents a spin $\frac{1}{2}$ variable in quantum theory, which can only take on the quantized eigenvalues of spin up or spin down, and thereby represents information in a binary code like a switch that is either on or off. An $n \times n$ $SU(2)$ matrix can represent n bits of information in a binary code since it has n eigenvalues. These n eigenvalues are entangled in the sense of quantum entanglement, which basically tells us that a holographic world is characterized by the holistic entanglement of information. In quantum gravity, the value of n , which is the number of non-commuting variables defined on the bounding surface of space, is given in terms of the surface area A of that surface as $n=A/4\ell^2$, where $\ell^2=\hbar G/c^3$ is the Planck area defined in terms of Planck's constant, the gravitational constant and the speed of light.

The next big question is how do we get a dynamical space-time geometry along the lines of Einstein's field equations for the space-time metric from the holographic principle? Einstein's field equations are the nature of gravity, which we understand as the curvature of a dynamical space-time geometry. This seems to be a problem, since the holographic principle is defined on a two dimensional bounding surface of space, while Einstein's field equations define the dynamical nature of a 3+1 dimensional space-time geometry. Where do the extra dimensions come from?

The holographic principle again gives the answer since everything an observer can perceive in its holographic world is defined on a holographic screen that can only arise as an event horizon in the observer's accelerated frame of reference. The observer's acceleration implies the expenditure of energy that the observer perceives as the flow of energy through its own holographic world. That flow of energy animates everything in its world, just like the flow of energy through a computer animates the images that are projected from a computer screen over a sequence of screen outputs. In terms of the holographic principle, the flow of time is a natural consequence of the flow of energy that animates the projected form of things that the observer perceives in its holographic world as forms are projected like images from its holographic screen to its own point of view. Each observation of something is a holographic projection from the screen, and those things are animated in the flow of energy like an animated sequence of screen outputs.

We still need to explain where the third dimension of space comes from. The observer's holographic screen is a two dimensional bounding surface of space, but everything the observer observes in its holographic world appears in the bounded three dimensional space of its world. The best explanation for holographic projection comes from string theory, where the bounding surface is understood to encode bits of information along the lines of a conformal field theory. A conformal theory is characterized by a special kind of symmetry called Weyl invariance, which is the kind of symmetry seen in fractal geometries, where the geometric structure of fractals appears self-similar or invariant under a change in distance scale. Conformal symmetry is a symmetry of the changing size of objects that appear self-similar no matter at what distance scale they're being observed. A holographic screen will always encode bits of information for objects in a way that manifests conformal symmetry. It is as though a light is projecting a shadow of the object on a screen and the observed size of the shadow depends on how far away the object is from the screen relative to the observer. The closer the object is to the screen, or the farther away the object is from the observer, the smaller the shadow appears to the observer. The shadow of the object is defined by the way bits of information are encoded on the holographic screen, which gives the appearance of the object moving in a third dimension toward or away from the observer as the shadow of the object appears to grow or shrink in size. The changing size of the projected shadow gives the illusion of the object moving in a third dimension toward or away from the observer. The appearance of movement in a third dimension is a holographic illusion that only results from holographic projection. The perception of a third dimension is a result of conformal symmetry. Underlying this effect is the conformal symmetry that describes how information is encoded on the screen for the object. This scientific explanation for the appearance of objects moving in a third dimension is eerily similar to how Plato described the appearance of objects as shadows projected on the wall of the Cave in the Allegory.

The holographic principle therefore solves the problem of how a 3+1 dimensional space-time geometry can arise from a two dimensional holographic screen. We still have the problem of the laws of physics, like the law of gravity that Einstein tells us can be understood as the dynamical

curvature of a 3+1 dimensional space-time geometry. Where do Einstein's field equations for the force of gravity as expressed in terms of the space-time metric come from?

