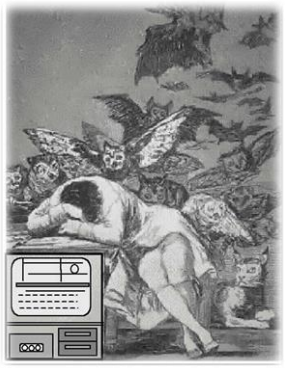
Yuri Tarnopolsky

ESSAYS

Essays à la Montaigne



2001-2013

Essay 59. The Knot

HUMANS, IDEAS, THINGS, AND EVOLUTION OF ECOSPHERE

2013

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Ist er ein Hiesiger? Nein, aus beiden
Reichen erwuchs seine weite Natur.
Kundiger böge die Zweige der Weiden,
wer die Wurzeln der Weiden erfuhr.

Is he a native? No, his ample nature
emerges from both kingdoms.
He who understands the roots of the willow
is better skilled in weaving its twigs.

Reiner Maria Rilke
Sonnets to Orpheus, Part I, VI

The image of Atlas on the right is taken from the *Nordisk familjebok*, *Sweden's* Encyclopedia in 38 volumes, 1876-1926. Mythological Atlas is holding the celestial sphere, commonly misunderstood as the Earth, on his back. Atlas means also a collection of maps, mostly of the Earth. There is a clear evolutionary pathway between both meanings. *Atlas of Brain Maps* is a relatively recent development. In this Essay, I am preoccupied with the pattern similarity between the globe that carries us and the brain—the globe we all carry on our shoulders.

CONTENTS

For previous **Essays** see: **http://spirospero.net/simplicity.html**

1. ECONATION

With time, the difference between my Essays in **simplicity** and other e-publications in **complexity** has been vanishing. The most benign of the reasons for that is that I have completed a structure of ideas answering my life long questions about the Everything: why is Everything complex and how could it emerge? In short, the answer is that a complex system begins as an object so **simple** that it can emerge spontaneously and it further evolves by **simple** steps. The key to understanding Everything is to turn to the simplest representations—patterns—of its history

My structure stands on the premises of Pattern Theory (Ulf Grenander). It displays an ambitious sign board "PATTERN CHEMISTRY," although it has gaps, holes, and cracks in the walls. It is not supposed to be as tight as a physical theory, however. It should allow a free flow of time, ideally, like a wattle hut or a dragnet.

I raise the pronoun "everything" to the rank of noun: the Everything is all things in the world, πάντα in "πάντα ῥεῖ," *everything flows* of Heraclites.

Following Michel Montaigne, I simply express what flows through my mind. It is not a reliable source of academic knowledge. It could be just a fantasy. Or something already suggested. Or, it could be a source of some new direction of thought, as fantasies often are.

I am coming back to my vision of a strange evolutionary phenomenon, which could be something real and definitive for human history for some time ahead. It is a close, tangled, coiled relation between humans, ideas, and Things, HITs, for short, with organic life and even minerals, water, and air stuck in the coils. To avoid ambiguity, I capitalize Things meant as a species, moreover, as a "nation." Although I expect the trefoil knot on the title page to express this phenomenon better than a thousand words, I still need almost 16,000 more.

Technology (man-made things reproducing from blueprints) and ideas (reproducing themselves as memes) have already been looked at as life forms similar to organic DNA- and RNA-based life. I am not sure, however, that all three have been looked at as taxonomic domains of a higher super-kingdom. This idea has its precursors. Among them, the ideas of Gaia (James Lovelock)

and a casually expressed and undeveloped but unforgettable concept of noosphere (Vladimir Vernadsky) should be mentioned. Probably, there are other important ideas of which I am not aware. To follow everything said about Everything is an experiment with infinity.

It would be good to have distinct but egalitarian terms for humans, Things and ideas (HITs). *Technosphere* and *noosphere* are clumsy, vague, and already taken. We can call the natural, not man-made life Bios. It may sound good for organic life, although tainted by computer science (Basic Input/Output System), and, to the English ear, by bias. I like Technos for Things. *Mentos* (from Latin *mens*, mind) for ideas, sounds artificial. *Humus* for humans? No way! Anyway, *humans, Things*, and *ideas* are fine with me. What we really need is the generic term for all three, and I suggest the already existing *ecosphere*, where they could be found. Ecosphere is their habitat and I see the three "super-life-forms" as *econations* (**eco-nations**). I hope something better could be invented. I am for the unpretentious but 100% accurate word *economy*. Like the word *things*, it could be misunderstood, however. And yet HITs and economy are equivalent.

Made of a different stuff—although the difference narrows—but inseparable from humans at birth, Things and ideas seem to be splitting from the initial entirely organic evolutionary branch into separate twigs, following the grand pattern of evolution. The Things comprise man-made things, services, and pleasures, i.e., products of economy, in other words, everything exchangeable for money, as ideas and hired or enslaved humans also are. I include public ideas into products of economy, too, which is a relatively recent phenomenon if we put aside the history of education. As for Bios, today it is completely enslaved by humans[1], although numerous abolitionists try to at least legally represent and protect it. It has some slim but real chances of cultural autonomy. The independence may be attainable at the very end of serving Growth the Unlimited, the idol of the new global paganism, prophetically illustrated by Goya.

We, humans, Things, and ideas are one **Economy** under the Sun. We are of the same pattern blood. We fight, as brothers often do. We all are the metabolites of economy, its masters and slaves. We all can be bought for money, which, changing shape, color, and sound through history, today is hardly distinguishable from ideas (see **APPENDIX 3**). The idealization of money has been the most recent and deepest evolutionary shift and digitalization of ideas is just the other side of the new universal coin.

We all compete for limited resources of energy and matter—even the now naked paperless ideas that need rare earth metals for digital devices, their new dress. We are alive while we can evolve, but toward what? Deciding what is good or bad, we now need to specify for which of the HITs.

This Essay is yet another exercise in pattern reasoning. I will try to minimize repetitions. Details and explanations can be found with Google search in **"Yuri Tarnopolsky" + complexity OR simplicity + [topic]**.

As a believer in evolution and adaptation, I am against condemning modernity. I am for its understanding. I do not sympathize with conservatives of any kind.

[1] Harmful viruses and bacteria are still waging a guerilla war.

2. TREE

The tree of biological evolution has been portrayed countless times. See three examples in **Figure 1**. The curious thing is that very few, if any, "trees of life" go deep enough to the roots which every tree is supposed to have.

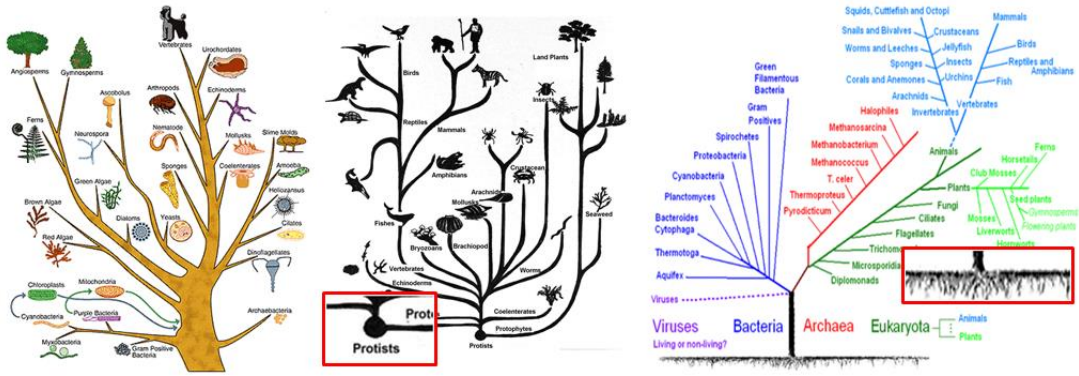

Figure 1. Images of the tree of life. Points of origin are enlarged in red frames.

Figure 2 shows a borrowed from the Web selection of evolutionary trees drawn with some attention to their parts hidden in the distant past as well as in the dead substance of the upper layers of the Earth.

Figure 2.1 was one of the first detailed phylogenetic trees for plants published by Heinrich Georg Bronn in 1858.[2] It has roots of no specific meaning, just for botanic veracity. **Figures 2.2** and **2.3,** with some hypothetic amoeba-like creature as the first life form, were designed by the creationists who wanted to fight Darwin with his own ideas, but they are quite expressive.

[2] Source: http://listoffigures.wordpress.com/tag/phylogenetic-tree/

There is nothing, at least in the solar system, without a previous state. Both the Earth and life on it must have some predecessor. In **Figure 2.4**, I present my own visual metaphor of the evolutionary roots of life. Its meaning, however, is factual: life emerged from the "dead" physical and chemical substance of the planet. Of course, our planet looked differently without its blue and green outfits.

My epigraph from Rilke refers to the origin of life and everything human with it. I supplement it with a visual metaphor on the right.

Planet Earth is a system. The globe in **Figure 2.4** represents the ecosphere of the earth: the outer layers of lithosphere (minerals), hydrosphere (water), and atmosphere (gases) in which life (biosphere) exists together with, in my perspective, humans, ideas and Things. I certainly follow the Vernadsky pattern and I have no serious objection against *noosphere*.

> The concept of noosphere has never been clear cut and today it looks especially muddled. Russia is currently (2013) commemorating the 150th anniversary of the birth of V. Vernadsky. It is not forgotten in Russia that he imagined the ultimate noosphere as the global victory of the Marxist-Leninist "democracy" becoming a geological planet-transforming force. Nevertheless, V. I. Vernadsky was the first to place it in the same pattern as other spheres of the earth. He ascribed the invention of the term to Édouard Le Roy (1927), although Teilhard de Chardin suggested it in 1922. Both French philosophers had listened to Vernadsky's lections in Paris.

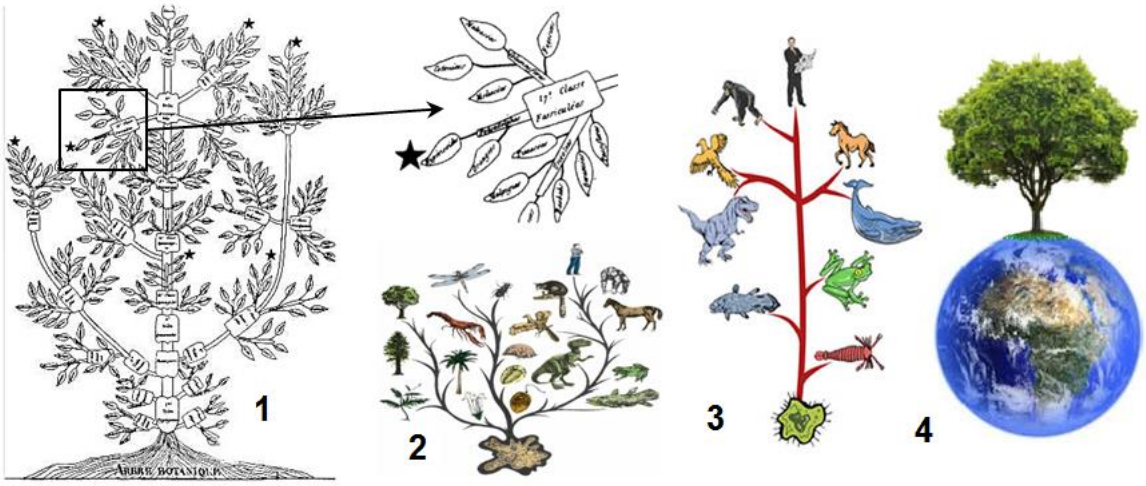

Figure 2. Evolutionary trees with "roots." See text.

I include Technos, the man-made Things[3], to the "sphere of spheres," or ecosphere. The outer layers of the Earth are a place for **cohabitation** of Bios (organic life), humans, their ideas, and Technos.

[3] "Man-made" is a simplification. Things are also made by Things: cell phone accessories are made by cell phones as much as by humans.

By ecosphere I mean the layers of the Earth and near space accessible to humans, Things, and ideas, which is much wider, higher, and deeper than the habitat of organic life. I have not found the roots of the term *technosphere*, which is applied to everything designed by humans. I put emphasis on man-made Things and I place design in the sphere of ideas. To summarize, the earth is a place where humans, Things, and ideas coexist with organic life and inanimate matter in the ecosphere similar to the way organisms and species coexist and compete in biosphere. In other words, I suggest placing humans at a humbler rank in a larger company.

> I am not a believer, but I appreciate the poetic and artistic side of religion and want to use the Abrahamic religious terminology to clarify my thought: as Man is created in the image of the Creator, the creations of Man are in the image of Man. In the language of Darwinism, for a balance, as Man had evolved from primates, so Things and ideas have been evolving from Man in **struggle** for existence. Even such a powerful idea as God is licking its wounds after the suicidal blasts of terrorists. The dead can be buried, but ideas do not die.

I see the term **economy** as the modern name for the cohabitation of four econations, organic life included. In times of Pierre Teilhard de Chardin (1881-1955) and Vladimir Vernadsky (1864-1945) and not until the beginning of the twenty-first century, nothing was truly global, except the British Empire and radio. In modern economy, on the contrary, nothing is local, even rural backyards, poverty, and isolation, even the rarest of the animal species, and not even human bedroom peeped into by mini-drones.

Cohabitation seems to me a more exact term than coexistence. It requires obtaining, sharing, and distributing limited resources in a household or, maybe, a cult compound, in which inhabitants are not necessarily relatives. It is life in a cabin with flower pots on windowsills, a wood stove, a cat, a dog, and a garden outside.

After the inanimate earth had given birth to organic life, both geosphere and biosphere formed a global system in which both changed. Geosphere and biosphere were involved in various kinds of cyclic patterns of change. Organic life let the thinking-making humans out of Pandora's box and a new—triple knot—of a system, for which economy is the term, began its twisted circulation of energy.

Mountains are resigned to their fate and the universal forces of change that brought them to existence and will level them out. Life, however, is adaptation to instability. It survives external instability by being internally unstable. It is an exystem (evolving complex system): far from equilibrium, it is never fully asleep.

Life needed something to keep it awake during the very first minute of emergence, before the first intake of food and burst of internal energy. Life emerged from geochemistry in the cradle

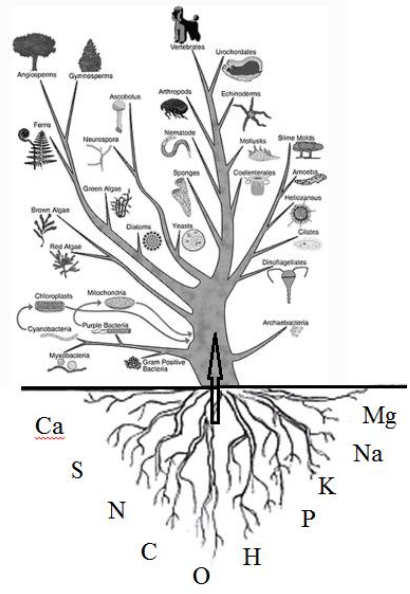

Figure 3. Geochemical roots of life on earth

rocked by the planetary rotation and all periodical and irregular processes on earth.

The spontaneous origin of life was possible because the first life was simple and simple systems have a limited number of possible configurations. The roots of life grow down into the geochemical substrate of the upper crust of the Earth (lithosphere) and its fluid components. The soil and oxygen in our ecosphere grow from organic life. Technos devours soil and exhales carbon and nitrogen oxides. It sounds metaphoric, but it is the language of patterns.

Figure 3 connects the trunk of the evolutionary tree with the roots: the available elements form simple molecules and ions which further aggregate and recombine into organic mass under the influence of geophysical processes. The figure symbolizes not a state but a process of evolution that started as a cosmic planetary development.

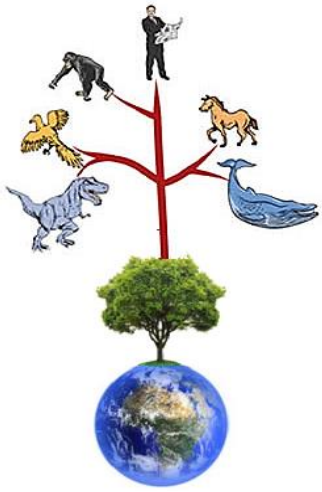

Figure 4. What's next?

In **Figure 3,** the system of minerals, water, and gases generates the dramatically different **organic** life. I stress *organic* because there are other life forms, such as Technos with Things, human societies with culture, and culture with memes. The major difference between the HITs is the phenomenon of memory, i.e., information stored in inorganic, as well as organic matter: genome, books, human and computer memory. It is something that survives individual Things, organisms, and great thinkers and evolves by elementary steps.

The tree in **Figure 4** bears a new fruit**:** the man, his business suit with stuffed with Things pockets, and the newspaper full of ideas. Evolutionary biologists could recognize it as coevolution, the typical example of which is the bond between bees and flowers, which needs only to hook up honey production by beekeepers and their equipment to be considered a mini-ecosphere, a module of the larger agricultural module. In a module, the components evolve along their own pathways but stay together.

Can the newspaper follow the evolutionary pattern of the dinosaurs? Yes, the *NYT. rex* is already evolving toward dematerialization. But it stays in human environment and employs human staff, don't ask for how long.

The triad at the top of **Figure 4** is also a **modular** mini-ecosphere inhabiting an individual human body and its outer space.

