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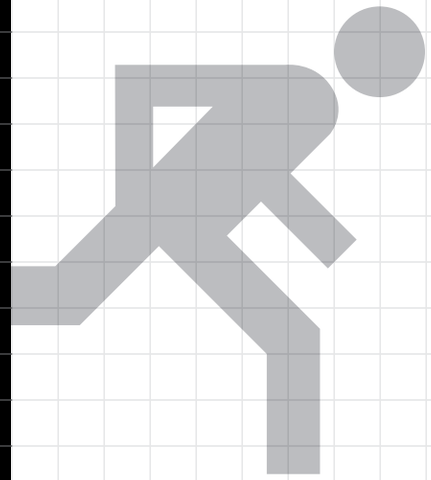
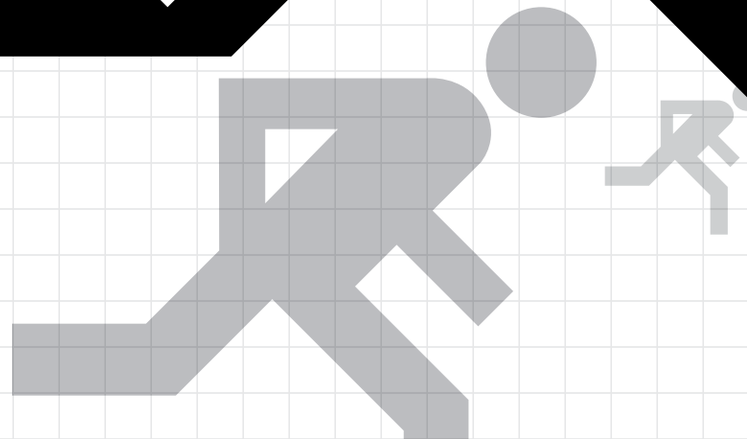


fleeing from absence

four cross-disciplinary essays on time, its nature and its interpretations

by olga ast



NEW YORK 2009

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Fleeing from Absence
Four cross-disciplinary essays on time, its nature and its interpretations

Written by Olga Ast & Julia Druk

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Introduction

Our knowledge of the universe is fragmented. We have assigned it to the sciences, mathematics, visual art, music, literature, poetry, religion, philosophy and so on. All these disciplines have developed their own languages to study and describe the universe. Even within a single discipline, each expert creates his own language of understanding.

We have come to the point where specialists from different fields – and even those from the same field – understand each other with difficulty, if at all.

Yet the universe is not arbitrarily divided into specialized areas of mathematics or physics or poetry. It exists as a whole, and its contents encompass the knowledge that we have segregated into different disciplines. We have not created a language that can describe the universe as it exists, and still be flexible enough to write a poem, a symphony, or a segment of DNA.

The only language we have thus far that connects rather than divides us is conversational. Even star practitioners of their respective disciplines revert to common speech with their families, their friends and strangers on the street.

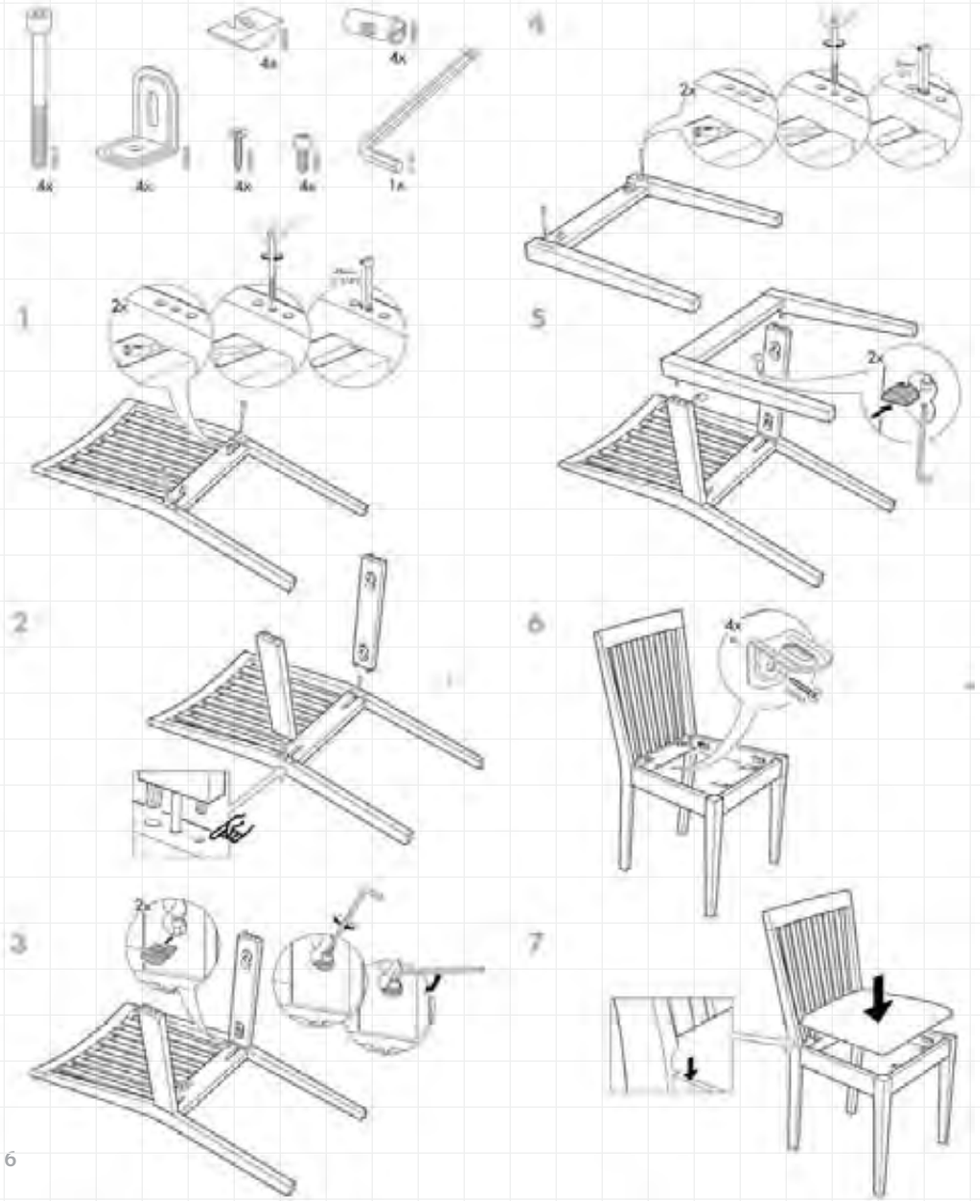
This collection of four essays is an attempt at a cross-disciplinary approach to the problem of time. I have attempted to avoid specific jargon so as not to lean one way or another into particular cultural or social territories. I have to reconcile myself to all the imperfections and imprecision of conversational language, and yet I recognize that this is the form of language that gave birth to all others. It is the cradle of all languages.

These essays will focus on time as it is perceived, studied and explained from different points of view with different conclusions. The concept of time has appeared and reappeared throughout our human canon, subject to various analogies and metaphorical and metaphysical references. I write about these diverse interpretations, without making judgments as to their worth, as different lights shed on the problem, each casting it into sharper relief.

Olga Ast

"Time flies like an arrow,
fruit flies like a banana."
–Groucho Marx

The Visualization of Time



1. A VISUAL METAPHOR

Visualization is one of the first steps in coming to know an object. When we say the word *chair*, for example, the first thing that comes to mind is a mental image of a chair – not a single, concrete object, but an assembly of visual ideas about what the chair should look like. Each of these visual ideas is a *visual metaphor*. What is the visual metaphor of time?

Illustration by Olga Ast. Containing: Instructions for assembly of IKEA chair. Detail.

2. TIME AS A CLOCK

Most often we visualize time as a clock – a device invented in the middle of the second millennium. The visual image of the clock is a circle divided into twelve equal parts, containing twelve numbers and two hands. We tend to place most emphasis on the numbered dial and the point at which one day turns into the next. Many traditional folktales and fairy tales situate much of the action at the midnight hour, where various ghouls and ghosts come alive and Cinderella's carriage turns back into a pumpkin.

One recent example of this type of visualization is an advertisement that appeared in several issues of a marketing magazine. An artist represents time as a clock mechanism, adding to it half of a numbered dial and two moving gears to clarify the metaphor in an age when many people may only be familiar with the digital clock. The artist encapsulates several people within the mechanism, and adds word bubbles that read "deadlines" and "you've got mail" to portray modern man as trapped under the pressures of time management.

A less recent example is the painting by Salvador Dali entitled *The Persistence of Memory*, where a limp clock faces a vast desert landscape in the foreground. Even Salvador Dali – who proclaimed "I am Surrealism!" – could not refrain from using this imagery. Clocks reappear throughout Dali's work, and are linked directly to his search for a metaphor of time and its passage.

Other surrealist works use similar analogies. In René Magritte's painting *Time Transfixed* he depicted a fast-moving train coming out of a fireplace and placed a clock on the mantelpiece.

Salvador Dali. The Persistence of Memory. 1931. Held at the Illinois Institute of Art. Chicago, Illinois.