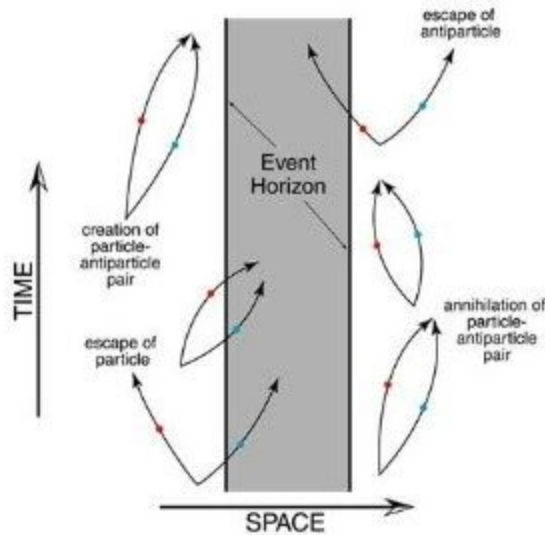
The holographic principle gives the answer. The holographic principle not only tells us how bits of information are encoded on a holographic screen, which physicists call entropy, but also tells us about the thermal energy of these bits of information, which physicists call temperature. In the holographic principle, the temperature of a holographic screen arises from the thermal energy of bits of information, which tend to flip back and forth between the 1 and 0 states of information like a quantized spin variable that tends to flip back and forth between the spin up and the spin down states. Thermal energy is a measure of the random flipping of these information states, which is perceived as temperature. Temperature is defined in physics as the amount of thermal energy per degree of freedom when things are at thermal equilibrium. The holographic principle tells us a degree of freedom is a bit of information encoded on a holographic screen.

The second law of thermodynamics is a general statistical statement of how the entropy of any system is related to the total amount of thermal energy in that system and the temperature of that system when the system is at thermal equilibrium. The system of interest is the observable world, which from the point of view of the observer of that world is defined on a holographic screen. The entropy of the observable world is defined in terms of the number of bits of information encoded on that holographic screen, and the temperature of that holographic screen is defined in terms of thermal energy per bit of information. At thermal equilibrium, when the temperature is constant, a change in the total thermal energy of that observable world must be related to a change in the entropy of that world. This is usually written as $\Delta E = T\Delta S$, where ΔE is a change in the total thermal energy of the world and $\Delta S = k\Delta n$ is a change in the entropy of that world, where the number n is the number of bits of information encoded on the holographic screen that defines that observable world. This makes sense since the temperature of that holographic screen is defined in terms of the thermal energy per bit of information, wherein $\Delta n = 1$, and so $\Delta E = kT$.

In order to use the second law of thermodynamics, we need to know how S and T are defined with the holographic principle. The answer for $S = kn$ is simple, since the holographic principle says the number of bits of information encoded on a holographic screen is proportional to the surface area A of the screen, which is usually written as $n = A/4\ell^2$, where $\ell^2 = \hbar G/c^3$ is the Planck area defined in terms of Planck's constant, the gravitational constant and the speed of light. The temperature of a holographic screen is given in terms of the Unruh temperature, which is the temperature of the event horizon that arises in an observer's accelerated frame of reference. The Unruh temperature is given as $kT = \hbar a/2\pi c$, where a is the observer's acceleration.

The thermal energy of the observer's event horizon as specified by the Unruh temperature arises from the separation of virtual particle-antiparticle pairs at the event horizon as observed by the accelerating observer. Quantum field theory tells us that the vacuum of empty space is full of

virtual particle-antiparticle pairs, which are created out of nothing and rapidly annihilate back into nothing. At the observer's event horizon something very weird appears to happen. These virtual particle-antiparticle pairs can appear to separate. The virtual antiparticle can disappear from view behind the event horizon while the virtual particle can appear to become a real particle that carries thermal energy with it as it travels toward the observer's point of view. The observer then sees the event horizon to radiate away thermal radiation, which gives it a temperature. This observed thermal radiation that is radiated away from an event horizon to an observer, which can only appear in the observer's accelerated frame of reference, is also called Hawking radiation.