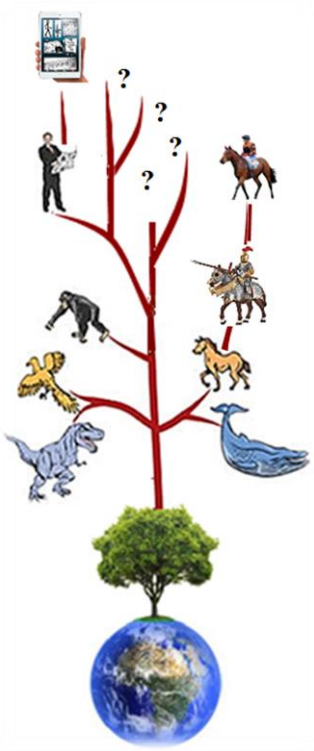

Figure 5. Then what?

Figure 5 illustrates the evolution of another module: horse riding. As some humans acquire newspapers, some horses acquired humans. Or, we can say, humans developed horses as removable organs before the first newspaper. The bond between humans and horses, although on the wane, still persists. Similarly,

although each member of the trio will evolve along its own pathway, as a newspaper branches off into a mobile computer, they will stay close to each other, like humans and horses. This is what I call modularity and we will come to that matter regarding a different kind of the globe.

In production of honey everything stays **close**: the beekeeper, bees, fields and meadows, and the equipment. But what does it mean? Our language is anthropocentric because it was originally for humans only. Its ancient vocabulary comes from humans and their limited in space habitat. Some words, like to have, make, want, good, and bad lose meaning in science and others, like **close**, acquire new one. Mathematics and theoretical physics are full of such aristocratic descendants of humble ancestors.[4]

Most of the subsequent parts of this Essay are about closeness. What does it mean to be close on the map of the world and on the map of the brain? How does closeness evolve? I am going to take a very narrow pattern chemical angle of vision.

Things, except business suits, evolve fast. They cling to human body and sneak into it. The wearable computers are already putting a feet in the door, anxious to interfere with various daily activities of humans and the "smart" phone already does it, even pushing the classic wristwatch into the company of mechanical typewriters. It matters less and less whether a tablet or a phone lives in your pocket or head. But wait for **Google Brain™**.

Can we say that horse evolved into automobile as a means of transportation? In a sense, yes, but not in a biological sense because there are no intermediate steps between the horse and the automobile. Neither there is a middle stage between paper and computer. Yet cars and computers have been evolving through mutations, quite like species, reproducing from a design template in the womb of technology.

Things and ideas came into the world inseparable from humans. Being human means to have ideas and make things. It also means to have a limited life, the last half of which usually runs in the visible shadow of mortality.

Can the taxonomic super-kingdoms of humans, Things, and ideas be really independent econations? What does it mean to be independent in the ecosphere in which nothing except the geophysics of the earth seems to be independent? My tentative answer is: no. The words like "to have," "to make, and "independent" are of little use in untangling the web of relations between the inhabitants of the ecosphere grown on the tree of life. The econations are all similar in how they form exystems with their template (DNA, blueprint, text), inherent instability, and dissipation of energy. Why would we say that humans keep the ultimate control over what they make and think? Not everywhere and not always have they the power to say what they think, let alone act and make.

The image of a tree of life masks the fact of an evolutionary drive to total interdependence, called economy.

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[4] Michael Pollan has wonderful examples of this deficiency of language in his ***The Botany of Desire: A Plant's-Eye View of the World***.

Even the ancient dinosaurs from Mongolia are pulled into economy[5], not to mention the distant past, in which the Big Bang, the theoretical beginning of Everything, pushed aside the story of Atlantis, the attraction of the previous centuries. As for the future, it has been a profitable industry for ages, contriving all kinds of aliens, almost universally powerful and repulsive.

The inclusion of different spheres of ecosphere or, in my terminology, different econations into a network of connections as result of the weakening and loss of metric distance in time and space is a novel and striking pattern of modern ecosphere. I was lucky to observe its emergence throughout my life, which, by the way, began under sounds of air alert and bombardment, the lullaby of the WW2.

By the end of my long exploration of Pattern Theory, with my mind, irreversibly tuned to patterns, I detect a seemingly far-fetched **similarity between the ecosphere and human mind**. It is surprising for a moment, as always with the New, but then it looks obvious. Moreover, it is an idea with ancient roots and a great obsessive power. But I cannot afford another distraction here, go astray, and drown in philosophy.

[5] In what was called a million dollars dinosaur scandal, the bones of a Mongolian dinosaur were illegally smuggled out and put for auction in US (2012).

3. NETWORK

The growth of network science within the computer science was stimulated by Internet and its money-making endeavors.

> DISCLAIMER: The network science is today a very large area, in which I am absolutely not an expert—as well as in computer science, brain anatomy, geophysics, economics, etc., with a limited exception of fundamentals of chemistry. But the language of patterns does not recognize academic maps of the world.

Dynamic network analysis, in particular, the Internet connectivity and the new exploding area of study of connectome (connectomics) is a new intensive area of research. Both offer a striking imagery, which I borrow in **Figure 6**, adding to them the humble thousand year old road maps because they belong to the same pattern as the Web networks and connectome. There is a deep similarity between not only their configurations, from the point of view of Pattern Theory, but also between their imagery. Unfortunately, to discuss all that would take a lot of space.

All such networks consist of points and lines, or at least lines with endpoints. The similarity of all physically different networks is well realized in scientific community.

> Historically, many non-neurophysiological systems have been used as explanatory metaphors for the brain, perhaps the most recent examples of which are the computer and the Internet [72]. The mind–brain dualism has been simply likened to the relation between software and hardware in a computer system. Due to recent advances in diffusion weighted imaging, the large-scale wiring diagram of the human brain has been estimated and its organizational structure has been directly compared to that of computer chips, specifically very large-scale integrated circuits [7]. Striking similarities are evident, suggesting that both technological innovation and natural selection have discovered similar solutions to the problems of wiring efficiency in information processing systems.
>
> Danielle S. Bassett[1] and Michael S. Gazzaniga, **Understanding complexity in the human brain,** Trends Cogn Sci. 2011 May; 15(5): 200–209. doi: 10.1016/j.tics.2011.03.006 http://www.ncbi.nlm.nih.gov/pmc/articles/PMC3170818/ . See also Bassett DS, et al., **Efficient physical embedding of topologically complex information processing networks in brains and computer circuits**. PLoS Comput Biol. 2010; 6:e1000748, http://www.ncbi.nlm.nih.gov/pmc/articles/PMC2858671/

The difference between pattern and metaphor is subtle and controversial. In my view, metaphor takes a configuration *A*, which is the subject in the focus of interest, for example, human life and puts it side by side with a similar configuration *B*, for example, journey, but without any interest

in journey *per se*. Each is a process with beginning, end, and duration, filled with events. In Pattern Theory, pattern is the entire space of configurations forming a group under the similarity transformation. Any of the configurations could be chosen as a template. The latter is a starting or otherwise marked point for similarity transformation, roughly, a typical configuration. Pattern is everything that is connected with the above rule of similarity, whether we know about it or not.

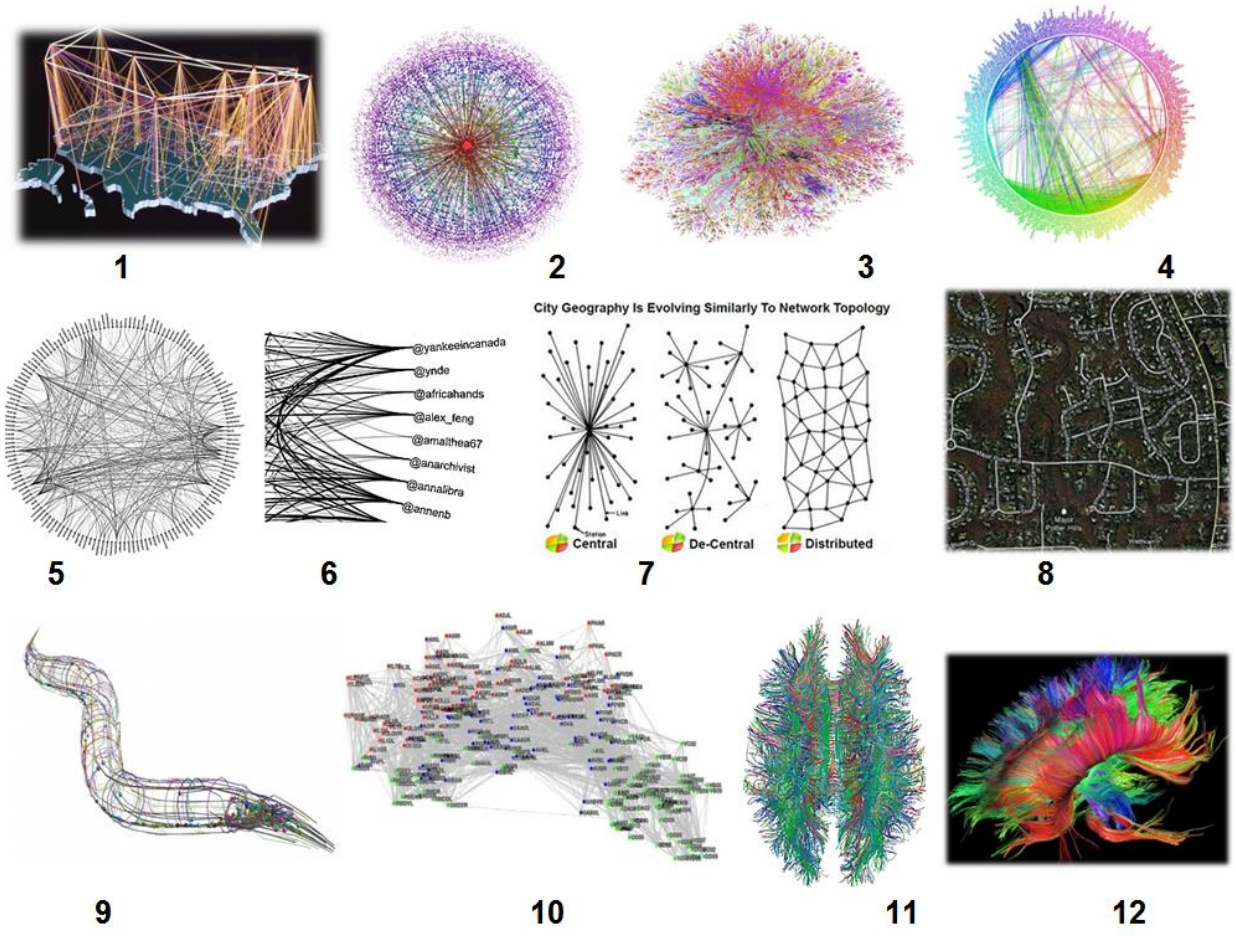

Figure 6. Networks. 1, 2, 3: Internet; 4: Facebook; 5, 6: Twitter; 7, 8: town; 9, 10: nervous system of *C. elegans*; 11, 12: fibers of white matter in human brain.

> … My conscience, thou art fetter'd
> More than my shanks and wrists: you
> good gods give me
> The penitent instrument to pick that bolt,
> Then free for ever! Is't enough I am sorry?
>
> Shakespeare, *Cymbeline*, V,4

For a poet even life is too abstract a notion and a metaphor puts it down on the ground. A poet uses rose as metaphor without any botanical associations. Posthumus in Shakespeare's *Cymbeline* is not a philosopher locksmith. If I find Pattern Theory poetic, it is because I am obsessed with it in my own personal way.

My goal in this Essay is to explore the general pattern of the evolution of the ecosphere of econations, which includes the future, as well as the past. Fascinated by the ongoing mapping of

the brain, which I see as similar to the mapping of the world fifteen hundred years ago, I ask myself the following question:

> If brain is similar to the globe in some way and if it is very old and changing very slowly, if ever, what can our understanding of the brain contribute to the understanding of our fast evolving global ecosphere?

I believe this kind of question is natural within the framework of Pattern Theory. I want to use pattern similarity of the human brain to ecosphere as of one configuration to another. Since by human standards[6] the brain is evolutionary old and stable, while the ecosphere with the three econations is evolutionary young and fast changing, where is the ecosphere going as configuration? Is the changing since the Industrial Revolution with dizzying speed world means that we are in the pattern-chemical **transition state** between two dramatically different relatively slow **stable states**, one of which is the age of the ancient great empires, strict class divisions, and constant wars, and the other something either new or just different old?

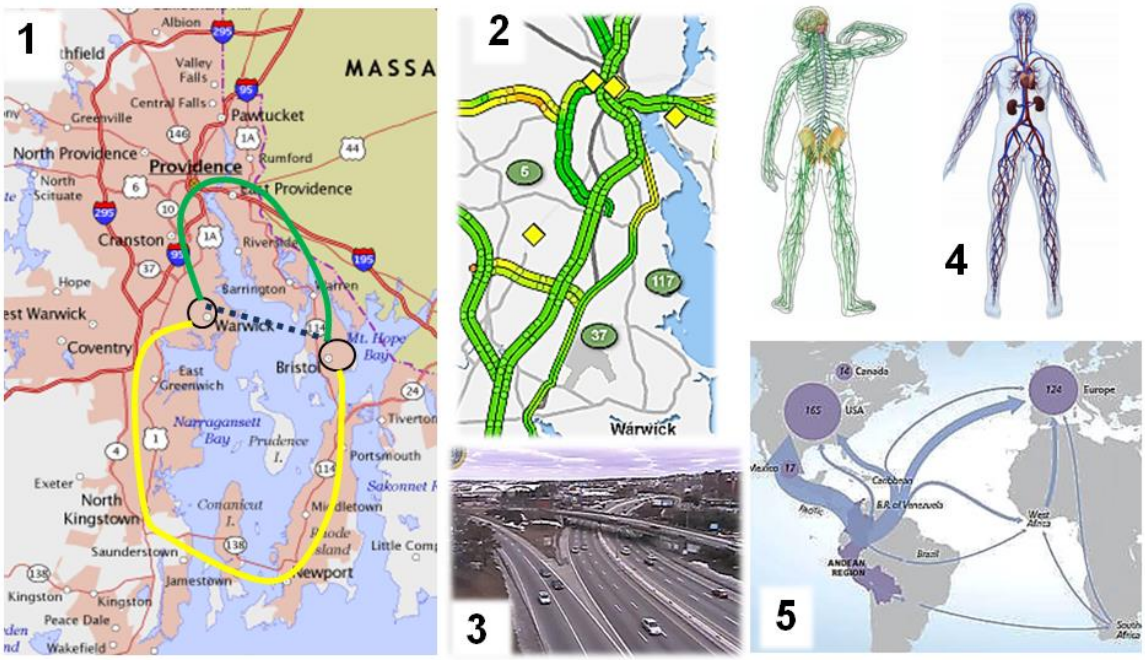

Figure 7. Down-to-earth networks. 1: Distance; 2, 3: function; 4: nervous system and blood circulation; 5. South American cocaine trafficking routes (UN source)

I see evolution in terms of points and lines.[7] A combination of points (nodes) and lines (edges) is a graph. Configurations of Pattern Theory are graphs that can behave like real objects representable as graphs. They could follow the laws of conservation and have a preferred direction of events toward the most probable state, which is the essence of chemistry as paradigm. Distance on graphs can be measured in the number of nodes along an uninterrupted

[6] Taking human life as a unit of time.
[7] See Yuri Tarnopolsky and Ulf Grenander, *History as Points and Lines*.

sequence of edges. Most generally, nodes and edges can be attributed any properties, quantitative or qualitative.

To approach the evolution of ecosphere inhabited by humans, Things, and ideas, I start with the oldest networks the HITs—brought to the globe.

> Evolution of transportation of matter, joined by the transportation of ideas, has been one of the driving forces of history. Historically, the first way of communicating a message in a verbal form over a large (beyond horizon) distance was through a human messenger. Therefore, the minimal cost of information transfer was that of moving a human over a terrain, possibly, with challenging topography and various hidden dangers. The emergence of fast long distance communication, destined to run far and fast, is an interesting example of a (topological) revolution rather than evolution. It is still running, transforming the ecosphere, mixing and reshaping matter, ideas, and human ways of life and extending its reach over the solar system.
>
> From the pattern angle, teleportation, still the favorite trick of sci-fi is by all means real and rather cheap. From artificial insemination over a distance to a hacked and stolen US trade secret materialized in China with local minds, hands, and materials and to 3-D printing are the first steps of teleportation, some of them not even too slow.

Figure 7 presents examples of material networks of the most ancient origin: road maps for movement of people (**7.1** to **7.3)**, blood and nervous impulse (**7.4**), and illegal substance for sale (**7.5**). The latter is incomplete because it shows no back routes for money.[8]

The networks are characterized by topology, in which Euclidean distance plays little role.[9] Topology, however, is complemented by functions measured in various ways. For example, the main cocaine supply highway in **Figure 7.5** moves at least about 165 ton of cocaine a **year** to the USA. Digital networks measure throughput in MBps (Megabytes per **second**).

Figure 7.1 shows a map of the State of Rhode Island, USA. As any roadmap, it has a lot of common features with the maps of blood vessels and nerves. Thus, the thickness of a line reflects the throughput of traffic.

Two towns, Warwick and Bristol are separated by the Narragansett Bay so that the actual geographic distance between them is much shorter that along either of the two routes shown by the green and yellow lines. Topologically, both lines and the imaginary connecting bridge across the bay are equivalent. Topographically, the two towns are connected with two very different lines on the road map. In fact, there is a multitude of ways to get from one to the other, all but two of them impractically long and making no sense.