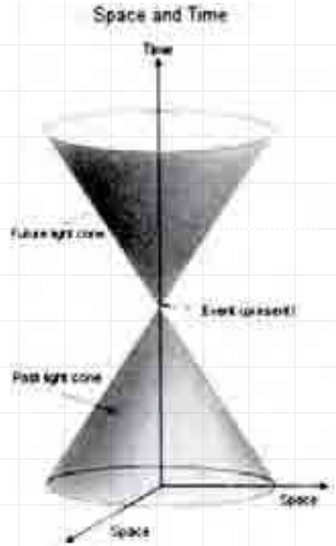
Magazine Advertisement. Direct. Prism Business Media Publication. July 2006. Pg. 35.

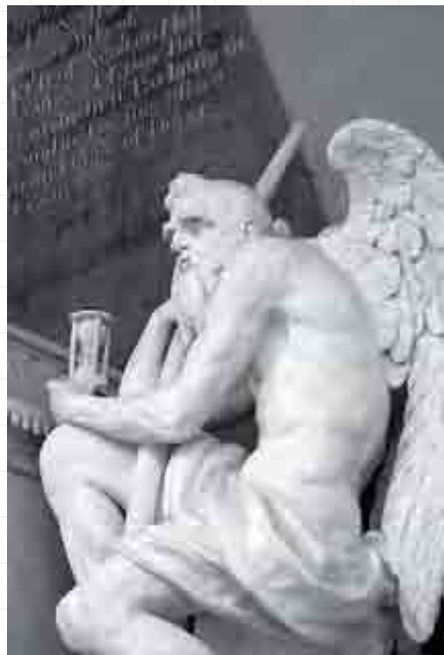
René Magritte. Time Transfixed. 1938. Held at the The Art Institute of Chicago, Joseph Winterbotham Collection.

3. TIME AS A SANDGLASS

Before the invention of the mechanical clock and the pendulum, early civilizations developed a variety of other devices for tracking time: sundials, sandglasses, water and candle clocks. Out of all of these, the sandglass has become a natural emblem of time.

The sandglass metaphor allows us to separate time into three distinct chambers or phases. There is the bottom-most portion of the glass, which represents the past; the top chamber, representing the future; and the narrow meeting point between the two, playing host to the present. The movement of the sand adds to the metaphoric value of the device, and allows us to visualize the passage of time as we have come to understand it. In the contemporary work *A Brief History of Time*, Stephen Hawking illustrates space and time as two cones connected by their vertices. To the viewer, these bear a strong resemblance to a sandglass, filled with an infinite quantity of sand. Even in this last century, Hawking' visual imagination leads him to this ancient metaphor.





Philippe de Champaigne. Vanity. XVII century. Held at Musée de Tessé, Le Mans, France.

Stephen Hawking. XX century. *A Brief History of Time.* 10th Edition. Bantam books. Figure 2.4. Pg. 27.

Figure of Time. The Henniker tombs in the North Aisle of Rochester Cathedral. Kent, England. XVIII century.

4. TIME AS A RIVER

Clocks have long served as the direct translation of time into a visual image. When we try to speak of the intrinsic or philosophical nature of time, we are inevitably confronted with another set of visual metaphors. These represent not only how we picture time, but also how we experience it.

Characteristic of modern man are two visualizations of time: as a river and as an arrow. The *river of time* has particularly captivated the human imagination – immutable, eternal in nature, and existing in constant, flowing motion.

It is tempting to suggest that the original visual parallel between the structure of time and that of a river originated in ancient Egypt, a river civilization entirely dependent on the Nile for both sustenance and trade. Yet other ancient river civilizations could also take credit for the metaphor. We frequently see, for example, the figure of the mythical boatman who carries dead souls across a river – the Greek ferryman Charon led his charges toward Hades, the realm of the dead.

No matter the origin, our psychology has proved so well suited to this concept that we have become entirely dependent on it in our interaction with the subject of time. The image of a river of time has taken on the role of a powerful cross-cultural metaphor, existing in the collective consciousness of the Western world.

Joachim Patenier. Charon crossing the Styx. 1515-24. Held at the British Museum. London, England.

Zick. Psyche and Charon. 1892. Carlos Parada Greek Mythology Link Collection. http://homepage.mac.com/cparada/GML/.

Tomb of Seti I, Son of Rameses I. The Valley of the Kings. XIX Dynasty. 1278 BC.

5. TIME AS AN ARROW

Equally important is the visualization of time as an arrow, a concept that apparently appeared in the West in the beginning of the 20th century. One of the first Europeans to articulate the concept of "time's arrow" was Sir Albert Eddington in his book, *Nature of the Physical World*. Prior to that date, this metaphor had been conspicuously absent from *The General Theory of Relativity* by Albert Einstein, and from other works on the nature of time, such as one dedicated to dissecting the fourth dimension, *Tertium Organum* by the Russian mysticist Pyotr Uspensky.

Eastern literature linked time to an arrow even earlier. A Japanese proverb that appeared in the 18th century neo-Confucianist text *Ten Kun (The Way of Contentment)* by Kaibara Ekken – "Koin ya no gotoshi" – has been translated and re-translated to English as either "time is like an arrow" or more commonly as "time flies like an arrow." The latter of these has been popularized in the West by the comic Groucho Marx who famously quipped that "time flies like an arrow, fruit flies like a banana." Today, the link has become so widespread that it has found its way into literary, philosophic and scientific works.

Both visual metaphors of time as a river and as an arrow are unidirectional and irrevocable.

They represent time as moving in a single, irreversible direction. There is a definite point of origin in both images – either a riverbed or a bow – from which all of the movement emanates and continues onward in a unique, singular direction. There is also no point of return once that movement has begun. Just as one cannot enter the same river twice, one cannot retrieve an arrow from its flight.

Photo by Jim Grey.

Book Cover: *Time's Arrow and Archimedes' Point: New Directions for the Physics of Time* by Huw Price. 1997.

Book Cover: *Time's Arrow* by Martin Amis. 1992.

Book Cover: *Time's Arrows: Scientific Attitudes toward Time* by Richard Morris. 1986.

6. TIME AS A CIRCLE

Looking back at prehistoric symbolism, we find a competing vision of time to the linear conceptions of the arrow and the river. Some traditional societies viewed time as a cyclical process, rather than a linear one. These images were based on an understanding of time as an eternal repetition of daily, annual and generational patterns.

For such ancient societies, the future did not hold the unique mystical quality that we attach to it, but was a symmetrical reflection of both the past and the present. Belief in the cyclical repetition of patterns was the basis for the Buddhist wheel of rebirth, which represents time's passage as a closed circular wheel. This symbolism is also prevalent in several ancient Eastern societies, and has been preserved to this day in the astrological wheel of fortune and the circular representations of the Zodiac.

People living in the ancient world, with its small tribal and village societies, routinely witnessed weddings, births and burials. The entire cycle of a human life passed before their eyes and was tightly woven into their understanding of the everyday. Modern society has largely separated us from these events. We have allocated specialized spaces for birthing and death – hospitals, morgues, churches, cemeteries, etc. We have lost the ability to perceive the cycles which naturally occur in human life. The perception of progress has replaced that of repetition as the foundation for our experience of the world.

Aztec Sun Stone-Calendar. Mexico City. Anthropological Museum. XV century.

Wheel of Fortune. Miniature. France. XIV century (original source unknown).

Tibetan mandala. XVIII century. John Glines' Photo Collection.

Wheel of Salvation. India. VIII century. John Glines' Photo Collection.

Kali, warrior goddess of fertility, time, mysteries, destruction and death. India. Contemporary replica of the ancient sculpture. Private collection.