Hawking Radiation and the Unruh Temperature of an Event Horizon

We now have all the pieces of the puzzle in place that are needed to understand where Einstein's field equations for the space-time metric come from in terms of the holographic principle. Whenever an observer enters into an accelerated frame of reference, an event horizon arises that limits the observer's observations of things in space. The holographic principle tells us that the observer's event horizon is a bounding surface of space that acts as a holographic screen that encodes information for everything observable in the observer's world. If thermal energy appears to flow across that bounding surface of space, the second law of thermodynamics tells us the entropy of that world must change as $\Delta E = T\Delta S$, but the holographic principle then tells us the entropy of that world must change as $\Delta S = k\Delta n$, where $n = A/4\ell^2$ is defined in terms of the surface area of that bounding surface of space. In other words, a change in the total thermal energy of the observer's world is equivalent to a change in the entropy of that world which is equivalent to a change in the surface area of the holographic screen that defines that observable world. A change in the surface area of that holographic screen implies a change in that bounding surface of space, which implies a change in the geometry of that bounded region of space. The amazing thing about the holographic principle, as interpreted in terms of the second law of thermodynamics and

Unruh temperature, is that change in the geometry of the bounded space is described by Einstein's field equations for the space-time metric. Einstein's field equations for the metric, which is the field theory for the force of gravity, are a thermodynamic consequence of the holographic principle. Einstein's field equations for the space-time metric are not really fundamental, but only arise as thermodynamic equations of state from the holographic principle when things are near thermal equilibrium, sort of like the equations for sound waves arise from atomic theory as thermodynamic equations of state when things are near thermal equilibrium.

Space-time geometry is not really a fundamental thing and neither are Einstein's field equations for the space-time metric, which is the field theory for gravity. Dynamical space-time geometry is a holographic illusion that results from holographic projection, and Einstein's field equations for gravity are no more fundamental than the wave equation for sound waves. All we're really looking at here is a thermodynamic equation of state that is only valid near thermal equilibrium.

What about the quantum field theories for the standard model of particle physics that include the electromagnetic and nuclear forces? Are these equations fundamental? No. The unification of these quantum field theories with Einstein's field theory for gravity proceeds along the lines of the usual unification mechanisms of super-symmetry and the Kaluza-Klein mechanism of extra compactified dimensions of space. This is how unification is understood in string theory or in M-theory, which includes 11-dimensional super-gravity as a low energy limit. Once we can use the holographic principle to deduce Einstein's field equations for the space-time metric as thermodynamic equations of state, then we understand that all the quantum field theories of the standard model of particle physics arise from Einstein's field equations as extra components of the space-time metric. The fermion matter fields arise from super-symmetry and the boson force fields arise with extra compactified dimensions of space. All these quantum field theories are no more fundamental than a thermodynamic equation of state. They are only valid when things are near thermal equilibrium. None of the laws of physics are really fundamental.

If the laws of physics are not really fundamental and even the dynamical space-time geometry of the world is not really fundamental, then what is? The answer is simple. Pure consciousness is fundamental. Pure consciousness is the ultimate nature of existence. Pure consciousness can also be called the ground of being or the ultimate nature of reality. It is what exists when everything else disappears from existence. Everything that appears to come into existence in some sense is a holographic illusion that can only appear to exist when an observer enters into an accelerated frame of reference, since that is how a holographic screen arises that projects the images of all things to the observer's point of view. Everything perceivable is a form of information defined on the observer's holographic screen, which is projected to the observer's point of view like an image and animated in the flow of energy that arises with the observer's own acceleration.

When the observer enters into a freely falling frame of reference and that acceleration comes to an end, the observer no longer has a holographic screen and everything perceivable disappears from existence from the observer's own point of view. What remains when everything disappears from existence is pure consciousness, which is nothing perceivable, and can only be described in the sense of negation as formless nothingness. Since the observer's holographic screen is a bounding surface of space that limits the observer's observations of things in space, when that bounding surface disappears in a state of freefall, the observer's observations become unlimited, but nothing is perceived. When the observer's acceleration comes to an end and that energy is no longer expended, nothing is animated and even the flow of time comes to an end. In the sense of negation, what remains when everything disappears from existence is the timeless, unlimited, undivided formless nothingness of pure consciousness. That is the ultimate nature of existence.



There is No Spoon

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