There are many different distinct patterns of topology, some of them illustrated in **Figure 6.7**. The typical topology of New England streets (**Figure 6.8**) is mystifying to somebody from Chicago. As for random pattern, it seems to me that nature, all the more, humans, do not produce anything random.

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[8] Although the materiality of money is questionable in our digital era, the drug money moving back home is pure paper without a shadow of the doubt. Its outflow from USA to Mexico counts tens of billions.

[9] There is also such powerful thing as cultural distance. In America it is exemplified by Blue and Red states, as well big towns and rural communities.

Figures 7.2 and **7.3** show the function, which is, obviously, transportation of matter. In particular, they reflect the lack of congestion in early morning hours.

The topologies of blood circulation and nervous systems are essentially the same while the functions may appear dramatically different: the vessels transport energy and the nerves pass information.[10]

I like the term **topography**, description of the place, which covers all qualitative and quantitative **local** specifics superimposed on topology. The primary concept of topology is neighborhood and topography includes everything about the place, including its neighborhood.

Topology versus topography is like black-and-white line drawing versus color photo. By looking at the topology alone we cannot see the function. Topology is necessary to navigate the colorful jungles of modern knowledge as well as the tangled streets of Old New England. Order betrays a free human intent, while a dash of chaos implies free evolution.

Three pounds of flesh, with its billions of neurons, can hold big chunks of the world. The nervous system of a tiny worm is a far cry of human brain. An army of enthusiasts is working on mapping the human brain, with functional topography and the mouse's brain as an intermediate station on the way from the worm to the man. It became possible with the development of highly sophisticated methods and instruments used previously in medicine and organic chemistry.

> I believe this is the latest great story of scientific exploration comparable with the discovery of America and the structure of DNA. It also promises gold and spices of a kind, and there is no shortage of investment. Will this onslaught on the globe we carry on our shoulders do the same the West did to the indigenous population of the Americas? I would prefer to live on a reservation in the Brave New World. I will be in a good company.

The lines on the pictures like **Figures 6.11** and **6.12** connect not individual neurons but small parcels and modules. There are big expectations, as well as doubts, regarding the level of individual neurons and synapses. I believe that if we fully understand how some simplest and smallest areas work and how form and function makes the next small step toward complexity, the complexity itself will become transparent. The principle of emergence of complexity is: from simple beginning through a sequence of simple steps to complexity. I am not sure if this is correct Latin, but let me try: *Ex simplicibus per simplicem ad complexu.* For mistakes blame Google Translate.

Next I want to note the universality and ubiquity of networks, alternative ways of their representation, and visualization of connectivity.

Let us draw a pathway of similarity between the town streets in **Figure 6.4** to the tiny—1 mm—but illustrious worm Caenorhabditis *elegans* in **Figure 6.9**. It consists of 1031 cells (959 for a different form), 302 of which constitute its nervous system. The neurons are topologically similar to houses of a town interconnected with bonds of communication over electronic media, which normally does not fully depend on street topography. Most neighbors can even talk face to face.

---

[10] The difference looks exaggerated. Information cannot be transferred without energy and work (form of energy) is not supposed to be performed without a signal, i.e., additional energy.

I expect **Figures 8** and **9** to save me a lot of words explaining the meaning of points and lines arranged in circles. I will need this kind of visualization to report from the world of **ideas**. Those ethereal creatures have neither mass, nor time, nor terrain, and seem to have no topography. All these points and lines are naked ideas. They can be clothed with substance, however, which is what Pattern Theory is about. They can be a whole world with numbers, weight, color, and struggle, a kind of a live video from the world we live in.

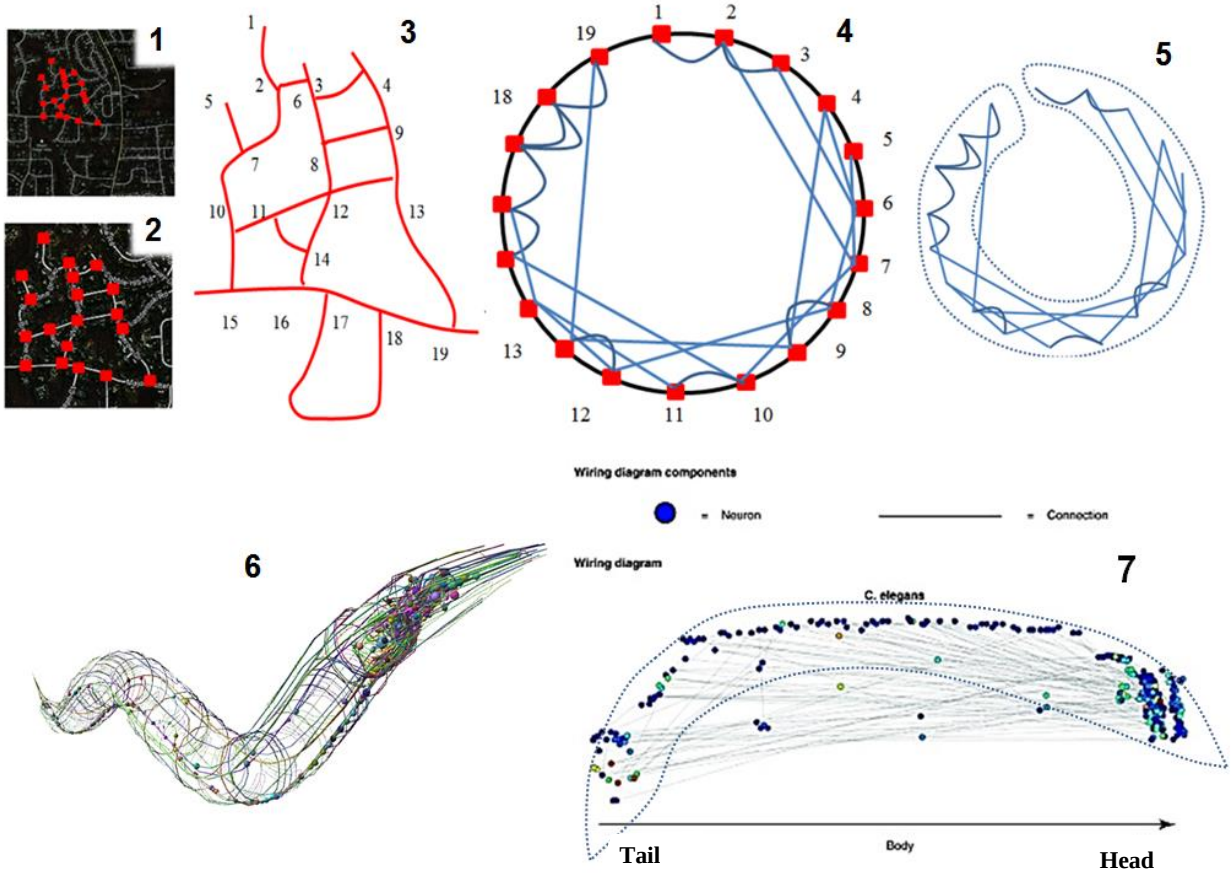


Figure 8. Topology. Upper row: A neighborhood. 1,2, 3: street intersections; 4: intersection connectivity; 5: connectivity reflects distance. Bottom row: Nervous system of *C. elegans*. 6: its topography, source: OpenWorm Project; 7. partial connectome, source: D. S. Bassett and M. S. Gazzaniga, see page 11 of this Essay.

In **Figure 9,** I take a 4 x 4 table as an object of real—on the screen or paper—world, in which each cell is presumed to be connected to its neighbors in rows and columns, but not diagonally. I use two different numerations of cells: orthogonal and radial. For example, cell 1 in orthogonally enumerated table is connected to cells 2 and 5. With radial numeration, its neighbors are cells 8, 6, 2, and 4. Although both tables are topologically identical, they look visually different.

Square matrix, with each row marking connections of a node in the column, is an alternative way to visualize connectivity. It reveals interesting things when they are enumerated reflecting not only topology but also topography, i.e., spatial order as directly perceived by humans. In Pattern

Theory, what I call topography is the **image** to be analytically processed into a **configuration** of a pattern.[11] Image is something all normal humans perceive by senses more or less the same way but may interpret differently, as politics exemplify.

In **Figure 10**, which further illustrates the two alternative ways of representing connectivity, the matrices reveal the regularity masked in the circle form.

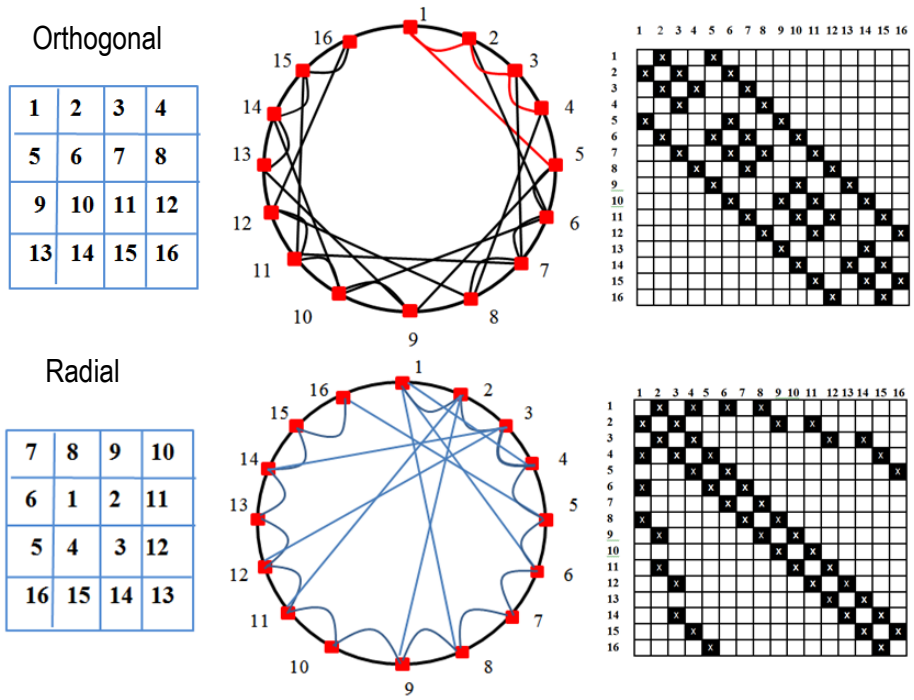


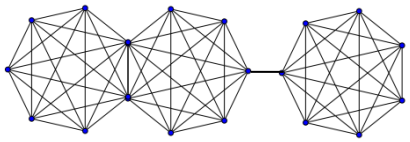
Figure 9 Circular and matrix visualization of the same connectivity at orthogonal and radial numeration of nodes. Cells of a small table are presumed connected with neighbors in columns and rows.

Figures 9 and **10** metaphorically hint at a seemingly irrational importance of the way the same content is presented *ad hominem*. It is a fact recorded in behavioral psychology.

> Ideas enter our mind through our senses. Advertisement in the business—whether of donuts or firearms or politics—depends on this property of an average mind to look into things not deeper than the surface. To look deep into things, as science does, has its cost and we do not pay it unless it promises some return. The borderline between art and science, therefore, runs between the visible and invisible: science is the art of invisible or, more generally, not perceived by senses. The key to the science of Everything, which is trendy to associate with complexity, is to fraternize it with art where we do not look at the back side of a canvas.

There is a particular type connectivity represented by a complete graph, in which each node connects to all other nodes. The "completeness" can be relaxed, so that there will be no nodes separated by more than ***N*** other nodes. This important type of network is known as the "small world" topology.

[11] See also my Pattern Chemistry of the Origin of Mind, in particular, its APPENDIX 3.



Small worlds can be connected through a small number of channels, which results in modular connectivity. The three giant "small worlds" are economy, Internet, and human brain. They combine many kinds of connectivity, among them star, modular, hierarchical, etc. I doubt, however, that it is random, although there could be random segments. To prove that something is random, or even that such proof is practically possible, is a problem the solubility of which is also problematic.

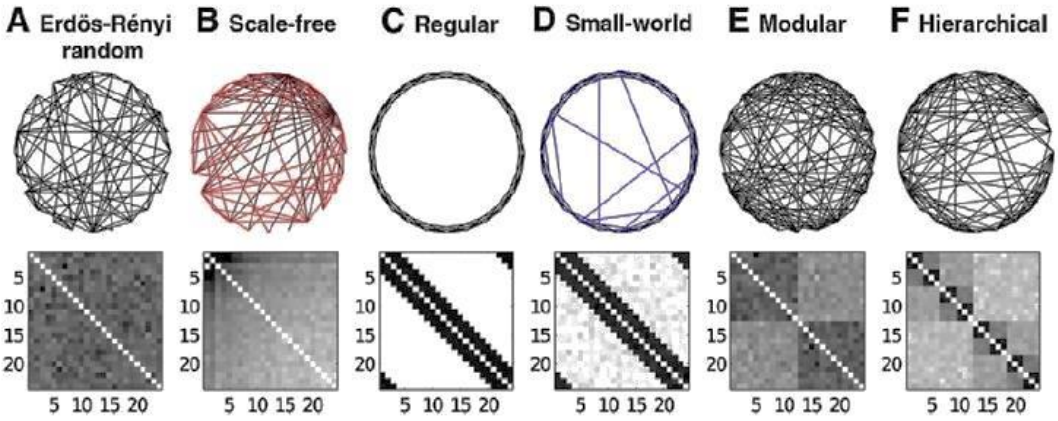
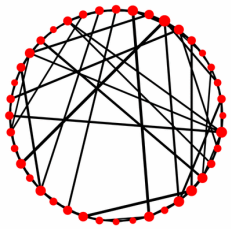


Figure 10. Networks in circular and matrix representation. Degree of black color corresponds to number of connections at the node. Source: Marcus Kaiser, A Tutorial in Connectome Analysis: Topological and Spatial Features of Brain Networks, Figure 6, p.15.



The points and lines of a graph are nothing but ideas: they have no other attributes. Networks are much less ghostly: their nodes and connections have qualitative and quantitative labels or measures, variously visualized. Thus, the intensity of communication can be portrayed by the thickness of a line and the number of connections of a node by its size. Graphs with properties of elements other than topological are known as labeled and weighted, which networks are. Configurations of Pattern Theory are more than that: they have thermodynamic properties. Their generators are similar to atoms, differ in mutual affinities, and they, as well as bonds, can be described in terms of statistical mechanics.

What I want to see in the company with Things and humans is the econation of ideas. It has been always difficult to find a firm ground with these otherworldly products of gray matter. The discovery of information as measurable quantity revealed nothing about its qualitative properties. A chemist, however, is on a sufficiently firm ground with molecules none of which can be seen other than a combination of symbols and connecting lines, with no mathematical formulas attached. We can always manage what we can draw.

4. CIRCLE

In this segment I want to introduce ideas as equals (sort of) into the company of humans and Things. This kind of intimacy is best achieved by arranging the seats in a circle, like in **Figures 8.4** and **9.1.** The circle is a symbol of close relations, not necessarily positive: family circle, circle of friends, or circle of rivals. The links between the members could be different or even non-existing. It is important that people at the round table can address each other with the same physical ease, at least theoretically, in the absence of noise. Yet the number of two-way conversations is limited to half the number of members, assuming that a conversation fully involves two members. Everybody's attention can be focused on one source during a monologue, but it could be also wandering in search of a personal contact, in a competitive atmosphere. The contacts can vary from complete chaos to complete order regulated by the chairman, schedule, or just physical distance.

Thus, 54 out of 55 African states have a round table in the African Union, with rather complex relations between the members. The 193 members of the United Nations are united in the name only. The UN Security Council is physically round, but inherently split horizontally and vertically.

The connectivity of the brain, economy, and world politics is modular.[12] Densely interconnected areas form a sparsely connected network, often hierarchically layered, see **Figure 11**. It is not a round table, but rather a circle or a hierarchy of circles of round tables or ballrooms. Fine details

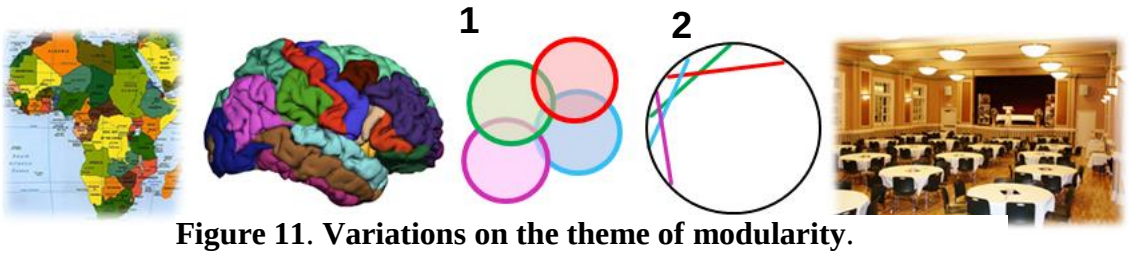


Figure 11. **Variations on the theme of modularity**.
1 and 2: various compact ways to represent topology of the brain areas

are still scarce for humans, but could be further known for mice.

Regarding economy (modern politics included) this topology is of a relatively recent historical origin. The modern map of Africa is much younger than me. The map of the brain has a much longer history measured in millions of years. It is densely modular anatomically, as well as functionally.

I have a chemical template of the round table pattern: chemical interactions in a solution of chemicals. Although only two particles most probably participate in an interaction—a triple collision is less probable—all molecules behave like any one interacts with any other because of their number and large frequency of collisions. In a macroscopic volume, the process does not depend on the volume. It depends on relative concentrations of reagents—quite like in politics. Situation is different in the solid state, which is more like a prison.