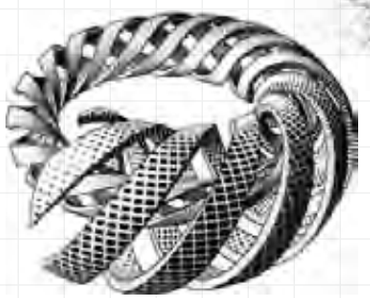
7. TIME AS THE OUROBOROS

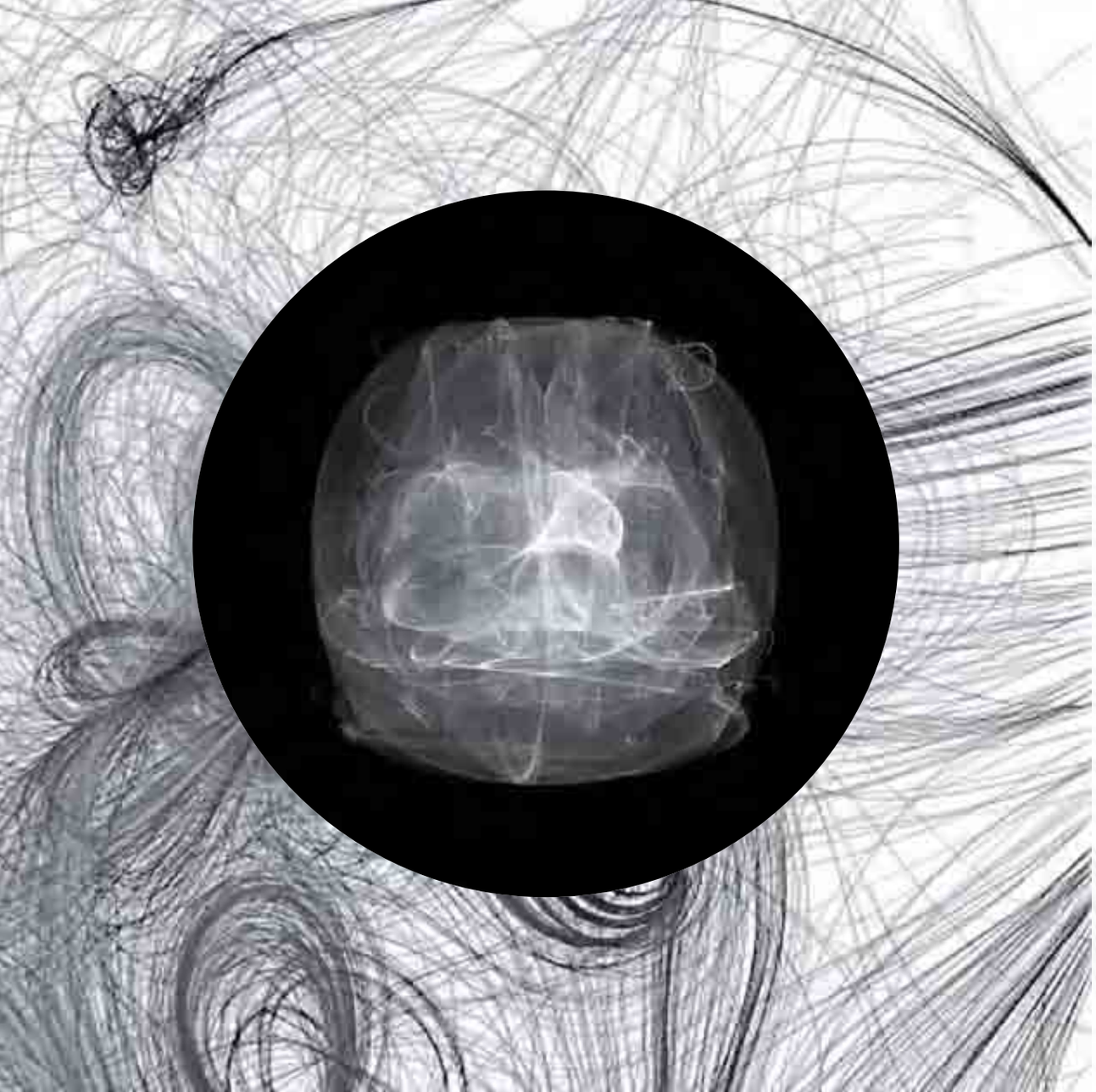
One of the notable early symbols that portrays the cycle of time is the Ouroboros – a snake eating its own tail. We can trace this symbol back to neolithic China in 6000 B.C., as well as the mythologies of such diverse societies as the Egyptians, the Aztecs and the Greeks. At the epoch during which the Ouroboros first made its appearance, it was one of many symbols considered to possess a magical or religious function. This sense of the symbol was assimilated into the Western world through the imaginings of the medieval alchemists, whose visual language incorporated the cyclical figure, and emphasized its magical properties. More recently, the Ouroboros lost its association with time and became an esoteric emblem divorced from its original significance.

In the age of the trademark and the computer icon, our relationship with symbols has changed. While primitive societies ascribed mystical powers to their drawings, we view them today as largely decorative elements. It will therefore make more sense to the modern viewer to see the Ouroboros reinvented by the artist M.C. Escher to fit our scientific, utilitarian concept of the symbol.

Escher, known for his complex geometric illustrations and paradoxical visual games, transformed the Ouroboros from its original magical form as a self-devouring snake into a modern, non-magical symbol. His drawing of the Ouroboros does not rely on the traditional form of the snake. Rather, he draws a spiral coil that winds around itself in a seemingly endless pattern. As Escher demonstrates, the Ouroboros is a fitting metaphor for any repeated cyclical process. It is the logical continuation of the spiral – a winding circle that collapses in on itself. It seems to have a beginning and an end; at the same time, it does not.

Ouroboros from Medieval Alchemy Manuscripts.
Ouroboros as emblem of mortality. George Wither's Collection of Emblems, Ancient and Modern. 1635.
Brown Jade pig-dragon (Coiled Zhulong). Neolithic Hongshan culture. IV millennium BC. Private collection.
M.C. Escher. Spiral. Wood engraving. 1953.
The Magic Mirror of M.C. Escher by Bruno Ernst. Barnes & Noble Books. New York, 1994, 98, 99. Fig. 219, 220, 221.





8. TIME AS A TRAJECTORY

There are few straight lines in nature; it is we who superimpose the Cartesian plane onto circular and elliptical shapes and trajectories. Our perception of time is no different. We view history as a record of linear progress, and we visualize time as an eternal line from point A to point B.

Is the cyclical understanding embodied in the Ouroboros therefore more in tune with nature than the notions of the directed river or arrow?

Our tendency to assign linear visualizations to time is analogous to the experience of a fish that spends its entire life in a river with a strong, directed current. The fish considers the current a basic characteristic of its environment, but we know that temperature, gravitation, the earth's relief and numerous other factors contribute to the formation of the current, which is not a necessary attribute of water. Our perception of time is parallel to the view of the current held by the fish. Having lived within an environment that seems to be subject to the forces of a unidirectional time, we have accepted it as intrinsic to our world.

While modern history relies on a linear understanding of time, modern science seeks out recurring patterns and repetitions, codifying this search through the scientific method of observation and experimentation. One of the fundamental tenets of the Scientific Method is that a hypothesis can be proven only if its conclusion can be reliably repeated under similar conditions. It can be inferred from this that given a set of identical circumstances, any observable process will repeat itself in a cyclical fashion. We can call this repetition the *life trajectory* of any given process. In ideal conditions, this life trajectory can be visualized as a circle.

Outside of tightly controlled experiments, individual circular trajectories can interact and intersect. Imagine the human body in which each organ and cell has its own life cycle, and each exists at different stages within its cycle. In an alcoholic's body the liver will reach the end of its life span first, while the rest of the body may be able to outlive it by years or decades. In an even larger system, each element will have its own life trajectory, and these trajectories will each experience time individually.

Paul Richards & Paul Bourke. Clifford Attractor. http://local.wasp.uwa.edu.au/~pbourke/fractals/ (Published with author's permission).

Casey Reas. Tissue Type C-03. 2002 (Published with author's permission).

Casey Reas. Path 17. 2001. Lines in the image reveal paths of autonomous software machines' movement as they respond to stimuli in their environment. http://reas.com. (Published with author's permission).

9. TIME AS AN OCEAN

Time is more accurately visualized not as a river, but as an ocean with a wide array of competing currents moving in different directions, each following its own cyclical pattern. In other words, time moves in different directions and at varying speeds at every individual point in space. As human beings with relatively limited life spans, we happen to exist within one cyclical current, which seems to us to be unidirectional.

As usual, our perceptions play tricks with us. We are raised in a particular cultural setting that teaches us to be members of society and see things according to society's conventions. The standard visual metaphors, including those of time, are implanted in our collective consciousness by a long process of social education or socialization. We recognize physical objects and abstract concepts as we were taught. Even artists' imaginations cannot escape societal clichés.

Photo by Haus. www.flickr.com. Published with author's permission. Author chose not to make public his full name.

10. TIME AS A MIRROR

The most remarkable visualization of the perception of time that I have seen belongs to René Magritte. His painting *La Réproduction Interdite*, (Reproduction Prohibited) portrays a man looking into a mirror and seeing not his face, but his back. Magritte never personally connected this work to time, but it is a perfect example of our perception of it. We look ahead to the future, but all we can see is our past. In the painting, the future and the past are mirror images of one another.

As a symbol, the mirror itself is extremely important in our visual culture. Fairytale creatures love to come into our world through mirrors, whose reflections seem so similar to our surroundings but are entirely impenetrable. For our purposes, this quality of a mirror to reflect what is behind the viewer but not let him enter is what aligns mirror symbolism more closely to space rather than time.

Unlike time, space is thought of as symmetrical. It extends evenly in all directions. Time is believed to be asymmetrical and extending in only one direction. A mirror folds space onto itself, giving the viewer an illusion of perfect symmetry – what is behind him is also in front of him. Yet in his painting, Magritte also unwittingly captures the symmetry of time. It is not the simple mirror symmetry that reflects its viewer, but symmetry which, reversed in its own reflection, faces the same direction as the viewer.

René Magritte. La Reproduction Interdite. 1937.
Held at Museum Boijmans Van Beuningen, Rotterdam Belgium.

"The charms of a passing woman are usually in direct relation to the speed of her passing."
–Marcel Proust

In Search of Absent Time

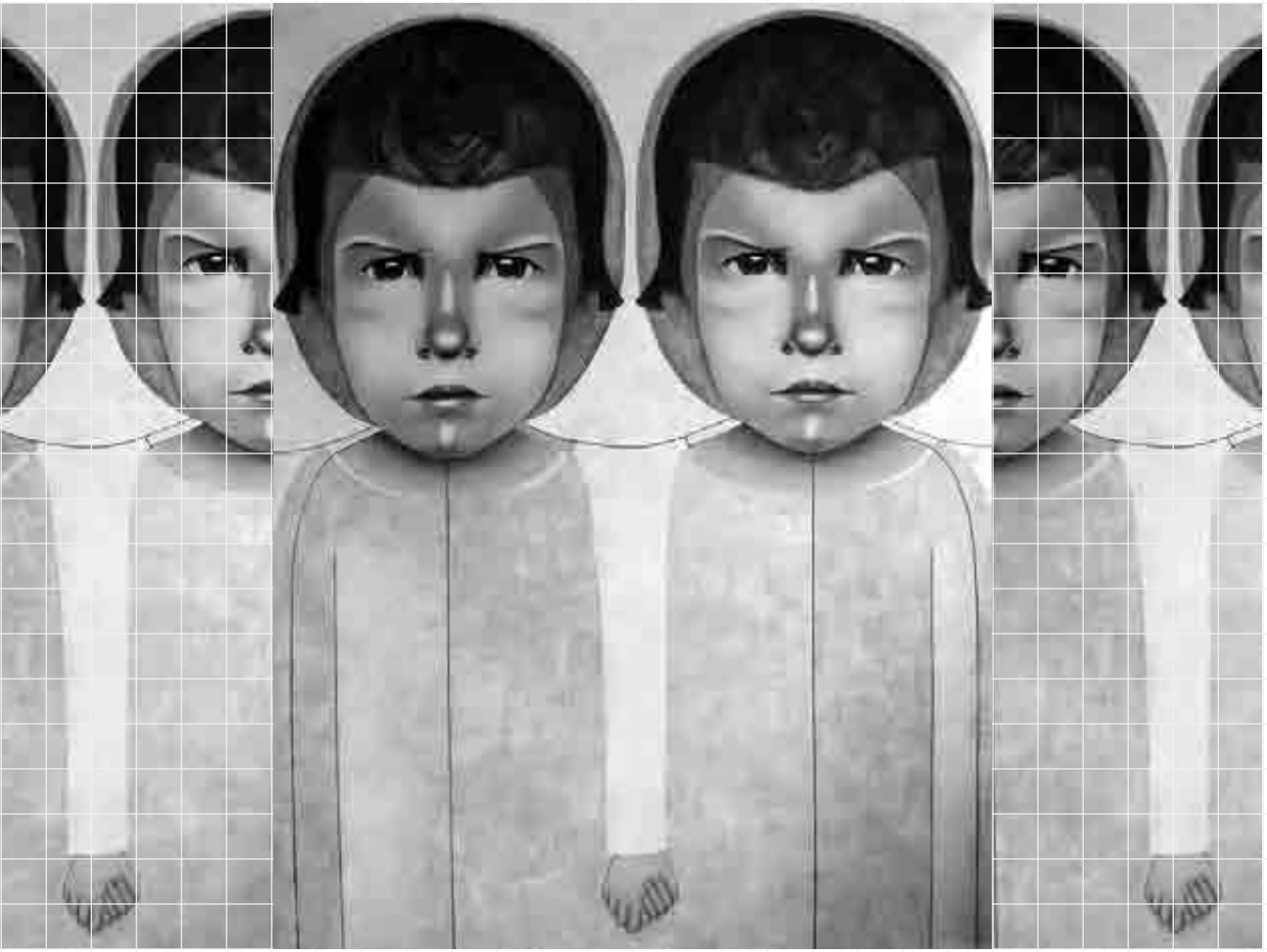
1. PERCEPTION AND IMPERCEPTION

The human body has various sensory mechanisms designed to perceive and organize information. Our eyes, ears, nose, tongue and skin make the outside world understandable to us in particular ways. We perceive electromagnetic waves as color, and particular molecular shapes as scent, etc. Our perceptions determine the way we experience our environment, and determine the look and feel of our world.

Time has never been truly accepted as a part of the repertoire of our perceptions. A simple linguistic demonstration of this is contained in these two questions: "Does the universe have a scent?" and "Does the universe have time?" The first, based on our senses, seems nonsensical; the second seems to hold some meaning.

But time in its essence may not be different from scent or the other senses. Having observed repeated and regular changes in the matter around us, we have learned to interpret their cause as the result of the passage of time. As examples, we can take the processes of human aging, the spoilage of food and the deterioration of buildings. In other words, our view of time has been determined by the ability of our perceptual organs to detect changes in the surrounding world.

Linearity may not be intrinsic to these processes of aging and decay. Like a fish that lives in a current and believes itself to be an innate part of its environment, so do we perceive time as linear. Yet the assumption that linearity is a natural aspect of time limits our ability to determine its real nature. We see only its seemingly mysterious impact on the objects that surround us.



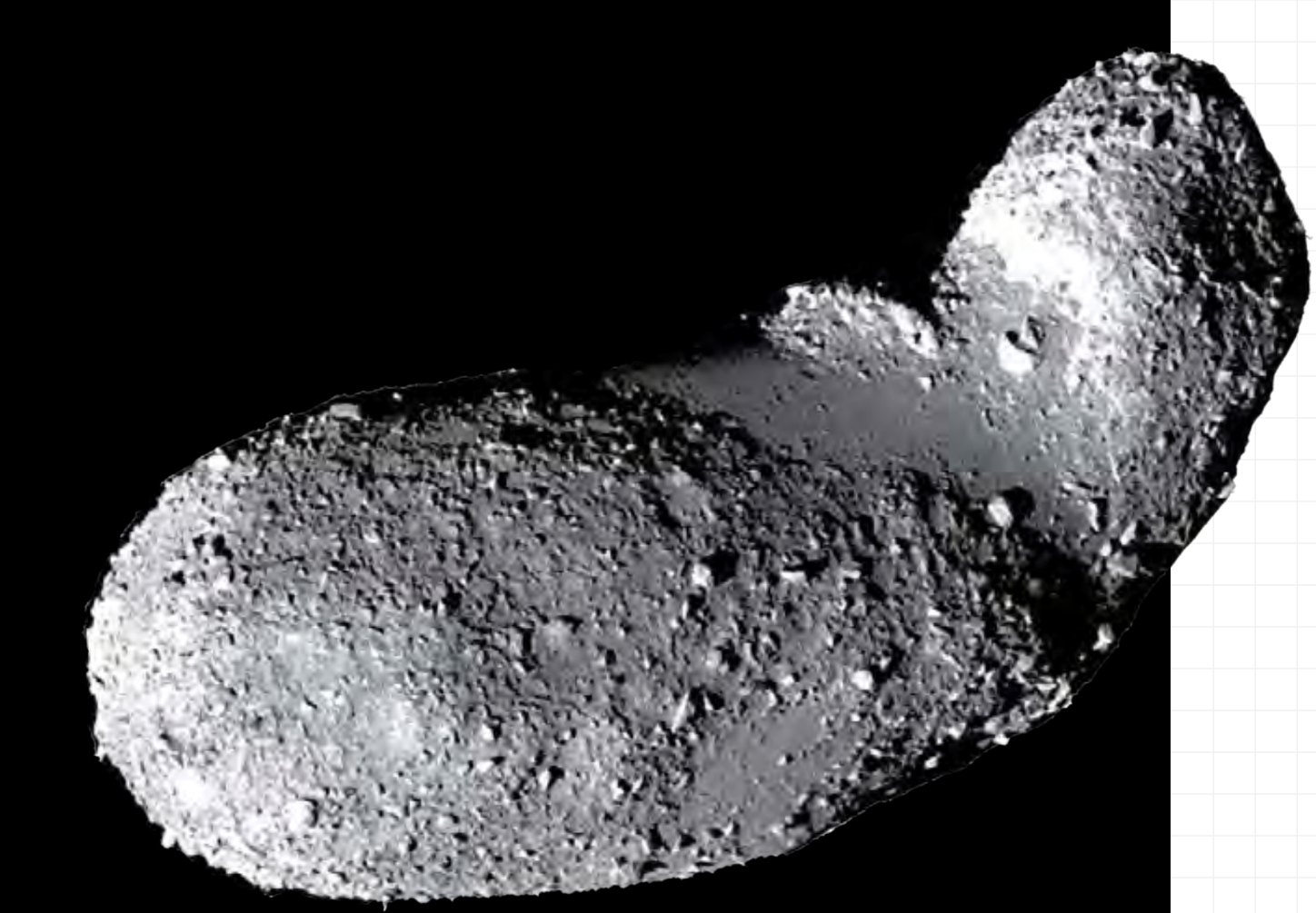
2. THE TWIN PARADOX

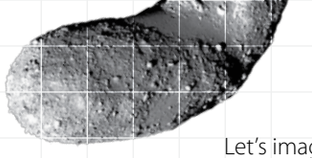
Having inferred early on the existence of a basic cyclical process of the relative motion of the sun and the earth, we have trained our perception to measure all other changes against it. Are the changes in objects that we relate to aging and the passage of time as predictable as the circular movements of the clock that we have designed to measure them? The obvious answer is no. Even similar objects can diverge in how they change.

Let's take the example of two copies of the same book placed in separate environments – one in a private collection, and one in a public library. These copies, subject to different circumstances, will change differently to reach the point at which we cannot determine their age. In 1911, the French physicist Paul Langevin proposed the famous "Twin Paradox," based on the work of Albert Einstein. Langevin used the example of two twin brothers, one of whom is an astronaut and undertakes a long space journey at the speed of light, and the other who stays on Earth. He states that the brother who travels will be younger than his twin when he returns. This, too, seems to support our observation.

We do not need to go to the extremes of space travel to observe the twin paradox. If you were to refrigerate a piece of food while leaving its twin out on a table you'd prove that the refrigerated food will "live" longer and decay more slowly than its counterpart. There is no paradox here. Isolating a piece of food slows down the natural processes of decay that occur within it, and protects it from external interactions which may damage it. If we bring both to a halt, we could preserve a piece of food indefinitely.

Illustration by Olga Ast. Containing: Gatekeepers. Painting by Anje Roosjen. 2005. Held in the artist's personal collection.