The brain is made of a composite material: it is both solid and liquid. Its powerful connectome works like a solution of chemicals. Instead of multiple collisions of numerous copies, the solid functional parcels (redistricting is possible) communicate by making "phone calls" through the powerful neuronal fiber network. Today, numerous individual minds can conflict and unite through the global network of social media, although it is naïve to believe that we all will benefit from it without paying a price (which we are already paying). Political geography will be influential for a long time, but for how long? This question is all the more intriguing if we, humans, are not alone on the globe: powerful ideas and Things compete with us for the limited but fluctuating resources of fiat money.

Things compete with farmers for land in China today as they did it in England of land enclosures. In Stalin's Russia, **all** land was taken away from farmers in the name of idea and, as some believe, with the help of American tractors. Millions of people lost their lives, property, and freedom.

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[12] There is a lot of material on the Web. For example: David Meunier, Renaud Lambiotte and Edward T. Bullmore, **Modular and hierarchically modular organization of brain networks** Front. Neurosci., 08 December 2010 | doi: 10.3389/fnins.2010.00200. Abstract with a link to pdf. **PDF:** http://www.frontiersin.org/Journal/DownloadFile.ashx?pdf=1&FileId=4837&articleId=7572&Version=1&ContentTypeId=21&FileName=fnins-04-00200.pdf

> ‘What is that?’ said the Cardinal: ‘The increase of pasture,’ said I, ‘by which your sheep, which are naturally mild, and easily kept in order, may be said now to devour men and unpeople, not only villages, but towns… Thomas Moor, Utopia , 1515.

I reiterate here the main theme of this Essay as a question:

> **If topology of the modern all-encompassing global economy is evolving toward a global network with topology similar (in the sense of Pattern Theory) to that of the brain, what could it mean for the ecosphere and its econations?**

Are the relations between the HITs really close?

To answer this question, any human has only to cast a quick look around. I am surrounded by **Things**, bombarded by **ideas**, most of them about **Things** and **humans**, my books are **Things**, but they are tightly stuffed with **ideas**, and the screens of my computer and TV are spewing what looks like **ideas**, but most of them are about **Things**. With my secluded way of life I rarely see more than one **human** nearby, but the crowds of **Things** are always mixed with the crowds of **humans** whose minds are dominated by **ideas** and images from TV. Moreover, **human** face-to-face and even voice-to-voice communication have been more and more taken over by **Things**. The free flight of fantasy is reduced to menus. **Ideas** are pummeling each other with **humans** paying with their lives for the show, as seen in fragments on flat rectangular **Things** flickering with colors. As for the Things, they die by billions, sometimes living for minutes. Automobiles, computers, and cellphones—sophisticated man-made **Things**—are coming for a one-night, one-week, or one-year stand. **Ideas**, euphemistically called “information,” are forgotten the very moment they are perceived, although a few infect millions of minds for decades.

> I am reluctant to use the term information instead of ideas. Why ideas and not info? It is not an easy question because information has a lot of meanings depending on context. Different humans respond to the same ideas differently or not at all. They can also spontaneously generate ideas. Ideas can cause unpredictable actions.
>
> If you believe that you know what information is, for example, in information theory, then idea is the elusive quality of information. As a chemist I can compare idea with a chemical structure: it is a structure built of simpler ideas as a molecule is built of smaller fragments or atoms. It is one of uncountable number of other structures, some still unknown—as a chemical structure is one of uncountable number of other structures, some still not only unknown but even unimaginable. Idea possesses individuality: it makes sense only as a unique one among all the others. What idea does not have—unlike man-made Things—are multiple copies. The concept of idea is inseparable from human evolution: there were a few simple ideas in the beginning and then they started multiplying, growing, and recombining, quite like organisms. It is evolution and not so much DNA, blueprints, and ideas that demonstrate the unity of the ecosphere and its econations.
>
> The problem with idea is that we can define it only with other ideas. This is why I believe that the best way to deal with idea is to drop all definitions and to shape the concept of idea simply by using it, as physics does with energy and work. Idea will be defined not by what it is, but what it is not. It is a node in semantic network, i.e., not the rest of the nodes.
>
> Idea is a human thought that can be expressed in language and transferred to another human.

Being human means producing and consuming Things and ideas. Being alive means consuming and dissipating energy. The evolutionary novelty is the density of the distance and borders defying links between the HITs. The world is topologically shrinking and becoming small.

The most dramatic manifestation of the evolution of topology was for me the triple Islamic terrorist attack on America on September 11, 2001 designed on the other side of the globe in one of the least economically developed spots on earth, driven by an idea, and performed with large sophisticated flying Things stuffed with, fortunately, not always predictable humans having strong ideas of their own. It makes me substitute the word revolution for evolution.

Another episode of the topological revolution was the US stock market of 2012. It was periodically spooked for a day or two by a few words from Europe and places mostly irrelevant for what was going on in America, but fundamentally important political and economic long term factors did not prevent it from relentless bull chase.

High level personal and corporate information hacked by China and Russia in 2013, "Made in China" as far as the eye can (and cannot) see in America, chopsticks for China "Made in USA," the digital Great Wall of China erect against Western ideas, the idiocy of the American politics, the ongoing war of the Christian Right against Darwin, women, and Enlightening, the hysterical worshipped Apple face into dust like a monument to an overturned dictator—all that tells me that the econations of the world are continuing the history previously—until the Industrial revolution—made by kings and emperors. History is no more driven by individual human will: Things and ideas compete with humans and each other because economy is not only international but also inter-econational.

I would compare the last decade with the Age of Discovery of the 15th and 16th centuries when as result of geographic exploration the whole Western hemisphere was put on the map. The twenty-first century has already brought a re-discovery and mapping of both hemispheres of human brain resulting in pictures like **Figure 6.11** and **6.12**. This is a fast developing area.

The explorers of the brain are running into the same problem as the explorers of the globe: mapping. Both have the topology of sphere and cannot be projected onto plane without change in distances and angles. **APPENDIX 2** illustrates the deformations of the maddeningly crumpled cortex during its mapping onto sphere and plane and some spectacular pictures of global connectivity.

Figure 12.1 and **12.2** presents two more illustrations. The rest of it offers a hypothetic view of the connectivity between ideas not as semantic networks but as configurations in a dynamic succession, forming and breaking bonds quite like molecule in another ancient spherical vessel: chemical flask.

I have already touched lightly on the relation between mind and brain, which has been heavily handled by philosophers, later joined by computer scientists, from time immemorial. I see the mind as a function of the brain. The function consists of maintaining a population of ideas in a system open to exchange with other minds. If this sounds like the function of an economic unit,

all the better: I see ideas in the metabolism of modern economy, as well as in the flask of the individual mind.

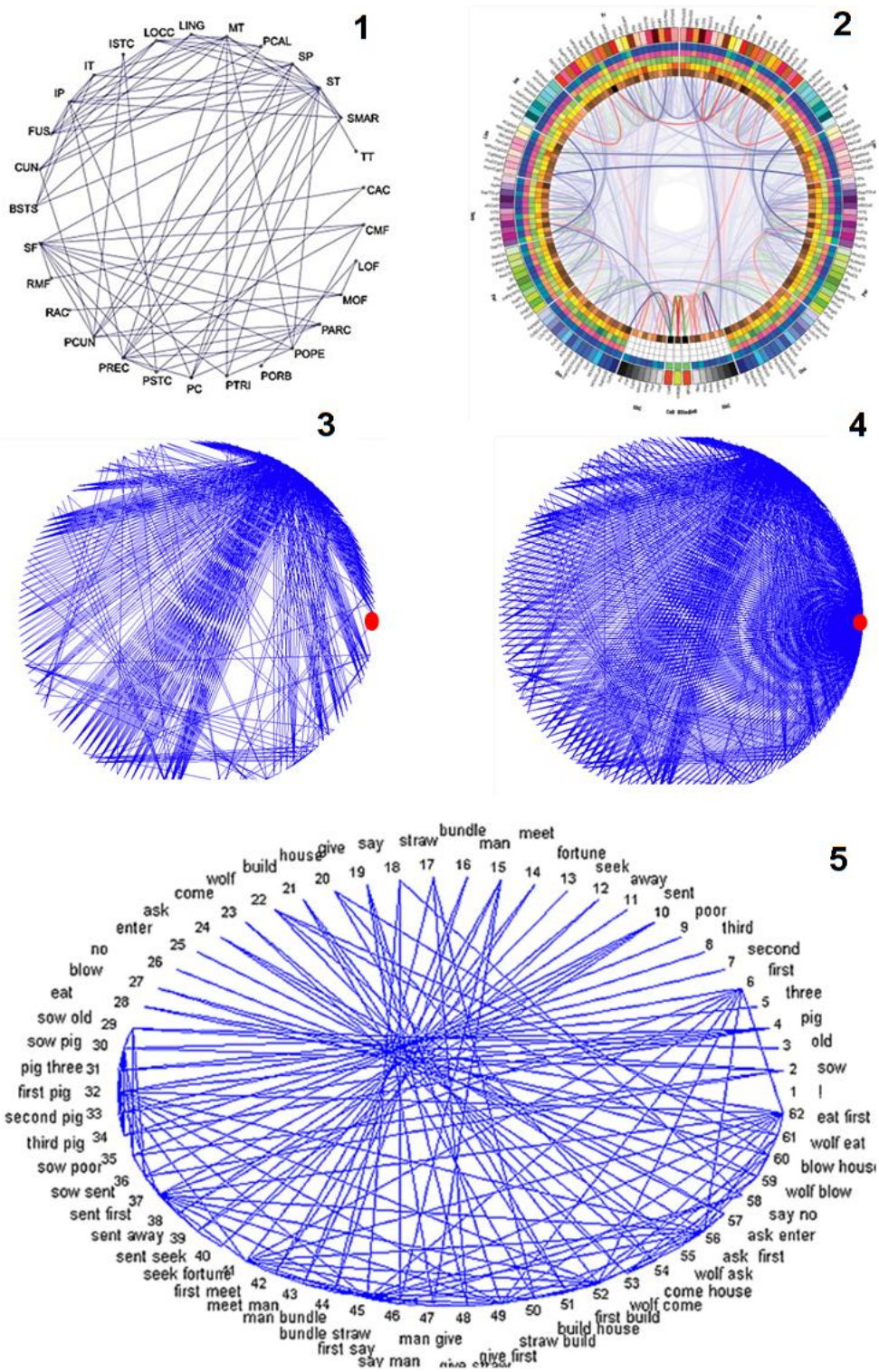


Figure 12. Brain and mind. 1, 2: Connectomes of brain parcels; 3, 4: Development of "connectome" in Ulf Grenander's *Calculus of Ideas*; 5: "Connectome" of the world in the story of *The Three Little Pigs*.

The Pattern Theory of ideas as not just a combinatorial gallery but a process, "Calculus of ideas," has been developed by Ulf Grenander. My version of it is a lightweight modification inspired by fundamental concepts of chemical transformation.

The upper row in **Figure 12** shows the already familiar circles of connectivity, which could be also presented as matrices-like square images. The points on the circle are not individual neurons, but small areas of the brain topography, including functional aspects. The Figures in the middle row are reproduced from **Ulf Grenander, *A Calculus of Ideas: A Mathematical Study of Human Thought,* World Scientific Pub Co Inc., 2012,** Figures 5.4 and 5.5, p.117.

The points on the circle there are elementary ideas (generators) and lines are links between them established during a simulation of a spontaneous thinking, which consists in selecting, along a generated probability distribution, configurations (connected generators) of **regular** ideas. Regularity, very approximately, is what makes ideas meaningful and coherent. The criterion of meaning is, of course, human.

Figures 12.3 and **12.4** are separated by a time interval and the red dot corresponds to the idea SELF, which becomes highly connected. The elementary ideas are placed on the circle, exactly as in the circular presentations of connectivity, but they do neither imply nor exclude interpretation as topographical points on the cortex. This is something we do not yet know. The connecting lines are formed and broken in the process of spontaneous thinking, but in the picture all of them leave a trace. This is why the density of the picture grows.

The system, nicknamed GOLEM, can be opened to an exchange with other similar systems, as well as to the outside world. It is not a piece of Artificial Intelligence, however, but a seed of a concept that points to a different, non-algorithmic direction: intelligence based on random processes, which gets rid of homunculus once and for all.

The lower image is reproduced from my *Pattern Chemistry of Thought and Speech and their Hypothetical Ancestor* . It is the circle of elementary ideas and their doublets, similar to the middle row, taken for the story of *The Three Little Pigs*. The circle, compressed here into ellipse for convenience, is what I call, the WORLD of the story, i.e., the content of a mind thinking about it. The lines connect the adjacent ideas in the linear story. Ideas correspond to nouns and verbs. They are numbered in the order of appearance in the story.

> The difference of my approach is twofold.
>
> (1) I do not pay attention to linguistic regularity of a thought, believing that thought is a pure configuration, not necessarily linear, produced in a universal way by all humans and further **linearized** into a verbal expression in a way depending on the language.
>
> (2) I believe that configurations of thoughts are competing for a limited resource (supply of energy by blood) in a non-linear manner, as in the population dynamics. The patterns of thought that maintain the supply of energy survive natural (trial and error) and artificial (education) selection.

I do not think that the above differences contradict in any way to the main idea of Ulf Grenander's GOLEM: human thinking is probabilistic and consists of random acts from which order emerges. I use the same principle of selection of content and connector from a probability distribution.

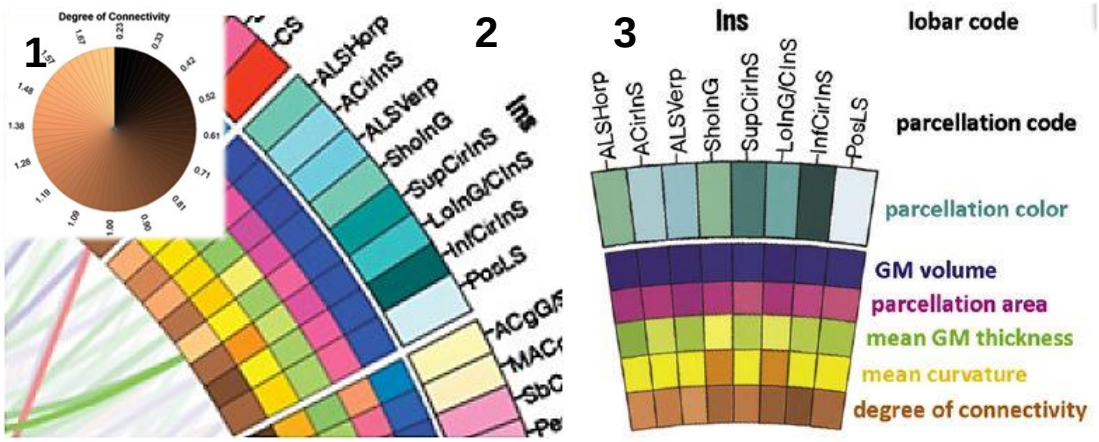


Figure 13. Labeling the topography map of connectome. 1: Color coding of degree of connectivity; 2: Fragment of the map; 3: Labels and codes (Source)

Figure 12.2[13] is for many reasons extraordinary in the context of this Essay: it is the apotheosis of topography. It shows the possibility of circular connectivity as a universal way to enrich abstract topology with many material details. Both nodes and connections can be labeled in many ways, including metric distance, statistics, frequency, whatever.

Insula (red)

Figure 13 illustrates the rich topography of the connectivity map and ways of visualizing it.

The large parts of the brain (lobes) are marked by names (for example, **Tem** is temporal lobe) and their smaller regions by abbreviated labels as well as colors**. For example, Ins means Insular sulcus** and **LoInG/CInS** means **Long insular gyrus and central insular sulcus**. The degree of a property, for example, connectivity, gray matter volume, *etc*., is reflected in the color, and its intensity, of the connecting lines (blue, red, and green). The color intensity also labels the degree of "fractional anisotropy," (how much the shape is close to a fiber and not a sphere) and relative number of fibers in a bundle.

The ecosphere as a whole, the human brain (and any nervous system), ideas, Things, living organisms, Technos, and just any part of land, populated or not, can be represented this way. It is

[13] Source: Andrei Irimia , Micah C. Chambers, Carinna M. Torgerson, John D. Van Horn, Circular representation of human cortical networks for subject and population-level connectomic visualization. NeuroImage, Volume 60, Issue 2, 2 April 2012, Pages 1340–1351. http://www.andrei-irimia.com/uploads/2/9/3/8/2938292/028-2012-irimia-connectogram.pdf . **See also this**.

the same that to say that they have something in common. What is it? Obviously, representation. Not so obviously, pattern. Does it mean that anything we can draw or paint or even talk about belongs to the same pattern? Of course, but these questions and answers belong to philosophy, which is little interested in the practical importance of its conclusions, never consensual.

What matters to me is not the universality of representation of different large objects as configurations of Pattern Theory or networks or topographies but the **similarity between the objects themselves**: nations and econations, market economy and ecology, ideas and technology. It is meaningful to me—and here is a dash of art needed for the science of Everything—that they are all parts of global economy. This view is not exactly science, it will not convince everybody, nor change the world, neither will it make new products, nor end conflicts. I consider it a step in the evolution of knowledge. To answer the questions, we need more steps.