3. THE COSMIC OBJECT

Similar objects can age differently when placed into different environments. The passage of time for any given object seems to be dependent on two elements.

The first element is the initial composition of an object, or its *informational structure*. The second is its subsequent interactions with other objects in its environment, which leave an *informational imprint* on it. In other words, objects are composed of the information that goes into their inner composition, as well as the history of their interactions with other objects and the changes that result.

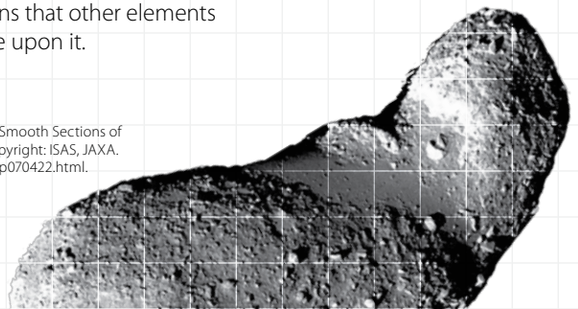
Every object can be studied in terms of its *informational structure* and *informational imprint*.

Any object in our physical universe ages according to how its *informational structure* accumulates information. Structural change within an object – aging – is not linked to the passage of time in the way that we currently comprehend it, as an independent force. Instead, it relates to the change in the *informational imprint* of the object, or the record of the impressions that other elements in its environment leave upon it.

Let's imagine a cosmic object that exists in a perfect vacuum somewhere in outer space, leaving the details about its shape, location and trajectory unknown. As observers, we know nothing about this object but the fact that it exists, and that it is not subject to any interactions within its given environment or within its inner properties. Does time as we understand it exist for this cosmic object?

If this object collides with another object and changes its shape and trajectory, what has actually happened is that the two objects exchanged information. They both have left *informational imprints* on one another and changed their *informational structures* accordingly.

Having previously known nothing about our cosmic object, we can now analyze its informational imprint and conclude with all probability that it interacted with another object. This allows us to examine not only its current state, but also its previous state. The informational imprint, or the record of change within the object, serves as a reference in dividing what we would normally term the "present" from the "past."



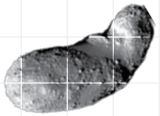
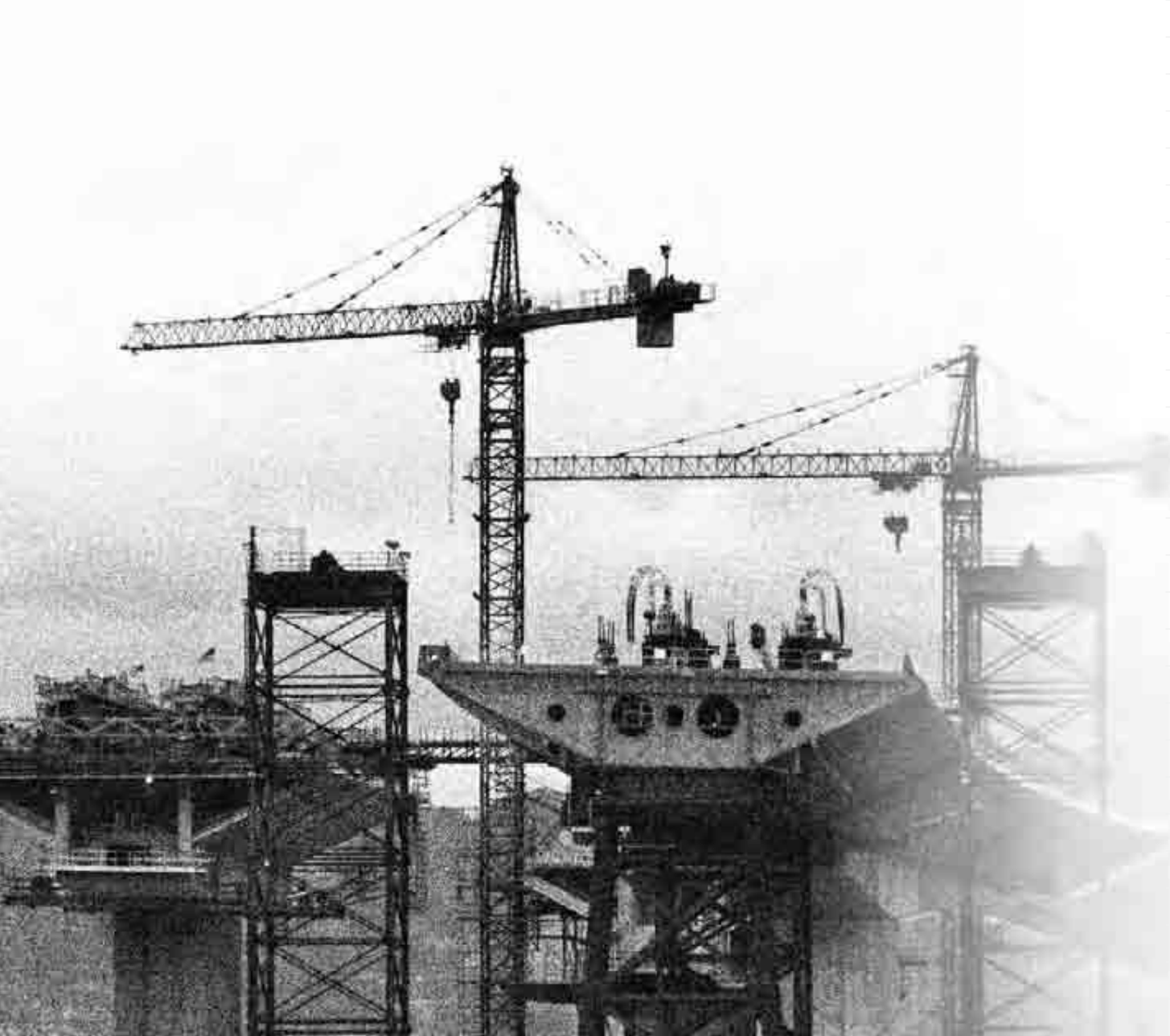


Illustration by Olga Ast. Containing: Smooth Sections of Asteroid Itokawa. Photo Credit & Copyright: ISAS, JAXA. http://antwrp.gsfc.nasa.gov/apod/ap070422.html.



9. MANIPULATING TI

How do we manipulate the coefficient of informational change? Let's begin by building a bridge. To do so, we will have to change the state of many objects, and change them in a particular order. How quickly can we change the original state of *nothing* over a river to the necessary state of a bridge across it?

We can add equipment such as a bulldozer or a crane, thereby increasing the Tf and decreasing the Ti for the task. We can add information that instead decreases the Tf by decreasing the number of workers on the construction site. This will correspondingly increase Ti. Both of these are examples of actualized, physical information acting within our simple informational exchange system.

Encoded information plays a more nuanced role in influencing the Ti of this system. We can increase the time necessary for the task by increasing the complexity of the bridge – by adding new elements to the building plans, for example. Though this does not change the Tf, it increases the Ti. If, on the other hand, we have an idea about how the bridge can be put together more efficiently by elements or streamlining our process, we can decrease the Ti again without changing the force applied to the informational system. This is achieved simply by managing the complexity of the system and its informational organization.[5]

Referring back to our earlier discussion of the levels of complexity of structured space, we can add that Ti can be manipulated by adding to, or subtracting from, the complexity of information within any informational system. *Regardless of whether the applied information is encoded or actualized, the higher the level of structural complexity of the elements within any informational system, the greater the potential to manipulate the Ti.*

[5] *Informational organization* belongs to the realm of encoded information. We gain the ability to manipulate it not through any actualized objects, but through ideas and codified languages. Differently organized informational systems create differently structured spaces. In the example of a bridge, a more efficient internal organization can create a more efficient bridge that takes less time to construct. Underlying this idea is the assumption that more complex systems are more pliable to manipulation. That it, it is easier to influence the resistance of the system (Tr) in a particular direction – to increase or to decrease it. Therefore, the more complex the informational structure, and the higher the level of complexity of its informational organization, the higher the ability to manipulate the coefficient of informational change in either direction.