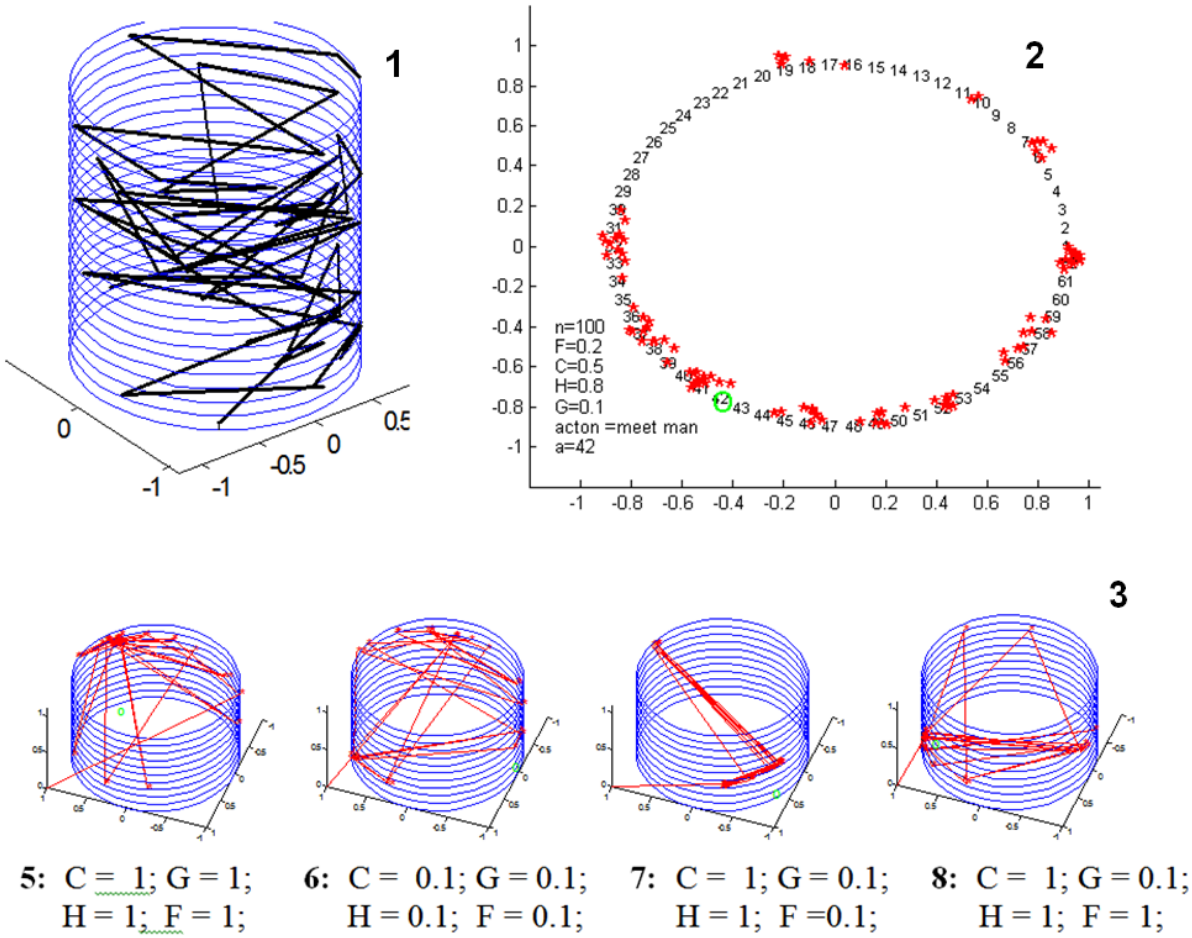


Figure 14. Experiments with *The Three Little Pigs*. 1: An example of time trajectory of thought; 2: Summary retrieval of elements of the story; 3. An example of "world" trajectories of thought with changing global parameters.

Figure 14 visualizes some results of competition between ideas according to a modified very general model of "chemical" reproductive competition first suggested by Manfred Eigen.

Figure 14.1 is a trajectory of consecutive ideas during a spontaneous thinking. The vertical axis is time and the circle in the horizontal plane is the WORLD of **Figure 12.5**.

Figure 14.2 shows the retrievals of ideas (red stars) from the WORLD after 100 iterations. The green circle marks the initial idea, which here is the doublet: MEET MAN.

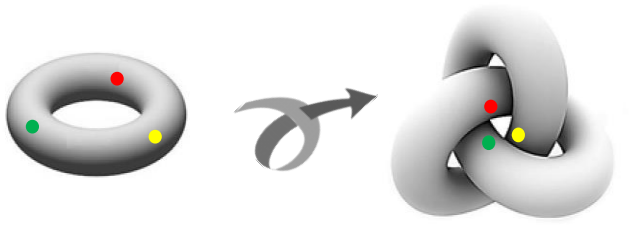
Finally, **Figure 14.3** shows how the result varies with changing four major parameters in the equation of the competition. They characterize such thing as the strength of interaction between ideas, depth of memory, influence of the preceding act of thought, etc. The vertical axis here is not time, but the numeration of points of WORLD, arranged along a spiral. Thus, the difference between the second (14.3.6) and third (14.3.7) pictures can be interpreted as the difference between intensive, jumpy, imaginative "thinking" and a rigid, narrow, constrained one.

5. KNOT

It seems to me that we are currently in a transition state to a distinctly new stage in history of the ecosphere. The indication of transition state in chemistry and pattern chemistry is the onset of instability and a relatively high speed of transformation from one stable state to the next. The "information revolution" moves on with mind-blowing speed. Sometimes the speed is illusory: a novelty is just a variation. Seeing history in terms of points and lines, I am interested in the topological revolution because it could lead us to a better understanding of our habitat and its economy.

I find it difficult to explain in unambiguous terms what is happening with the connectivity of ecosphere. Terms like "small world" topology, connectivity, data, information, and even probability require choosing from a set of available definitions because they depend on the human point of reference. In spite of my difficulties, I have a term for the typically ambiguous "topological revolution:" knotting.

There is nothing exotic in this idea. We hear every day that new Things and new ideas transform our physical and spiritual world. In our everyday media clatter, ideas and Things are like horse and carriage carrying us, the coachman and the passengers, toward a brighter future. Who is the driver if we are passengers?



Knotting. NO MYSTICISM OR LITERALISM, PLEASE!

I hope the illustrations to previous chapters of this Essay already introduced some of my points of reference in the language of gestures, on fingers instead of words. The picture on the left is yet another such gesture to appeal to vision rather than logic. It should not be taken as a mathematical statement. Both sides of the picture have a topology of torus on

which the three color points are distant. The right side, however, although it can be mapped onto the left side and *vice versa* (homeomorphism[14]) shows the three points close in a 3-D space.

> My pictures of the knots are not what are called knots in mathematical theory where knots are "circles embedded into 3-D Euclidean space." The knots here are "thickened" knots, i.e., *tori* (*plural* of torus). Alas, with knots nothing is simple. By the way, theory of knots had its beginning in Lord Kelvin's vortex theory of atoms.

The following is an example of knotting, inspired by the massacre of children and faculty at Sandy Hook Elementary School (Newtown, CT), December 14, 2012. However much I dislike any stick-in-the-mud bunch of pious acrimonious opportunists, in no way do I blame the Tea Party for that.

Figure 15 combines three pictures. **Figure 15.1** consists of six visual labels for six interconnected nodes of **Figure 15.2**. They are:

1. The Tea Party movement ("The Tea Party is America").
2. A poster at a right-wing demonstration ("We came unarmed this time").
3. The US Capitol symbolizing the US Legislation.
4. US Constitution.
5. Assault weapon.
6. An American.

In terms of Pattern Theory, they are six **generators** (components, elements) of one of the innumerable sub-configurations of American life, December 2012 – January 2013. The first four are, **in this context**, ideas. The last two are a Thing and a human.

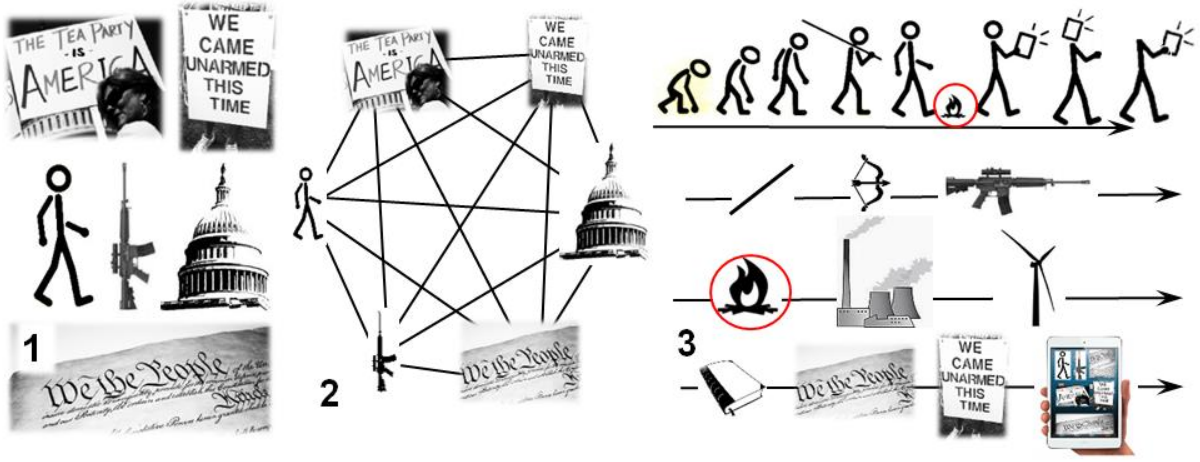


Figure 15: A knot: a small configuration of American life, 2012-2013
1: Generators. 2: Configuration. 3: Evolution of generators; top to bottom: humans, weapons, energy, ideas.

[14] "In the mathematical field of topology, a **homeomorphism** or **topological isomorphism** or **bicontinuous function** is a continuous function between topological spaces that has a continuous inverse function. Homeomorphisms are the isomorphisms in the category of topological spaces—that is, they are the mappings that preserve all the topological properties of a given space." (Wikipedia)

Configuration in Pattern Theory consists of generators and connecting bonds. The bonds between the generators in **Figure 15.2** form a complete graph, so that each generator is connected to all others.

For example, the fate of the murderous firearms in the USA depends on the interpretation of (1) the US Constitution, (2) behavior of US Congress, (3) the anti-government ideas—or pretense—of the Tea Party and its faction on Congress, (4) the perception of the right-wing activists by American public, (5) human nature and the far from equal distribution of its components over the US population and map.

The slogan "We came unarmed this time" is a threat of violence in response to actions of the elected government. "We" there resonates with "We, the People." Similarly, the slogan links to the rest of the components of the knot, US Constitution to Government, Tea Party to human nature and its capacity for anger, hate, intolerance, and violence, Tea Party's "no-matter-what" and "hell, no" frame of mind to political road blocks, etc.

The interests of each of the six members of their respective econations are represented by different organizations and associations, committees, and commissions, some of them of with diametrically opposite views.

Thus, the National Rifle Association (NRA) represents the interests of people, firearms, and related ideas in a package—or knot—which is not easy to undo. The idea in the foundation of NRA and the Congress come from the Constitution. The Congress is elected by the people. The interests of people and the legitimacy of the idea are being debated. Some adherents of Tea Party accompany the debates with threats of violence.[15] Firearms thrive under the wings of NRA and *vice versa*, for which some humans pay with life. Speaking of patterns, to be fair, environment and humans gain under EPA, for which they and Things pay with some loss of space.

Figure 16. The Knot.

In this way all six nodes are connected with each other. Each of the six is a sub-knot of controversies, contradictions, influences, interests, and conflicts in which all three econations are embroiled. Each idea has a material carrier, each Thing comes from an idea, and each human is bound by ideas and aided or harmed with Tings. And everything costs money. This is what I call the modern knot. I reproduce it in **Figure 16** from the figure on the title page. Within the US borders each Thing and every idea are accessible—topologically close—to every human and there is practically no geographical distance, no censorship, and little discrimination.

[15] Google "tea party" + "we came unarmed this time"

The anthropocentrism of the previous paragraph has a long history, which could be mapped onto evolution of topology from the social structure of a pack of primates through pagan religions, monarchy, monotheism, Renaissance, Enlightenment, and the entire Western history to the unique Serengeti Plain of ideas coming—or returning—from all ends of the world to America.

Figures 15.3 and 17 draw attention to the evolution of each econation. Evolution of ideas is much less known and inviting than general history of humans, but the latter inevitably includes history of technology and ideas as attributes of humans. Ideas and Technos have been regarded attributes of humanity as a whole, also known as (human) civilization, the development of which I have been witnessing for a long time from contrasting points of observation.

The cartoon of human evolution in **Figure 15.1** is a modified promotional bookmark of the *Scientific American* Magazine. The last stage symbolizes a transformation of the book into FaceBook accessed by a tablet computer or smart phone. As the great Stanisław Jerzy Lec wrote, *the window on the world can be covered with a newspaper*: for the lack of a newspaper (R.I.P.), a notebook or a tablet will do the job. As for the face, it has always been able to shield as well as betray the mind.

I am in no way bemoaning the past. For every generation the sun moves across the sky from dawn to dusk and the perception of the world landscape changes with the light. The shadows move, stretch, and shrink.

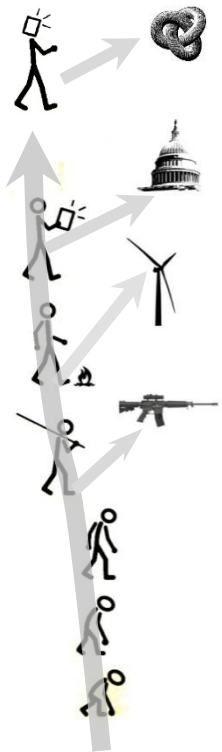


Figure 17. Econations: tree of life.

In the paradigm that I envision, which is not supposed to override the intellectual zoo in any way and is just a view from the pattern angle, humans are in the transition from the control over their ideas and Things to the position of a forced player in a tripartite game with cooperation and competition controlled by the pattern-chemical rules instead of human will.

The rules are more and more constrained by factors out of human control. They are universal rules of evolution as competition for a limited resource (Life sucks!) and **adaptation to its consequences** (Life is good!). In this paradigm, all three econations compete for limited abstract resources, beginning with energy and ending with abstract space, time, and probability.

By space I mean any extensive quality: land, wealth, energy, rare matter, number of dedicated voters, allegiance to an idea, etc. Probability is a kind of a limited resource because the sum of probabilities (if we know the full space of outcomes) is always 1. Not as sharp as mathematical probabilities, but human life time is limited, period.

From pattern-chemical perspective, the three econations are a non-equilibrium system of species, very different in nature, but much less different as patterns. For example, every Thing, idea, and human is trying to persuade you that it is good for you or somebody else. If a gangster or an Islamist terrorist wants to persuade you that he is bad for

you, it is only because he offers you a better choice than to resist. More seriously, all three can be products of economy, have an itemized price tag, and propagate similarly to organic life forms. There is some similarity between a human body with its complex molecular biochemistry, physiology of organs, and the function of the nervous system. All three are drastically different, but tightly knotted.

I included into **Figure 15.3** a line (second from the bottom) symbolizing the evolution of energy sources and, therefore, the entire Technos, from fire to steam and electricity from fuel to renewable energy. Ultimately, it is the energy production—as well as dissipation, i.e., waste—that defines the most radical changes in the evolution of humans, Things, and ideas.

History of the enclosures in England (18th century), the Chinese experiments with limiting human reproduction (since 1979) as well as with explosive growth of Things and massive removal of people from land, the Soviet experiment with limiting Things in human possession (since 1917-1930 to 1990) and their resulting decline, the world-wide constraining effect of Things on human fertility, the possible observable evolution of species as result of climate change—all those large-scale phenomena have not yet been discussed as an inter-eco-national pattern. I have not researched this subject, though.

The ultimate cause of the **knotting** in ecosphere is the evolution of connectivity **from the big world** with landscape, distances, natural obstacles, and man-drawn borders **to the small world**, in which you do not need to send a risky seafaring expedition for the spices of India: they are in a store or available online and delivered to your door, as almost anything else. As a trade-off, if you are in the cross-hairs, your bank account and your intimate thoughts could be open to others without much ado. Moreover, your thoughts can be easily manipulated in the age when Things are rarely accessible to Do-It-Yourself maintenance and are disposable on a grandiose scale.

This is a huge and public topic and I am afraid to be lost in this sink hole, one of many when you deal with Everything.

I realize that granting pattern independence to ideas looks no problem in democracy, but leveling the plane between humans and Things is more questionable in the context of knotting. Ideas are clearly not aliens in the world of Things, however. They have economic value and humans erect the Great Walls of Intellectual Property to protect them from abduction. They dump money into ideas because they expect return. The difference is in the cost of access, transportation, and dissemination.

The decrease of the cost began with writing and has been the latest evolutionary trend since practical implementation of telegraphy after 1850, radio after 1900, and Internet after 1990. The way the giant Google data centers look implies that the cost is far from negligible and grows. I quote:

> "There's no way around it. These things burn a lot of energy, and a lot of the energy in a data center is done to cool it down so the computers don't melt. Data centers in general consume 1.5 percent roughly of all the world's electricity," Jordan G. Teicher, The Brain of the Beast, NPR, October 17, 2012. See also:James Glanz, Power, Pollution and the Internet.

It is an understandable anthropocentric habit to consider data and Things "belonging" to humans, but to me the opposite equally natural. Humans "belong" to "their" data because the data influence the fate of their human providers. Data "belong" to Things because they store the data. The concept "belong" makes sense only in the context of economic transaction. I see no reason, however, to generalize this relationship over entire econations. I venture into this casuistic area only because I see there yet another argument for the pattern similarity, to put it cautiously, between HITs. **To belong** has a whole spectrum of meanings. The reader can try to sort it all out, but I will stand "my" grounds.

Since the volume of stored ideas of Things, alias **data**, grows exponentially, the data (overwhelmingly junk) will be felt as an energy burden rather sooner than later. Competition of **data** for storage may result in mass culling of data, controlled by some proprietary data and algorithms, quite like mass murder of humans. Will it be possible to predict whose teenage texting, kitten photos, or proprietary data survives and which of Plato's *Dialogs* succumbs when a cloud in the info-skies spills some info-slop down the earth? The past could be rewritten ("refreshed" in the Newspeak) daily, quite like in Orwell's *Nineteen Eighty-Four*.

The pattern kinship of Things and humans is hardly an extravagant idea: they both have mass, volume, can move, and evolve, multiplying from a blueprint: DNA and culture for humans and a digital file for Things. Things need humans, humans need Things. They are no twins, of course. Humans need to consume energy from food, allowing only short interruptions, while Things can be stored for years and even—in museums—for thousands years, although only few of them, like the treasure of Tutankhamen, actually can boast that kind of storage time.

What makes humans different from Things and ideas is mortality. While organic life—mostly water—stays perpetually unstable, i.e., far from equilibrium, Things can be stable and completely solid, although even a laptop contains liquids (sort of) in the battery and display.

Most idle solid Things decay very slowly and their vulnerable parts are replaceable. The problem with Things is that they are completely disposable and not just individually but as a species. Ideas do not care about time: they material carriers do.

Time—daytime or lifetime—is the most strictly limited resource of humans and this is what makes them vulnerable long before the end of life. Things have thousand ways of sequestrating humans from the productive time: in stop-and-go traffic, at the game terminal, in compulsive texting, attempts to understand fine print, years of unemployment, hours of re-learning a new version of Windows. Moreover, the Things have been constantly taking over human occupations and inserting themselves between humans and other Things, as well as within both econations. The previous sentence will be regarded by most readers as a typical metaphor. I am personalizing Things and use "taking over" and "inserting themselves" as patterns. See Essays 15 and 54 on "inserting themselves."

It is a cliché that time is a limited resource. Google: "time as a limited resource" OR "time is a limited resource". *Memento mori*. *Ars longa, vita brevis*. My Essays started with this topic, see Essay 2. Since "time is money" (another cliché), time attracts buyers and burglars.

I want to illustrate the concept of time as a resource in somewhat more than a trite sense. Let us take the hot problem of digital security and compare it with physical security. For ages, the cost

of security breach was measured in energy needed to perform work on matter. The Great Wall of China is the best pattern template: it took over a thousand years and enormous work to build and maintain. It takes substantial **energy and time**, more accurately, **work**, i.e., **work per unit of time (power), multiplied by time** to breach the wall at a chosen spot. The same destructive task, even for the most of the wall, could be performed simply by quietly waiting for the forces of nature. Thus, the first stretches of the Great Wall, built before 206 BC, left without repair, are today in ruins. The switch to bricks from earth and stones began in the 14th century AD. We shall visit the Wall after 3600 to see the full effect of the improvement.

A sufficiently long and random password is a typical recommendation regarding personal digital security, I suppose, at least for non-celebrities. In the digital world where pecking on keyboard is the effective equivalent of putting 22 lb. (10 kg) bricks into the Great Wall of China, the creator and the detractor of data have comparable chances. The reason for that is the ongoing dematerialization—and dehumanization—of important aspects of modern human life. As the gunpowder and dynamite had leveled the plane for creating and destruction of stone, dematerialization (=digitalization) leveled the plane for a smart teenager and a team of computer scientists.

The thoughts of Things (i.e., data), can be protected by increasing the time needed for breaking in and stealing or corrupting them. In this role time seems to work as a substitute for physical energy. But it does not mean in any way that time is energy or, for that matter, anything else, from the point of view of physics. It is just the equivalence of small power for long time and big power for short time.

> I suggested in **Introduction to Pattern Chemistry**[16] the use of natural scenes and non-electronic channels as a way to materialize the password and make it fit the pattern of the Great Wall.

There could be a way to stop the hand of a hacker. As for ideas, in the land of the Great Wall another experiment has been conducted with walling some ideas off. I remember how much the Voice of America and BBC radio service in Russian had done to destroy my Soviet illusions in spite of jamming.

America is still the open frontier, if not quite for humans[17] then for all Things and all humanitarian, liberal, conservative, hateful, philanthropic, genial, violent, tolerant, and just crazy ideas ever produced not only all over the globe but also over the entire span of human history, with a lot of recent inventions. My comparison of ideas with animals is not an extreme metaphor, but a reference to the pattern of a **life form**, however different from organic life. What is this difference? How big is it?

Literature on the structure of ideas is enormous. It has been built on the foundation laid by Aristotle. Ideas are combinations of basic parts, quite like flowers, computers, bones, DNA, and

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[16] See **Introduction to Pattern Chemistry**, Part 4, Chapter 8: PATTERN CHEMISTRY OF INFORMATION INSECURITY.

[17] "*Income Growth For Bottom 90 Percent Of Americans Averaged Just $59 Over 4 Decades*" (Huffington Post); original source: *Income Inequality: 1 Inch to 5 Miles* , by David Cay Johnston.

airport novels. They propagate, populate minds, and evolve by principles of memetics[18] instead of genetics. Politics is the husbandry of ideas counted by heads they inhabit for the lack of their own heads. Ideas mutate, multiply, fuse, and emerge. They are remembered, some of them as stored fossils or reconstructions of mental dinosaurs. Inside the individual mind, ideas compete for the share of time in consciousness where only one few ideas can be present at the same time. Some ideas usurp the minds of their unfortunate hosts and turn them into possessed. Other ideas make

Any omnipotent tyrant dies. Anything of matter decays. Do ideas die? I always denied it. The resurrection of the old imperial ideas in Russia, neo-Nazism in Western Europe, and never-ending fight against Darwin in America confirm that ideas never accept defeat.

When the ideas of pattern chemistry began to solidify in my mind, the most surprising realization was the role of size in the behavior of configurations and patterns. What can be duller than size? I skip repeating the principles (see Introduction to Pattern Chemistry) and limit myself to how it applies to ideas.

While I see humans, Things, and ideas stirred in the cauldron of evolving ecosphere, I try to formulate what is so different and even bizarre about the apparently immaterial information expressible in words and emotions as compared with material Things. Can they somehow escape, as Horace and other poets believed, the steamroll of **time** (the ancient word for entropy), which was incomparably expressed by Shakespeare?

Horace: *Odes* III.3

Exegi monumentum aere perennius
Regalique situ pyramidum altius,
Quod non imber edax, non Aquilo impotens
Possit diruere, aut innumerabilis
Annorum series et fuga temporum.
Non omnis moriar multaque pars mei
uitabit Libitinam…

I've raised a monument, more durable than bronze,
one higher than the Pyramids' royal towers,
that no devouring rain, or fierce northerly gale,
has power to destroy: nor the immeasurable
succession of years, and the swift passage of time.
I'll not utterly die, but a rich part of me,
will escape Persephone…

Translated by A. S. Kline © 2003

Shakespeare: *Sonnets*

Sonnet 64

When I have seen by Time's fell hand defaced
The rich proud cost of outworn buried age;
When sometime lofty towers I see down-razed,
And brass eternal slave to mortal rage;
When I have seen the hungry ocean gain
Advantage on the kingdom of the shore,
And the firm soil win of the watery main,
Increasing store with loss, and loss with store;
When I have seen such interchange of state,
Or state itself confounded to decay…

Sonnet 12

And nothing 'gainst Time's scythe can make defence
Save breed, to brave him when he takes thee hence.

Sonnet 60

And nothing stands but for his scythe to mow:
And yet to times in hope my verse shall stand,
Praising thy worth, despite his cruel hand.

[18] Meme, "an idea, behavior, style, or usage that spreads from person to person within a culture" (Merriam-Webster Dictionary) is a great idea—and a widely spread meme—of Richard Dawkins (1976).

He mentioned two ways to immortality: to breed—whether ideas (verses, following Horace), or progeny, or both, deserving the title of the founder of memetics. And yet Shakespeare still lives, as much because of school indoctrination as in spite of it, while Horace, full of ideas and images that became seeds of Western civilization, seems distantly antique.

There is a particular pattern reason for the immortality of ideas: they can be so small that their self-assembly in a human mind can easily be spontaneous. It is the same pattern as in the emergence of organic life and it applies to Things, too. The apes, our caged and tortured messengers of evolution, supervise the spontaneous emergence of Things from rocks and sticks. In pattern-chemical terms, they play the role of enzymes.

"Life is good," "Life sucks," and "I must change my life" are examples of ideas that arise in human minds without a prompt from a T-shirt or spare tire cover. By a minimal mutation, a lot of things can be substituted for "life" or its description.

Large complex ideas have low probability in Ulf Grenander's *Calculus of Ideas*. Small ideas win competition.

The secret of longevity and invulnerability of ideas is not exactly immortality but the ease of spontaneous generation. There are few degrees of freedom in small systems. Probably, instincts and emotions are the closest precursors of simple ideas. The simplest ideas are just two bonded elementary ones[19] , but the latter also come from somewhere. I am not aware of a systematic work in the field of emergence of ideas but the Pavlovian dog comes to my mind.

Here is a subtler example of a small idea. In **Essay 43, The Cold Civil War in America**, uploaded in August, 2006, I reported 869 Google search results for **"cold civil war" + America** on August 17. I have repeated the search on April 15, 2013 with 258,000 results.

The intensity of the war is reflected in the following Table.

GOOGLE SEARCH RESULTS →	A: 2006	B: 2013	B/A
"democrats are shameless"	75	24800	331
"republicans are shameless"	81	1102000	1259
"shameless democrats"	656	77330	11
"shameless republicans"	710	550040	7
"kill democrats"	3450	18300	5
"kill republicans"	555	7590	14

[19] See TIKKI TIKKI TEMBO: The Chemistry of Protolanguage and Pattern Chemistry of Thought and Speech and their Hypothetical Ancestor

There was no single inventor of the idea. It occurred to many people because it was small in size, with only three generators in the configuration (America, Cold War, Civil War) although not quite simple in meaning. But to be conceived it needed the womb of a politically concerned or engaged mind with the US Civil War and the Cold War simmering not too deep in the subconscious.

Of course, the Table does not take to account the difference between the parties regarding upbringing and manners, but Dems sound more outraged while Reps look more bloodthirsty.

Very complex ideas[20] can emerge in the minds of scientists, but they involve with very exotic notions grown in a well processed and enriched soil from other worlds and available only to a few minds. Complex ideas are not fully remembered or even understood by all specialists: they are kept on record in books and files. Of course, complex ideas consist of simpler ones, but the hierarchical pyramid of simpler constituent ideas in science is itself a complex structure, usually built over time in trial-and-error manner. As for the emotional perception of life, the mechanisms of our mind supply the few needed parts for assembly without any conscious effort.

Nevertheless, even very complex discoveries and inventions can be made independently. One of the better known disputes of this kind flared up over the development of calculus between Newton and Leibnitz.[21]

Simple ideas, especially, prejudices, do not need to be put on paper, let alone a T-shirt. They just keep circulating and spreading over new generations of minds. There is always a hysterical party for every historical time.

As a long time believer in simple reasons, I just cannot resist a short digression.

> What is the true driving force of the American politics in the first decades of the twenty-first century? It must be something really simple because it is so persistent. On the surface, it seems that the American elections are driven only by simplest germ-like ideas capable of spontaneous generation and biting into human emotions like bedbugs. What could that be?
>
> I believe it is the irreconcilable conflict of free market democracy. It is the clash of two incommensurable numbers: wealth of the minority and voting power of the majority. The depletion of the middle class causes the reduction of the buffering center and this is the primary reason of the current Cold Civil War in America. With all the incredible concentration of wealth, the giraffes of Essay 57 cannot overpower the crocodiles because both exist literally in different dimensions, while the US Constitution ignores the difference. To get into the same universe, either the crocks must raise and concentrate a comparable pile of money (which Barak Obama did both times) or the giraffes must whip up the passions of half the crocks, which is possible because of the perpetual contrast between urban and city life. As for the hippos, they are a majority only regarding the intellectual power.

[20] For example, Gödel's incompleteness theorem, Andrew Wiles' proof of Fermat's Last Theorem, and modern particle physics.

[21] On multiple discoveries, see this.

> A somewhat similar Hot Civil War comes to my inflamed with patterns mind: the Russian Civil War (1917-1922) between the minority of the upper classes and the majority of the lower classes with a small middle class between them.
>
> This is a dispute not just over apples and oranges but, rather, over pounds and yards.

It would be logically to ask here, what is social justice? Is there anything objective? See **APPENDIX 3**.

Simple ideas are greatly vulnerable to confusion when the context evolves. What can be simpler but more confusing than the Second Amendment? Ideas like that need an interpreter with the mandate of heaven and a deafening voice. The idea is simple:

> *A well regulated Militia, being necessary to the security of a free State, the right of the people to keep and bear Arms, shall not be infringed.*

The idea is simple but its components are context-dependent: *well* (what is "well?" what is "poorly", *regulated* (by whom?) *Militia* (what does it mean today, if anything?), *security* (from what? from whom?), *people* (all human beings?[22]), *Arms* (machinegun? rocket launcher? tank? chemical weapons?), *infringed* (how does it go with a good regulation?). Now, *being necessary*: does it mean ***in case*** *it is necessary* or is it *always necessary*?

Simple ideas are simple at birth and in simple times. Tied in a knot with Things and humans, pulsating with the circulating money, they can be hopelessly complex.

We are surrounded and overcome by Things. They penetrate our physical, physiological, psychological, and cultural space. They are inside our bodies (pacers, stents, and joints) and in the air (the newest micro-drones[23] that will soon become disposable flying assassins peeping into our windows and hiding under the bed). Ideas are still visible on pages and monitors and heard on the radio. If we can move prosthetic hands and legs by our thoughts, sooner or later something will wedge in between our brain and somebody else's and will gently whisper that whatever evolution brings us is for the better.

What makes each citizen of an econation surrounded by other nationals as by masked doctors with sharp instruments? Why aren't humans bothered by the visions of millions smartphones killed in the prime of life and bulldozed into ditches like cadavers in an extermination camp? Aren't we afraid of the revenge of the Things whom we have given the gift of ideas deceitfully called data and algorithms? Will the ideas of freedom, human rights, and pursuit of happiness win a competition with ideas of submission to Heavens, class inequality, strong hand, predestination, and order no-matter-what? There must be some universal physics in the

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[22] "When the country was founded, in most states, only white men with real property (land) or sufficient wealth for taxation were permitted to vote. Freed slaves could vote in four states. Unpropertied white men, women, and all other people of color were denied the franchise. At the time of the American Civil War, most white men were allowed to vote, whether or not they owned property." (Wikipedia). See also A , B, and C ("…repel invasions, suppress insurrections, or execute the laws").

[23] See: D, E, F.

ecosphere that determines the preferred direction of events as well as the impossible one. If we create millions of ideas and Things, what will counterbalance the creation by destruction?

What is the place of humans in the future? We are the slowest evolving econation on earth, unless prodded by Things and ideas. Can we compete with the fertility of Mother Apple Inc?

> "There have been six generations of iPhone (original iPhone, iPhone 3G, iPhone 3GS, iPhone 4, iPhone 4S and iPhone 5), five of iPod Touch (1st to 5th generations), and four of iPad (iPad (1st generation), iPad 2, iPad (3rd generation) and iPad (4th generation))." (Wikipedia)

Those would be idle questions if we did not know well that the future has already started yesterday.

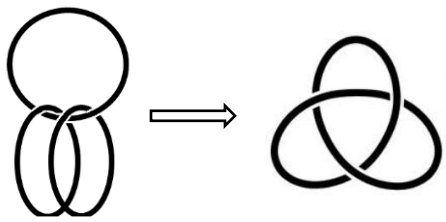
Ideas as an econation are a swarm of mutatnts. See **APPENDIX 4** for another take.

The power that ties everything into a single knot of economy is money: the now universal form of energy in the ecosphere that circulates inside the triple knot of economy, coming from sunlight, mineral fuel, and planetary rotation and dissipating with heat, garbage, and carbon dioxide. Things and ideas that used to comply with human preferences, however silly sometimes, may also warn us one day with something like "We came unarmed this time."

Indeed, money, formerly cattle, gold, and paper, has become an idea in a digital body.

Without even following the laws of conservation, it keeps the ecosphere together. It makes everything close: hand of the thief and your pocket, healing power of a new medicine and its crippling side effects, war and humanitarian aid, striving business and unemployment, assault weapons and school children, freedom of imagination and "press 4" of an automated responder, and only wealth and poverty stay worlds apart. In a bout of nostalgia, the idea materializes back into the pickled cattle of Damian Hirst and finds a buyer.

I am not an expert, but it seems to me that throughout its history America never went back to the past. It is quite possible that the enormous concentration, ubiquity, and fluidity of money are the main reason for the plasticity and dynamism of American society. It is moving ahead. The question is: what is there ahead for America and the world? I ask this question not because I want to stop it or suggest engaging any breaks. As a fatalist, I believe in adaptation—the steering wheel—not the breaks. If we formulate a question about the future, we will get a chance to complete an experiment with history which, unlike experiments on particle physics, will not cost us anything: time alone will do the job and bring us to the answer. Patience is the humming time machine. But we have to ask the right questions now and remember them later.