10. TIME AS A COEFFICIENT

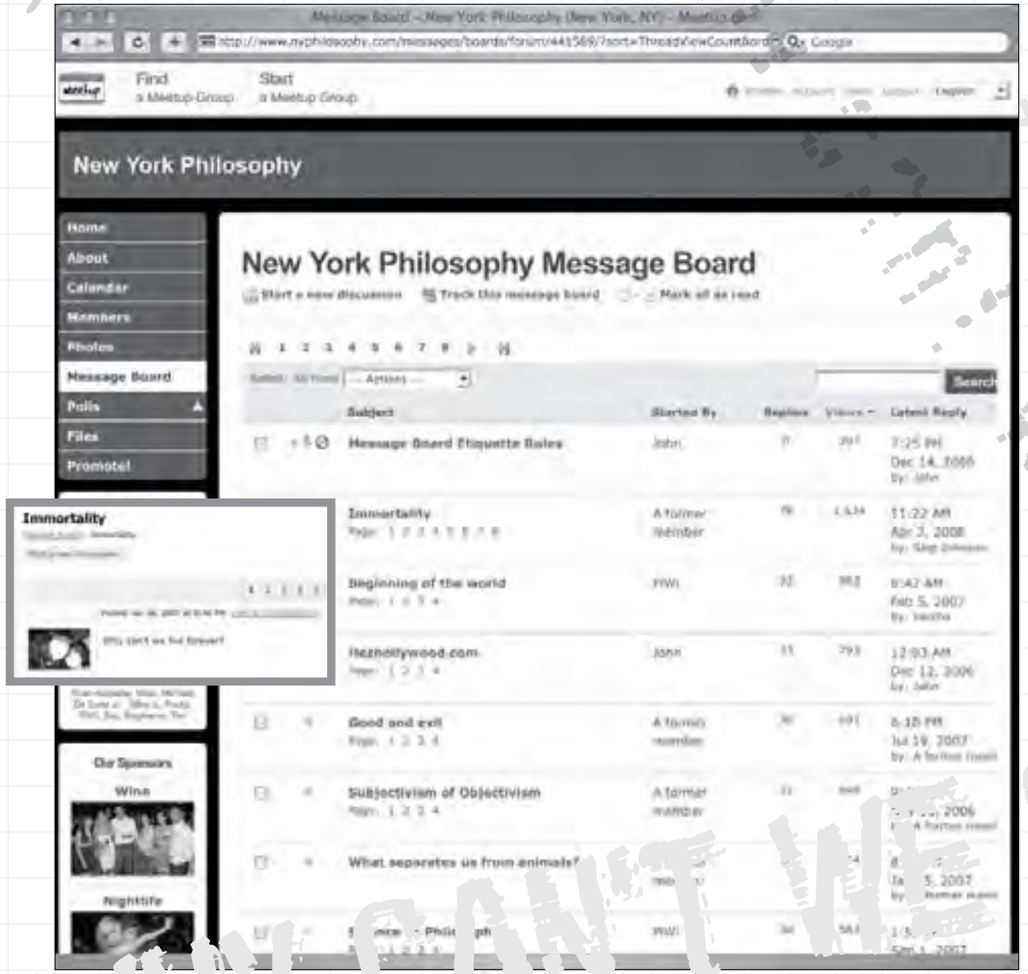
The equation Ti = Tr/Tf presupposes that time is not a linear progression but a *unique coefficient of informational change* for any region of structured space, and that this coefficient is perceived by us as a unified progression of time. In the classical scheme, we have measured this progression against a single interaction between two informational systems – the sun and the earth.

Time is not an absolute but a relative element of our world. There is no past or future, but an infinite informational field undergoing constant change.

Like water in an ocean, time moves information in different directions and at varying speeds at every individual point in space. In divorcing ourselves from our perception and imagery of time as a linear, one way progression, we have to create an alternate vocabulary for understanding how it works. Such an approach has to hinge on the relationships between time, space and information to build a new visualization, understanding and vision of time.

"Why are there beings at all,
instead of nothing?"
–Martin Heidegger

The Origin of Forms



1. TIME AS FEAR

The question "What is time?" has been considered to belong to physics or philosophy. To me, the question becomes more psychological, "Why do we experience changes in information as time passing?" More accurately, what we ask ourselves is "Why do we age? Why do we not live forever? Why do we have to die?"[1]

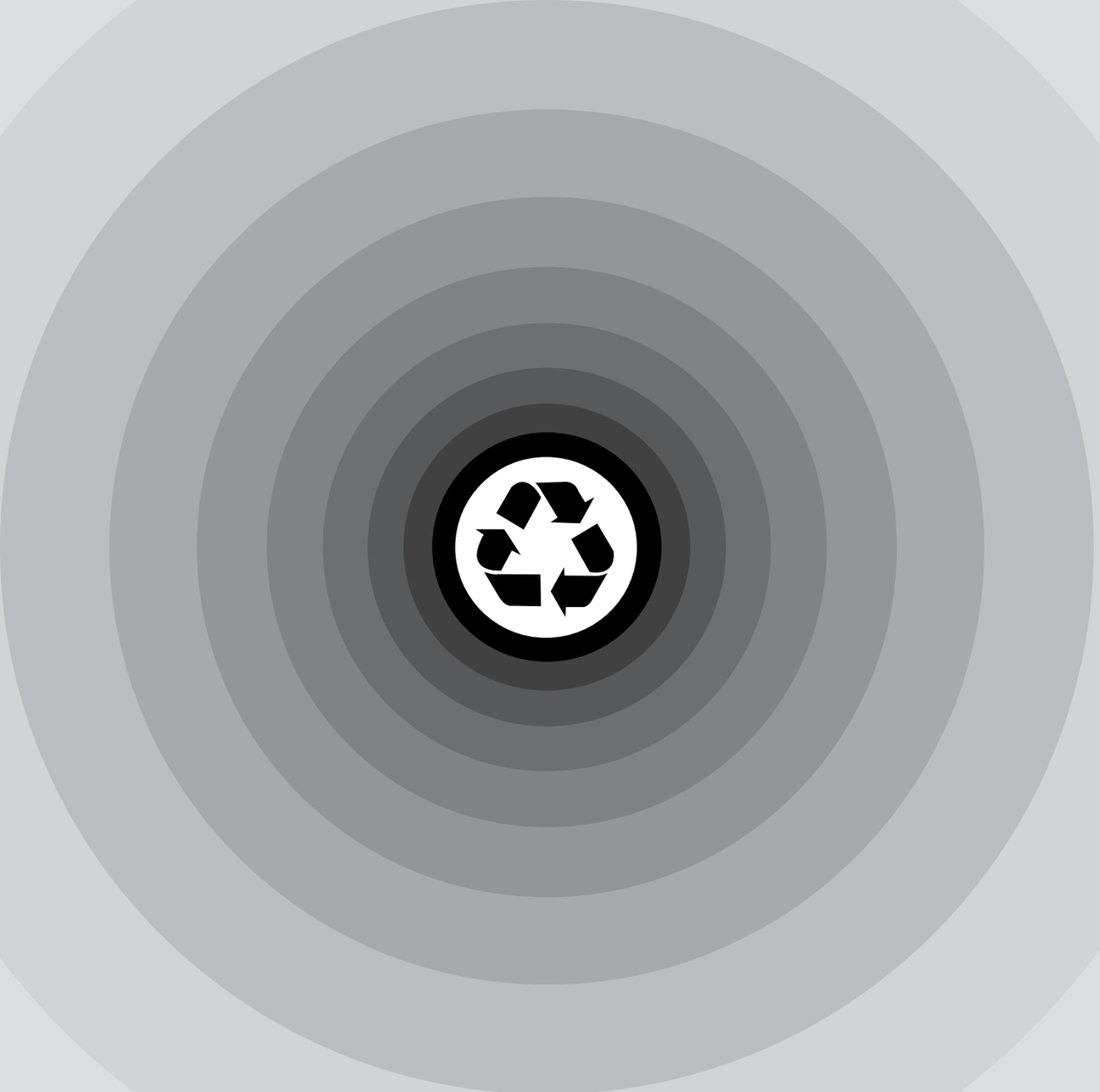
We connect the abstract idea of time with our fear of death. As a consequence, the concept of time transforms into a powerful myth that places an unbearable psychological burden on us that we cannot overcome. We are afraid to investigate time because we are afraid of death.[2] Instead, we look in the opposite direction. We strive to reverse our decline – go from old age to youth. We are on a never ending search for the ultimate elixir of youth – a cream, a pill, or a surgical intervention.

Time and age are inextricably linked in our collective consciousness. We have created the myth, and we are afraid of our creation. This fear is the reason for our interpretation of informational change as an irreversible passage and decline.

Time seems too overpowering to deal with.

[1] This question was most viewed (1,534) and received most number of responses (78) by 2009 on the discussion boards of the New York Philosophy Meetup, and was part of the most popular discussion of 2007 and 2008, titled "Immortality." http://www.nyphilosophy.com/messages/boards/. Screenshot on page 50.

[2] In China, people never offer a clock as a gift because the words *death* and *clock* are homonyms.



2. TIME AS SENSE

Humans have complex tools for collecting information from the environment – the senses.[3] Is there a sensory tool for sensing time?

Perhaps the answer is obvious. Among its other functions, the brain collects, encodes, stores, analyzes and decodes information that comes from the sense suppliers of the body. It produces new information. It does not touch, smell or feel anything, but deals solely with encoded information. It is a tool that never directly communicates with the outside world, yet is essential to us if we are to notice changes in our surrounding informational field. It records these changes as linear and sequential, and stores them in memory.

Our understanding of cause and effect depends on the linearity we assign to change. We know from experience that if we put water in a pot above a fire, it will boil and evaporate. If we cover the pot, the vapor will condense back into water. With reference to the human body, the same process has different results. A human body placed over a heat source will burn, but will not be able to condense and be re-used.

We designate as cyclical those processes which we can observe from beginning to end, like the change from water to vapor and vice versa. We see linear processes in those of human life and death. Our egocentric tendencies win over our objective observations which tell us that when humans are burned or buildings destroyed, their same atoms remain, simply rearranged. Yet we tend to perceive human life and the lives of man-made objects as linear, and connect these to our understanding of time.

Upon death, the space that had been structured as a human or a building remains, but changes the principles of its structure and the connections between its parts. The component parts of humans participate in much greater cycles of transformation than we can observe in water.

All informational systems are part of lesser or greater cycles of transformation, even as our brains sometimes perceive only a localized, limited portion of these cycles and encode them as straight, directed lines.

[3] Like other living beings with their own toolsets.

Illustration by Olga Ast.

3. TIME AS MEMORY

If we did not have memory, would time exist?

Our conception of time is wholly dependent on our ability to see the current state of a given object and compare it to what we remember as its previous state. We look to objects and events in search of patterns.