6. *ERGO…*

Suppose the idea of the ecosphere as competitive cohabitation of econations is sufficiently productive to be saved of immediate brushing off. The following conclusion seems to be in pattern spirit.

A species survives if it is productive, i.e., fertile.

Idea survives if it is productive in:

(1) generating new ideas,
(2) linking—positively or negatively—to old ones,
(3) spreading over large number of minds
(4) materializing in many Things.

A Thing survives if it is productive in:

(1) generating copies of itself,
(2) generating its mutants, hybrids, symbionts, hosts, and parasites,
(3) bonding with a good idea.

Do I really need to continue with humans?

I believe that the similarity of all three econations is clearly visible from the above comparison. In an ecosphere with limited space, resources, and population, all three econations will coevolve, driven by inherent ability to reproduce and propagate.

I have not mentioned money as a universal measure of energy, a kind of a universal ATP of the ecosphere. Will money shift to the form of a Thing (coin, paper), idea (number, future number, number as a goal), or raw human life, freedom, health, and even body part, as in some extreme ancient and modern ultra-religious, oppressive and genocidal trends?

Let us look at any detailed map of a piece of land, for example, **Figure 7.1**. Before the advent of man, it probably had only animal trails. Then pathways for humans and their animals appeared. Private land is closed to strangers. Modern highways are closed not only to pedestrians but also to vehicles between the entry and exit ramps. Moving around is constrained: it is physically easier, but has less degrees of freedom than in the age of walking and horse riding.

If we look at the map of the brain connectivity, like in **Figure 6.12**, we can see established pathways and highways of the brain paved with bundles of white matter. To compare with the communication on earth, those are underground cables, sometimes through the center of the earth or under the sea.

Like the earth, brain has two very big continuous cortical landmasses—Americas and Afro-Eurasia of the hemispheres—and the Australia of the cerebellum. It also has lots of smaller island formations deeper down. The modules are connected with interstate highways and smaller roadways between modules and parcels of the cortex that can be compared to neighborhoods.

Something like that could be a possible **pattern destiny** of the globe[24]: loss of freedom, fast track for a few options, more irregularity and less individuality. It could be survival of the similar, unremarkable, and run of the mill, as well as depletion of the surprising and unexpected, in short, the minimization and stabilization of the repertoire of patterns in ecosphere, even shorter: **freezing.**

The structure of human brain has been frozen for as long as we remember ourselves, although for a historically short time. Similarly, the evolutionary fluidity of the ecosphere could be freezing into a tight quasi-mechanical system similar of a large company with a very large number of customers, like Verizon, Amazon, Google, FaceBook, etc. How this GlobalMind Inc could be governed is an intriguing question, not to be considered here.

There is another configuration of the pattern of freezing: learning. Riding bicycle, speaking foreign language, or making money out of thin air on the stock market begins with lots of trial and error, exploration, missteps, playfulness, and final stabilization of the routine with some frozen errors hard to rid of. Evolutionary adaptation, however, is constant learning of changing languages, vehicles, and economic idiosyncrasies.

If there is a single ecosphere instead of a population, how can it adapt? This question is equivalent to the following: why is history accelerating, so that a single generation can witness dramatic changes? There are two possible answers: (1) the changes are not as dramatic as they seem, especially, as patterns and (2) the emergence, mutation, and selection of ideas is incomparably faster than selection of genomes.

The main argument for the idea of the ecosphere of HITs depicted in this Essay is that it is already there in the form of global economy. I leave to the reader to look at the economy from this angle, paying attention to how the process of globalization interacts with national and

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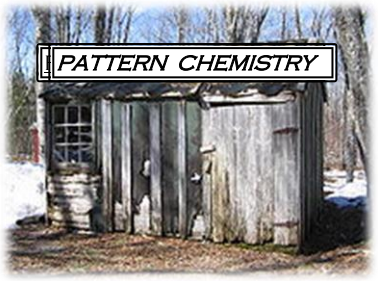
[24] On verticalization of social structure, start with **Introduction to Pattern chemistry, Part 1, 3.11.** ***Hats and roofs, lizards and dinosaurs*** and in subsequent text.

econational systems. A curious example is the hate of the West by the militant Islamism and the hate of the Socialist and Rationalist West by the militant Right Wing.

I do not have a coherent vision of the future, all the more, answers to my questions. The distant future is not really important. As for the near future, which already has put a foot in the door, the following questions are most solemn: (1) the fate of the political system in the USA, i.e., the dilemma which I defined as “from two parties to one there is only one step,” (2) the outcome of the competition between authoritarian (China, Russia) and democratic (USA, Europe) capitalism, (3) the potential of turning economic inequality into class warfare, and (4) whether the current explosive digitalization of all aspects of life is just a transition state between long slow centuries of the past and the long slow centuries of the future explored in details by historians and Sci-Fi writers with the globe on their shoulders.



APPENDIX

1. Pattern Theory and pattern chemistry

ESSAYS

Essays 1 to 58 (2001-2009) were previously published at:

http://spirospero.net/simplicity.html See APPENDIX 1 for full contents.

Essays 1 to 56 http://spirospero.net/essays-complete.pdf
Essays 1 to 20 http://www.scribd.com/doc/11607864/Essays-Part-1
Essays 21 to 40 http://www.scribd.com/doc/12273800/Essays-Part-2
Essays 41 to 56 http://www.scribd.com/doc/12529842/Essays-Part-3
Essays 1 to 56 , pdf http://www.scribd.com/doc/17164855/Essays-a-la-Montaigne-complete

Essay 57. THE FEW AND THE MANY , 2012 (html)
Essay 58. PATTERN CHEMISTRY OF RATIONALITY. ALL RATIONAL MINDS ARE ALIKE; EACH IRRATIONAL MIND IS RATIONAL IN ITS OWN WAY 2012

PATTERN THEORY

Ulf Grenander, *General Pattern Theory: A Mathematical Study of Regular Structures*, Oxford University Press, 1994.

Ulf Grenander, *Elements of Pattern Theory*, The Johns Hopkins University Press, 1996.

Ulf Grenander, *A Calculus of Ideas: A Mathematical Study of Human Thought*, World Scientific Pub Co Inc. , 2012.

Numerous sites on the Web.

PATTERN CHEMISTRY

Yuri Tarnopolsky, COMPLEXITY, http://spirospero.net/complexity.html
In particular:

Molecules and Thoughts: Pattern Complexity and Evolution in Chemical Systems and the Mind
The Three Little Pigs : Chemistry of language acquisition
TIKKI TIKKI TEMBO: The Chemistry of Protolanguage
Pattern Chemistry of Thought and Speech and their Hypothetical Ancestor

2. Mapping

Figure 18 illustrates two strategies of mapping the brain with preservation of topology. **Figure 18.1** shows the stages of "inflation" of the crumpled sphere of the cortex to a 3-D shape similar to the globe. **Figure 18.2** shows the stages of flattening the 3-D cortex into a 2-D map.

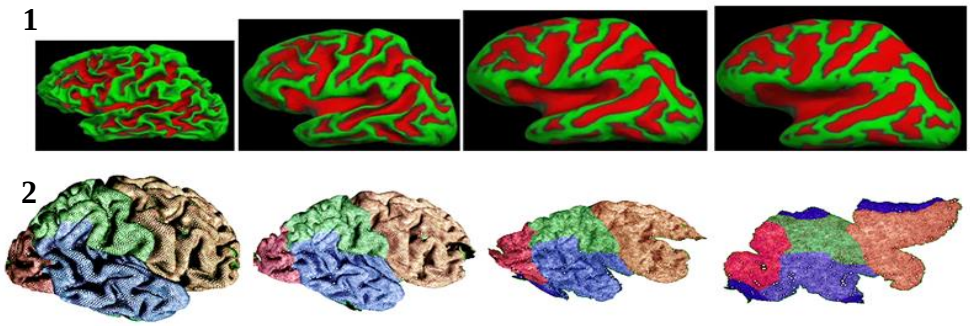
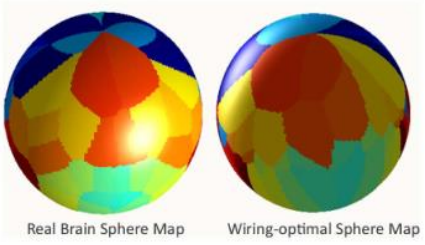


Figure 18. Homeomorphic mapping of the brain.
1. Inflation; 2. Flattening.

SOURCE:
Figure 18.1: Frames from a movie in: Florent Segonne**, A Short Introduction to Topology in Image Processing** .
Figure 18.2: Frames from a movie in: Monica K. Hurdal, **Visualizing Flat Maps of the Human Brain** .

Figure 19 adds three more illustrations of small world connectivity sharing the modularity pattern with brain: world airline routes, internet, and all kinds of land, sea, and air transportation.



The circular representation of the world connectivity would look like a 3-D globe with its "white matter" of bonds filling the internal space. This is not easy to show on 2-D plane. Nevertheless, it was found,[25] that if the brain is mapped on the sphere, its connectivity is very

[25] Ashish Raj and Yu-hsien Chen, **The Wiring Economy Principle: Connectivity Determines Anatomy in the Human Brain**, PLoS ONE (2011).

close to maximal economy of wiring. I reproduce here the real brain sphere map and "wiring-optimal" sphere map from the same (open) source.

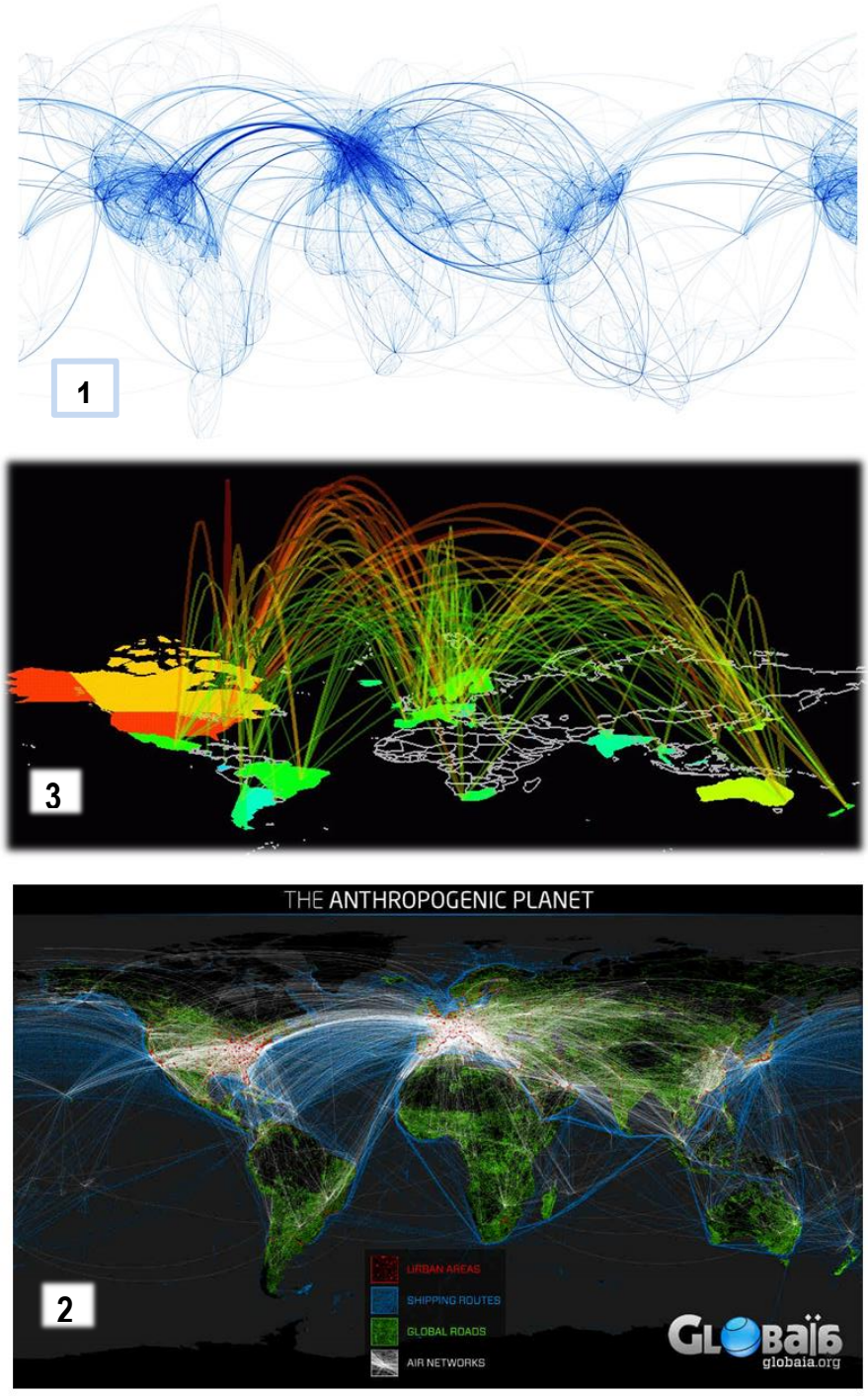


Figure 19. World connectivity.
1. Airlines. 2. Internet. 3. Land, see, and air transportation .

3. The marximum and social justice

This **APPENDIX** continues Essay 57, **THE FEW AND THE MANY: Pattern chemistry of 2012 Elections**[26]. In Essay 57, I discussed a particular boomerang-like angular shape of the income distribution curve revealing the income chasm between two classes none of which could be called middle. The middle finger to the middle class.

I am looking for a simple measure or indicator of social justice. This is the area where the lack of consensus is quite natural as in all disputes about something non-existing. The last decades have pushed income inequality in America to a striking and, as some believe, dangerous, even worse, irreversible degree. At the same time, there is a consensus that inequality is natural for capitalist society. I agree with all that. I would add that equality, even if not complete, is unnatural for any society, even the one without capitalism and private property, in which I was born. And yet from all I know about societies I was not born into, **extreme** inequality of any kind—of wealth, power, social status, representation, rights, and duties—is synonymous with instability. This is why history exists and keeps bringing surprises.

Two famous revolutions—in France and later in Russia happened in societies with high inequality in land distribution. Peasants were the overwhelming majority of population in both countries. In France by the end of the 18th century 3% of population owned 35% of all land and paid no taxes (the sweetest dream of the US Republicans). To add insult to injury, bourgeoisie (8%) owned 20-25% of land but had no political representation. The insult could be more painful than injury: bourgeoisie, rather well off, ran the revolution and redistributed the land. In Russia, about 100 years later, 1.5% of people owned 25% of land. The 100 years after the French Revolution had not been wasted: the Bolsheviks, who did not represent anybody but the specter of Karl Marx, surfed the wave toward a complete political repression of bourgeoisie as the first step, its annihilation as class next, and the **sequestration** (a US Republican obsession of 2013) of all land afterwards.

I believe the following idea is original, but I have not searched the literature.

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[26] HTML version

I want to draw a borderline between two types of social (i.e. economic, as everything today) justice so simple that it would be not so easy to dispute. It would be completely up to the observer which type to call justice and which injustice. Difference is all that matters.

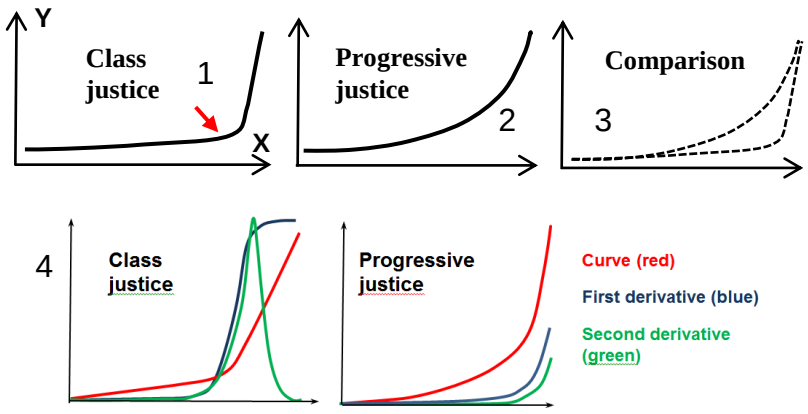
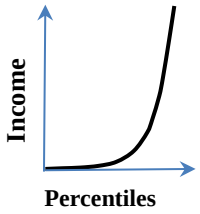


Figure 20. Social justice in terms of wealth distribution. 1– 3: Wealth (Y) plotted against population percentiles (X). 4: Second derivative as test for a social class division.

The upper row of **Figure 20** presents two types of justice/injustice. I call them class justice and progressive justice. In fact, it is nothing but two income distributions. They are fictional and not based on any real data.

The income distribution for class justice has the boomerang shape: a visible and abrupt change of the income growth. The transition from one social class to the other is relatively sharp. It looks like the two classes are separated by a barrier and obey different laws of nature. Even a superficial observation, not to mention the recent bumper crop of works on inequality, confirms the striking difference in all aspects of lifestyles.

The progressive distribution is smooth: there is no part of the curve that looks special. It is close to the shape of the exponential function $y = a^x$. It grows rather steeply from percentile to percentile. This is the famous (or infamous) exponential growth, a very divisive notion.