Yet when we recall information from memory, it is not necessarily sequential or linear. We sometimes have trouble remembering. Even if we have perfect recall, there are complications. One person sees a man running and, a few moments later, hears a loud sound. Another hears a loud sound and looks up to see a man running. Both of these people recall a different sequence of events. What's more is that the running man and the sound may be entirely unconnected, yet they can become linked in their observers' memories. Despite our brain's ability to find causal patterns in the events around us, a perceived sequence of events does not necessarily help us understand whether they actually depend on one another.

To deal with the sloppiness of memory, we have developed abstraction.

This is reminiscent of the causality dilemma – "Which came first, the chicken or the egg?" – that has entertained us for thousands of years. More complex questions require the intervention of an abstract outside observer, someone independent of our entire informational system.[4]

Problem solving requires another kind of recall. When we try to find a solution to a problem, the brain does not sift through all of our experiences from birth to the present moment. Rather, it calls forth only that information which it recognizes as necessary for the task at hand. This is the natural tendency of our recall. If we want to instead remember events in a linear, sequential order, we must impose on the brain to do so against its inclination. Remembering – and remembering in sequence – is not the main function or evolutionary strength of the brain. It evolved not to simply register events, but to produce new ideas and new encoded information.[5]

Sequential thinking is not an efficient process for the fabrication of new ideas, yet it is taught and reinforced through social education. We need to remember sequences so as to create objective, social narratives that do not depend on the perception of a single individual – for the survival of society and of the species.

So we teach children to methodically organize knowledge in a logical order, from the simple to the complex. We no longer try to understand nature as a whole. Instead, we learn to see it as a linear sequence of distinct fragments.

As we become socialized, sequential thinking comes to seem natural, and we start to see time as a sequence of elements – seconds and minutes – that follow one another in a precise, eternal order, in one direction and along an imaginary line.

[4] We have invented the notion of facts and documents, but this system is not foolproof. Whole epochs have been built on forged documentation – recall the regime of Joseph Stalin and its reliance on building a politicized version of history and implanting it into the collective memory of a country. Facts are often harder to prove than the ideas people have been manipulated to believe in.

[5] Imagination plays a role here. Memory and imagination interface in assembling ideas. Without imaginary figures and events, our perception of the world would be flat. We imagine, and we make our imaginations into reality.

Photo by Julia Druk.

Photo by Shannon Shaggy Fink.
Photo by Jason Bechtel. Available under a Creative Commons license (www.flickr.com).

9. SENSE OF DIRECTION

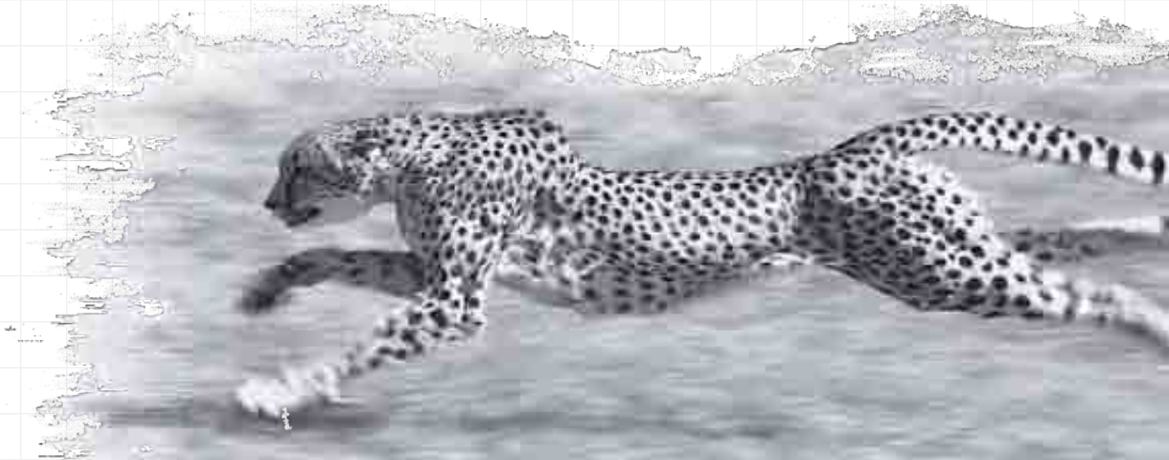
It is nonsensical to ask in which direction our planet moves around the sun. Is it from right to left or from left to right? There is no right or left or top or bottom to the universe. Yet living beings have developed a sense of orientation, and can consciously move in a particular direction: toward resources and away from danger.

How is it that this indifferent universe, lacking any sense of its own direction, produced such a multitude of directional, spatially oriented shapes on the surface of one planet? Is there a directional movement or force that might be the cause?

First, light always moves away from its source. Gravitational force also seems to move in a single direction – toward the center of a mass. If living matter did not try to overcome the pull of gravity, there would be no shapes other than spheres or their variants, ovals and spirals. Biological organisms developed while trying to escape gravity and, crawling, pull themselves to light and energy.

The aforementioned virus is still trying to find its direction, but the jellyfish already knows the difference between front and back. It has figured out where to go. Plants generally divide their foundational sphere, the seed, into two opposing directions to reach the resources they use – down for the roots, and up for the crown. Most mammals direct themselves along the plane of the Earth. They have developed a sense of front, back, left and right, but still lack an intuition for top and bottom.[8] Humans can intuit their spatial orientation in all directions.

[8] One exception to this is birds, whose bodies have developed the ability to move in an almost two-dimensional plane parallel to the earth's surface. Insects also fall under this exception.



10. FORM AS A MESSAGE

The main feature of our bodies is direction. We have a sense of direction – we feel it, and can intuitively move our bodies on a particular route. We determined our shape out of the directional force of gravitation and our desire to escape it – it is the result of our struggle with and resistance to gravity.[9]

Our bodies developed as a result of a constant, violent conflict between our desires and the resistance of the space into which we have grown.

We have reached out to sunlight, to food, to sexual partners for millions of years. These efforts have shapes our bodies, little by little. This shape is the result of an indeterminately long conversation between our bodies and their environment. We send a constant message to our surroundings: our body can resist and conquer you. Our every movement is a communication to our environment in response to its communication to us.

The more complex the environment, the more complex the messages that are passed between it and the bodies within it. With increasing environmental complexity, bodies too become more complex. An ecosystem is built of a countless number of such messages.

The spherical shape of a virus can develop anywhere in the universe. The complex, spatially oriented shapes of animals can grow and evolve only in the presence of a directional force. In our case, this force is the pressure of gravity.[10]

[9] "¡No pasarán!" (Spanish); "No passaran!" (Catalan); "Ils ne passeront pas" (French); "Sie kommen nicht durch!" (German); Враг не пройдет! (Russian); la Résistance; Rote Front!; etc.

[10] It is possible that *oriented* biological organisms have had to develop locally, on planetary surfaces, but we can make no conclusions as to where biological life first originated – on planets or some other location in space, e.g. as viruses carried to planets on the tails of comets.

11. DIRECTION AS PATTERN

Our sense of orientation is essential to our survival. No movement is possible without it. The vestibular system of the body is tuned to the direction of the gravitational force – we balance our bodies relative to it. As we discover new environments which have no gravity, we see that the lack of this force negatively affects human bodies. Astronauts working in zero gravity experience the deregulation of their organ functions, a decrease in their immune response and other effects.[11]

We are naturally trained to assign absolute meaning to that which we experience for a long enough duration – our brains look for such patterns. We have assigned such meaning to the direction of the gravitational force. We have to force ourselves to conceptualize it as relative to our local, limited portion of the planet's surface. Yet across from us, on the other side of the planet, this force points in the opposite direction, as absurd and funny as that sounds.[12]

[11] My guess is that one reason for organ failure is that the body begins to recognize that its shape is no longer optimal to its environment. Unlike humans, viruses must love zero gravity! They adapt to such environments much faster than we do.

[12] "'I wonder if I shall fall fight through the earth! How funny it'll seem to come out among the people that walk with their heads downwards! The antipathies, I think–' (she was rather glad there was no one listening, this time, as it didn't sound at all the right word) '–but I shall have to ask them what the name of the country is, you know. Please, Ma'am, is this New Zealand? Or Australia?'" *Alice's Adventures in Wonderland* by Lewis Carroll with an Introduction by E. S. Martin. New York and London. Harper & Brothers Publishers. October, 1901, 5

14. TIME AS WILL

Our will to conquer and dominate along with our ability to create abstract concepts gives us the potential to manipulate encoded information and apply it to our real surroundings, to actualize it in physical space. Yet with the desire to dominate comes the desire to accept only one point of view. Civilization is oriented toward competition, struggle and conquest. Only one vision can dominate.[15]

By narrowing our conceptual horizons as we solve problems, we are moving in a straight line toward one visible goal. This is how we have come to create a technological civilization. Yet technology is too powerful and cruel a tool to exist alongside a fragile nature. Our impact on our environment has become too straightforward, inflexible and brutal. We appreciate the advances brought about by the combination of science and the instincts traditionally assigned to the male gender, but at the same time bemoan its disastrous impact on the Earth.

Our increased ability to suppress our surroundings clouds our understanding of the natural way things work. Forcing nature into squares, cubes and straight lines will eventually turn it against us. We ourselves are irregular; we are a part of nature.

Yet our psychology is wired for *directionality*. Our sense of direction overwhelms our natural senses, and we cannot help but apply it to what surrounds us – including time. We create an imaginary line between the dark past and the bright future (or, just as strongly, between the "Golden Age" of the past and the Apocalypse). This is, in fact, a relative assignment based on our limited orientation in the universe. It does not belong to the universe. We see a local process, and assign to it an absolute meaning.

The straight line reflects not an absolute law, but the ruling principle of our will to move forward.

[15] Christianity and Islam, science and religion, reason and insanity, Capitalism and Communism are all reluctant to compromise. The idea of acceptance, tolerance and cooperation is relatively recent, though in many cases it has led to greater social success and survival. Perhaps tolerance came into society with the increased participation of women, but I leave to others the further exploration of this hypothesis.

15. TIME AS SHAPE

Our bodies actualize in space and grow into it as part of a conversation with the changes in their surroundings. They develop complex relationships with everything around them and inside of them. They orient themselves in a complex informational system with the perception of themselves at the center. Without this perception, they would not have developed their complex, *spatially oriented* shape. Our body puts itself at the center point of the informational system, and makes all its calculations referring to itself as the center of the system. Our central position gives us a frame of reference with six prime directions our body can recognize: 'front', 'back', 'left', 'right', 'bottom' and 'top.'

If time is an indicator of change and resistance to change in information, then our bodies and all the biological organisms around us are different forms of response to informational transformation. Therefore, we can say that *time forms and molds the shape of actualized information.*

Every shape in the universe is a unique record of its time. The form of a particular stone reflects its response to change, the form of a human body similarly reflects first its change along our human evolutionary path and second, its change during its own existence and experience.

Time is a form of information, information that comes into existence in the material world as material matter. It is the medium through which actualized matter comes into existence. Because of it, the physical world exists.

What has been will be again,
what has been done will be done again;
there is nothing new under the sun.
(Ecclesiastes 1:9-14 NIV)

A Copy Machine

1. TIME AS MOVEMENT

As we resist gravitation in trying to reach the objects of our desires, we develop a *sense of direction*. Our aspirations force us to figure out the shortest distance to the closest goal. We therefore sense the advantage of the straight line for crossing short distances, and we want everything to be *directed* along that line in the course of our will. We want to move forward as quickly as possible along straight lines.

But how did we begin interpreting our *sense of time* as a *passage of time* – something independent from our other senses, that moves, flows, controls and pulls us somewhere?

The life of a living creature is always on the move. It is always directed somewhere. Even as the creature sleeps, it has to move air through the lungs, digest food, heal, etc. The end of movement means death, and the transformation of the living creature into disintegrating substance.

Largely, this movement is cyclical – processes and actions recur in our bodies and lives. Every day, we repeat the same routines: we eat again, drink again, sleep and excrete again. Every generation repeats the experiences of the previous generations. Earth rotates around its own axis and around the sun, again and again…

We have built our civilization on collecting information about our world. By collecting and storing information about what surrounds us, we influence the circumstances and actions of subsequent generations. The Earth without human influence or catastrophic events moves at a slow pace. It changes slowly, imperceptibly – and would appear to the casual observer to be static.

4. REPLICATION AS A PRINCIPLE

Replication is as deeply fundamental to our lives as our genetic code, which we inevitably transfer to the next generation. And so we eternally return to the question: Why do we have to die? Why the injustice, why pass our genes and our knowledge on to our children but not retain them in ourselves? Why give up all that we collect throughout our lives? Why not use the same toothbrush eternally?

Yet we admit that the replication process is essential and necessary for the existence of living organisms. Replication may be visible or invisible. Even now, the cells in our bodies are invisibly making and discarding duplicates. They are always on the move, and always in the process of replicating themselves. When they stop, so do we.

Bodies are encoded to regulate the replication process even without the awareness of their owners. Even outside conscious thought, bodies manage this precisely and almost always accurately. The process is never chaotic. Every step is specifically arranged, one after another.

Photo by Dennis Smith, M1DLG.

5. TIME AS A SENSE

Is our sense of time connected to the process of replication?

The brain unconsciously registers and even regulates cellular division and replication. Is it possible, then, that it measures time not in seconds, but in copies?[1]

Through the process of replication, cells collect information about themselves and replicate themselves accordingly, whether for better or for worse. This is the basis of any progress, any evolution. With each new copy – whether of a cell or an organism – we can trace incremental improvements amid the many failures. The fittest of these survive and copy themselves yet again into newer generations.

Life is a constant process of replication.

[1] When I began to talk to biologists about my interpretation of time, I was told that a common way of counting time was not in seconds, but in cellular divisions. The phenomenon of relative development was first discovered by Tatiana Dettlaff, a Russian embryologist.

6. THE RATE OF REPLICATION

DNA controls the routine of replication, and governs the order of each step in the process. Yet the two spirals of DNA are in themselves copies (of copies of copies…). There is no longer original DNA, nor is there an original organism. We are all copies of an invisible yet ever-present replication process.

Replication happens at varying rates, even within a single organism. Mucous membranes take days to replicate themselves; organs like the eyes, heart and kidney take longer. The lifespan of most brain cells is almost the entire life of an organism. Simpler cells with simple functions replicate at faster rates. Cells that perform simple functions have less to learn – less information to gather before they can pass it on to a new generation.

This principle applies to organisms as well. The life span of viruses and bacteria is relatively short, and they replicate at rapid rates. In an optimal environment, a virus can copy itself a million times in minutes. Insects live longer – bees live up to 3 years, and ant queens live up to 15 years while laying up to 2 million eggs each month. Larger organisms – mammals, birds, reptiles – have yet fewer offspring, and a longer lifespan.

The smaller the organism, the faster it replicates itself. Smaller and simpler equals faster. Longer reproduction cycles allow complex organisms to accumulate more information over their lifespan than simple ones – information that can benefit the survival of future generations. Individual organisms can pool together this gathered information by forming colonies, flocks or herds. Humans form yet more complex group structures in personal, professional, national and religious alliances. Such collective structures allow individuals to gather, store, analyze and produce more information more efficiently. Thus social animals have an informational advantage.

The life span of groups can be longer than that of a single organism. The rate of reproduction slows from the bacteria to the human to the civilization; from the cell, to the organism, to the group.

7. TIME AS REPLICATION

We are products of constant replication, but we do not see the *gaps* between successive iterations. We can see the change in bodies as parent organisms replicate and create offspring. We can even see the process of mitosis on a cellular level. But beyond that, we see our bodies as continuous and homogeneous even as their components are in a constant state of change. We may have to accept that living organisms pass on their genes and die. We have yet to explore whether these processes happen in matter that we do not consider *alive*, and whether it is useful at all to separate matter into living and non-living, these two autonomous groups that do not intersect.

At the very basis of its existence, all matter is structurally identical. It is unlikely that the circular replication processes we've identified as fundamental to life only occur in the building blocks of living organisms. It is much more probable that if replication as a principle occurs, then it occurs for all matter. Despite all appearances to the contrary, living and non-living matter must undergo the same processes.

8. TIME AS EVOLUTION

Assuming we are correct, the universal code is then: Replicate! As much and as fast as possible!

This code is in every particle. It forms matter's *desire to exist*. Without it, matter would collapse and disappear. Replication makes change, movement and existence possible.

The principle of "smaller and simpler equals faster" applies here – it is probable that elementary particles replicate themselves at a rate that is much higher than that of atoms, molecules, cells, organisms, planets, stars, galaxies, etc. The *gaps* between their iterations are outside the scope of human perception, so their state appears to be continuous.

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Page 19. The Ouroboros, (Ourorboros, Oroborus, Uroboros or Uroborus) is an emblematic serpent of ancient Egypt and Greece. The name Ouroboros (or, in Latinized form, Uroborus) comes from the Greek 'ουροβόρος' meaning "tail-devourer."

Page 31. Langevin, Paul. (1911) "L'évolution de l'espace et du temps," Scientia 10: 31-54.

Page 57. Platonic Solids: Tetrahedron with four triangular faces, the hexahedron, or cube, with six square faces, the octahedron with eight triangular faces, the dodecahedron with twelve pentagonal faces, and the icosahedron with twenty triangular faces. Plato (428/427 BC – 348/347 BC) mystically associates fire, earth, air, universe and water to each regular solid. "Although they are termed Platonic solids there is convincing evidence that they were known to the Neolithic people of Scotland at least a thousand years before Plato, as demonstrated by the stone models which date from this period and are kept in the Ashmolean Museum in Oxford." Atiyah, Michael, and Sutcliffe, Paul. "Polyhedra in Physics, Chemistry and Geometry," Milan journal of mathematics, 2003, vol. 71, pp. 33-58.

Page 59. René Descartes (1596 –1650), a French philosopher, mathematician, scientist, and writer. The *Cartesian coordinate system*, named after Descartes, dominates the current human conceptual mapping of space. The system is used to plot points and objects in space by coordinate numbers (x, y and z). But he personally never drew it and didn't use it as far as we know. Some sources also suggest that his La Géométrie (1637) was for the most part a derivative work. The first attempt to develop a coordinate plane is a dark and mysterious story. Many historians agree that French lawyer Pierre Fermat (1601-1665), amateur mathematician and founder of the modern theory of numbers, may be the main contributor. But it's obvious that even the ancient Greeks and Egyptians had to develop a numerical coordinate system, given its relevance to astronomy and cartography. ThinkQuest. http://library.thinkquest.org/22584/temh3010.htm.

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