In practical terms, my only requirement to the progressive justice curve is that the income should grow more or less with the same acceleration. In terms of a mix of differential calculus with a movement of a vehicle, the first derivative of the income distribution characterizes the speed at a certain point and the second derivative gives the acceleration. For exponential growth, the function and both derivatives **have the same shape**.

I am neither mathematician, nor economist, biologist, nor physicist. My platform is pattern chemistry. Patterns are about similarity. I can afford looking as frivolous with serious scientists as poets with serious businessmen. Thus, I consider the mobility of a vehicle and the social mobility along the percentiles **similar.** In this sense I am talking about speed and acceleration. It

is natural to measure social mobility in income (or wealth) increase per percentile. If there are one hundred social classes in a society, there could be quite easy to notch up a percentile: such a small step for a man. However, if there are only three, as it was in pre-revolutionary France, or… by the way, how many are there classes in America? Certainly not less than two: enough wings for a boomerang.

Figure 20-4 shows how the first and second derivatives would look for two types of artificial income distribution curves. If there is a singular increase of the speed of social mobility, a noticeable acceleration, then the second derivative willd have a maximum. I have an irresistible term for this maximum: **marximum,** to honor Karl Marx who was obsessed with class conflicts, probably, for a good reason (the future will show).

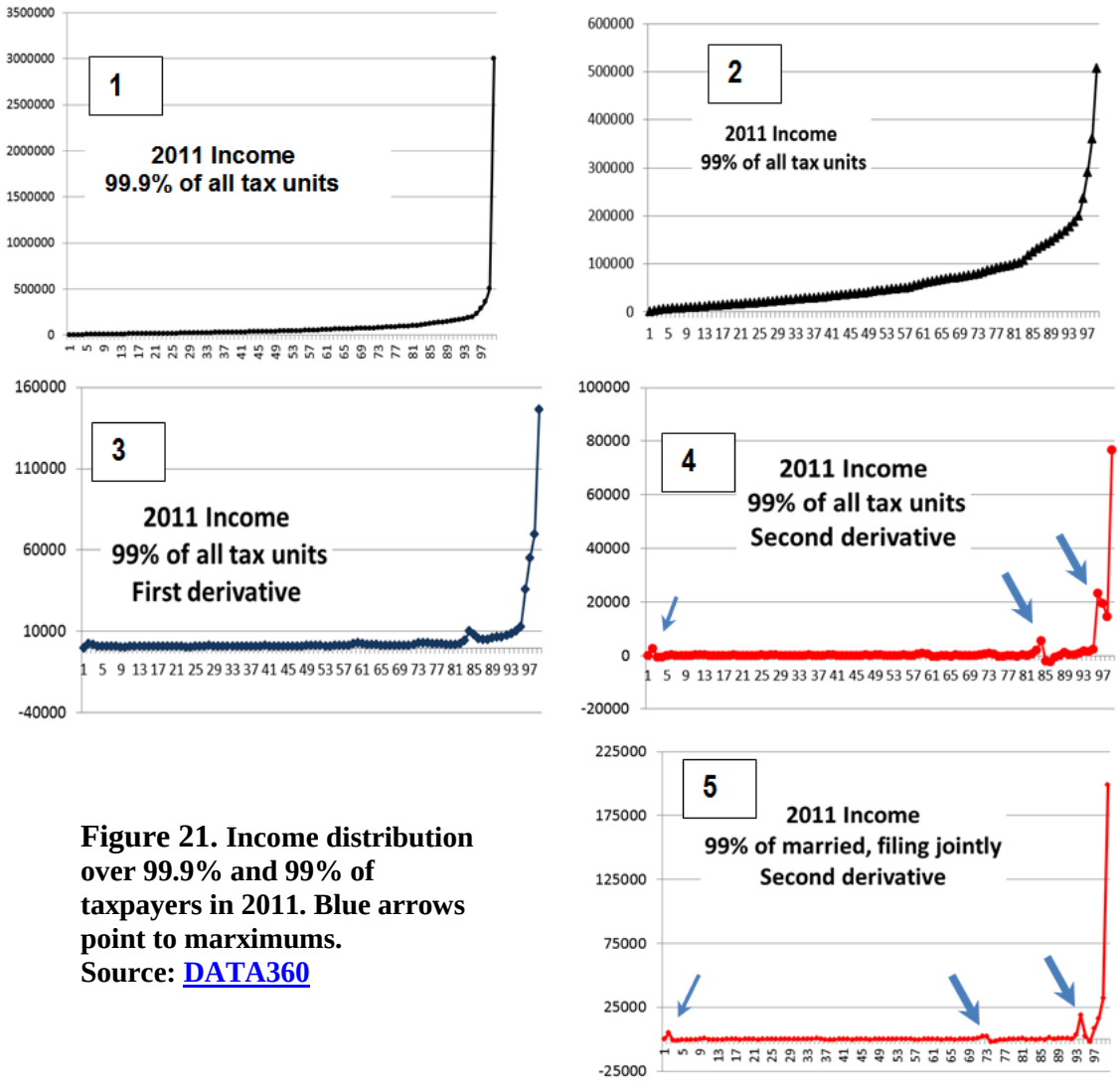


Figure 21. Income distribution over 99.9% and 99% of taxpayers in 2011. Blue arrows point to marximums.
Source: DATA360

I describe the society with progressive justice as the **equal inequality**: the laws of inequality are equal for all. Wherever you are on the inequality curve, your next step will increase your income in the same way. In other words, if your social mobility is described in terms of speed and acceleration, your speed will increase with an acceleration which is more or less the same along the road. The boomerang, however, shows that something happens at a certain point and you jump from an automobile to a supersonic jet accelerating to the space rocket speed. Very few people manage to stay in touch with the earth after that. True, very few people reach that point.

Let us now search for the marximum in the real-world income distribution statistics for 2011. The data are available at DATA360 , and could be accessed by search for "income," which leads to the table Income Percentiles 2011 (http://www.data360.org/pub_dp_report.aspx?Data_Plot_Id=824&count=all). Note, that they are based on tax data. The billionaire Warren Buffett famously reminded the people about the enormous gap between taxing wealth and taxing income: he paid less taxes than his secretary. And yet the tax data show the "boomerang effect," which is, depending on your character, either inspiring or intimidating.

In **Figure 21,** I plot the percentile distributions and their "derivatives." If 99.9% of taxpayers are included in the data, the boomerang effect is awesome. In the ecosphere it is like Mount Everest, or great white shark, Albert Einstein, the US Constitution, or the Large Hadron Collider, but not all of that together.

What I call derivatives are approximations by differences from percentile to percentile. Mathematical derivative[27], *dy/dx*, is, roughly, the difference of two *y* for two infinitely close *x*.

The top 1% is a difficult area where income hides in the shade of wealth. For fun rather than fact, I plot in **Figure 22** the **wealth** distribution within the Forbs 400 luminaries (September 2012).

Not surprisingly (for a power law distribution), it looks like a boomerang and shows the same high inequality. The Few are quite like the rest of us. Also, not surprisingly, it does not look like unjust. The small community of giants play by the same rules of human nature, are driven by the same ambitions, and tormented by the same inner demons, only of Godzilla size.

The nervous tremor of the area between the wings of the boomerang on **Figure 22** (red circle) is probably the result of the non-

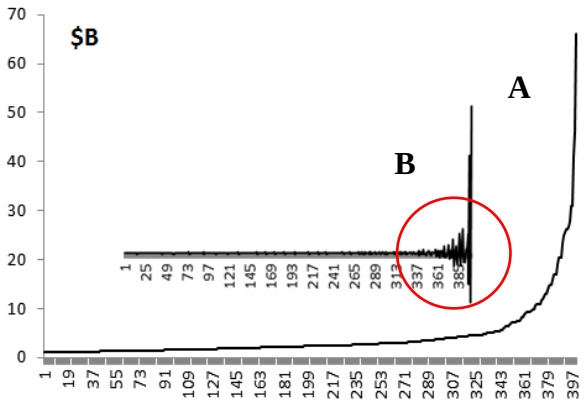


Figure 22. Wealth distribution (A) and its "second derivative" (B) based on Forbs 400 , September 2012.

[27] "In calculus, a branch of mathematics, the **derivative** is a measure of how a function changes as its input changes. Loosely speaking, a derivative can be thought of as how much one quantity is changing in response to changes in some other quantity; for example, the derivative of the position of a moving object with respect to time is the object's instantaneous velocity. "(Wikipedia)

uniformity of the *x*-axis, which is not fraction but ranking.

When I exclude the top 1% from the data, as in **Figure 21.2**, it looks like my ideal of social justice has been realized in America. Still, the second derivatives show two marximums and a tiny one in the very beginning of the Via (dolo)Rosa to the 400 Club. They are certainly not large.

The origin and meaning of the multiple marximums is beyond my scope of interests and should be left to professionals.[28] It could be just an effect of the Byzantine tax laws in America, the high cost of college education, the self-perpetuation of educated elites, or other reasons.

I tie this esoteric subject to ecosphere because I see here a poetic episode of the evolution of the HITs.

Here the pattern-chemical story. One of the most ancient forms of money has survived to modern times in tribal societies and it was unlike any other form: cattle. It could grow and multiply on land and in human hands. So could grain, another ancient currency. Moreover, the Things and ideas have also diversified the genealogy of money. In pattern parlance, money had split from life as another pattern life form and remains a life form today, although the strangest one. Money is a real child of ecosphere and a genealogical cocktail, combining the patterns of life, Things, and ideas, and, yes, humans, although only as images on coins and banknotes. And how could I forget gold and silver, the minerals? Below is the gallery of money's ancestors, although I find it difficult to visualize the digital money. Instead, I give a link to its various images:

https://www.google.com/search?q=bitcoin&hl=en&client=firefox-a&hs=uNO&rls=org.mozilla:en-US:official&source=lnms&tbm=isch&sa=X&ei=6yJcUfCOL42y0QGDyIDoCQ&ved=0CAoQ_AUoAQ&biw=1474&bih=807

The fourth from left is the now extinct but fondly remembered the 10 Deutschmark Banknote with all three HITs: (1) the image of Karl Friedrich Gauss (1777-1855), one of the greatest scientists ever lived, (2) his best known idea of normal distribution (the "bell curve"), and (3) on the back side, heliotrope, his invention used in land surveys which he conducted in his younger years.

[28] The marximums have a very abstract physical prototype: phase transitions.

Money could be farmed quite like cattle and grain. Both obey an ultra-sharp Gauss distribution (i.e., physical uniformity) in their materializations as cash, but otherwise in the world of money the normal distribution is powerless. It is the power law that rules and inequality that is normal.

The Few (the giraffes of Essay 57) are the class in possession of highly productive, actually, industrial means of money breeding. The better-offs among the Many (the crocodiles well above the water) stop short of the ownership in money industry but still can rent some of the slower and more regulated money farms.[29] Depletion of either species is perilous for society as a whole.

This is a separate and infinitely large subject, however. Capitalist democracy and, especially, the American democracy, is so historically new and the pace of history has been so much accelerating that people still do not quite know all habits and whims of this political order and what to expect of it. I have already got used to its paradoxes and to the most puzzling one: the pious Reds call for revolution and austerity while the Blues tacitly follow the steps of Jesus.

In the very long run, pendulum-like swings between democracy and autocracy are as natural as the change of seasons. Note that pendulum moves the slowest around its extreme points and sweeps fast through its middle position. So does history: from long historical "left" to long historical "right" and back through short fast transitions of wars, revolutions, depressions, recessions, and reforms.

I do not think, however, that the current political tension in America is a class conflict. **Figure 21.2** is still peaceful. The Red-Blue divide could be just a farewell to another handful of ossified marximums. I am optimistic because the conservatives seem to be intellectually in all respects lower than the progressives. Paraphrasing my father-in-law, you cannot find in a supermarket what you lack in your head.

As for myself, living in these exciting times, I am less and less inclined to grumble about the Cold Civil War and begin, cautiously, to believe in the possibility of a Cold Civil Peace in America. If a not-snow-white candidate or a woman becomes president, if gay marriage accepted, if the right to die wins, maybe even the atheists will be removed from the category of social lepers and the separation of church and state, now shaken, will be restored.

The pendulum of history is whooshing back and forth, the hands of the clock come full circle, but time runs only forward. It is measured not in days but in generations. I can't believe I am saying that!

[29] In entertainment industry the concentration of wealth follows the concentration of fame. The fame farming is the very basis of modern art and entertainment. Steve Jobs had put his iApples on that path, but fame…"*e mobile/ qual piuma al vento,/ muta d'accento/ e di pensiero*." [Woman] is unstable like a feather in the wind; she changes her tone and her mind.

4. Ideas and globalization

Finally, here is a yet another idea about ideas. There are Things about Things and humans about humans, but that would be an unnecessary distraction. Before laying it out I need to finalize the pattern concept of emergence.

I explain the emergence of the global complexity—you can call it economy or ecosphere, whichever you like—by three factors: (1) planetary sources of non-equilibrium, (2) spontaneity of simple changes, and (3) availability of slow processes. This applies to life, humans, ideas, and Things. Who knows, maybe something else will come out of nowhere.

(1) The non-equilibrium state of the geosphere has been maintained for its entire history by planetary rotation (day-to-day and seasonal cycles, tides, weather, volcanic and outer space activity, etc.

(2) The evolution of complexity starts with the **spontaneous** emergence of simple systems, just because they are simple, and continues by simple steps, which are possible just because they are simple. This point of view is extremely abstract and neither physical, nor chemical, but a pattern one. It all fits into this paragraph and there is nothing to elaborate: patterns are simple.[30]

(3) Everything evolves, but there is a big difference between **slow** and **fast** evolution if we take an external process as the reference point. This reference process, for example, the diurnal cycle, splits all processes in the system into those near equilibrium, i.e., faster than reference process, and far from equilibrium, i.e., slower than reference. The slower process does not catch up with the external change and is always off equilibrium. The faster process successfully follows the external change and stays close to equilibrium. Here comes a chemist: chemical transformations

[30] For comparison, see the most recent physical theories: (1) Alex Kleidon, *Life, hierarchy, and the thermodynamic machinery of planet Earth.* Physics of Life Reviews 7 (2010) 424–460 ; (2) A. D. Wissner-Gross, C. E. Freer, Causal Entropic Forces, PRL 110, 168702 (2013). For a pattern chemist, the physics' search for the origin of life and subsequent complexity has a surprisingly long and complex story and can itself be a good example of its very subject. Just teasing.

of the carbon compounds can be slow, as the processes in wine exemplify. They are a fertile ground for selection.
As far as the Things are concerned, the use of a stone or a stick and even a combination of both could be accidental. Many advanced important inventions were also made by accident because the bottleneck step was simple (just google "accidental inventions").

In our days, practically no Thing is produced without an idea, no idea is generated without a human, and no human begins a productive life without a set of Things and ideas. But this has been the way of life for millennia. What kind of novelty does **topologization**, a.k.a. globalization, bring? I will give just one example.

At the dawn of economy, a Thing, like a piece of pottery or fabric, was made to satisfy the needs of a spatially compact community, for example, a tribe, with known tastes and demands because the community maintained coherent, consistent, and stable patterns of thought, manufacturing, and everyday life. Economy was local, "Euclidean," driven by demand, constrained by distance, and modified by **slow** discoveries and new needs.

To be competitive in the current economy, a human, idea, or Thing cannot remain local because they have to **grow** in terms of money. They must appeal to a wide variety of often incompatible tastes, social profiles, and incomes: no pork for Muslims and Jews, no beef for the Hindus, no cars for Saudi women, no plug-in electric devices for savannas and jungles of Africa and South America, no uncensored Internet for China, no Darwin for some, no contraception for others. Evolution of ideas interferes with the evolution of Things and humans. The humans begin to coevolve with Things. Ideas are used like huge Caterpillar-Inc-made machines that turn human soil upside down. This is what the Knot means. Global economy of the supply type is still a historical novelty. It supplies not just what you need, but anything exchangeable for money, whether you need it or not and whether it is good for you or harmful. The transition from the demand economy to the supply economy, still ongoing, has been a real revolution, the significance of which is still disputed, mostly, academically and as propaganda. This is what I have in mind as one of the cardinal novelties of globalization.

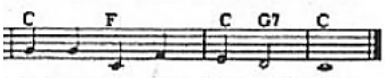
As somebody on CNBC Squawk Box has recently commented, regarding the Boston Marathon bombings, because of technology, it is now easier to both commit a crime and be caught after that. This is the latest example of the consequences of the big evolutionary shift. The society will have to adapt to it as it has adapted to the daily mortal accidents on the road. It adapts by nurturing the idea: "it will happen to somebody else."

Human, idea, and Thing

Human, idea, and Thing

The Things have become the most dynamic econation and they compete for physical space and resources by suppressing human fertility and common sense, which may be ultimately self-defeating. Who will buy then the iHealth? iLuck? iMoney? iFreedom? iSex? To watch that is both comic and daunting.

The Valkyries of ideas are flying on the digital horses of Technos over the battlefield of economy. They, as their job is, push some Things to death and others to life. As for the murderous power of ideas over humans, the events from the September 11, 2001 to the Boston Marathon bombings of 2013 are just the recent episodes in the entire recorded history of the Knot.

We all shall adapt someday. 

Per Nicolai Arbo (1831 - 1892), Valkyrien, **1879**.
Source of the image: the extraordinary website of Arild Hauge (in Norwegian and English).

Page created: April 6, 2013 —— Last updated **December, 2015**

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>>> To Essay 60. Art and Nexistence

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