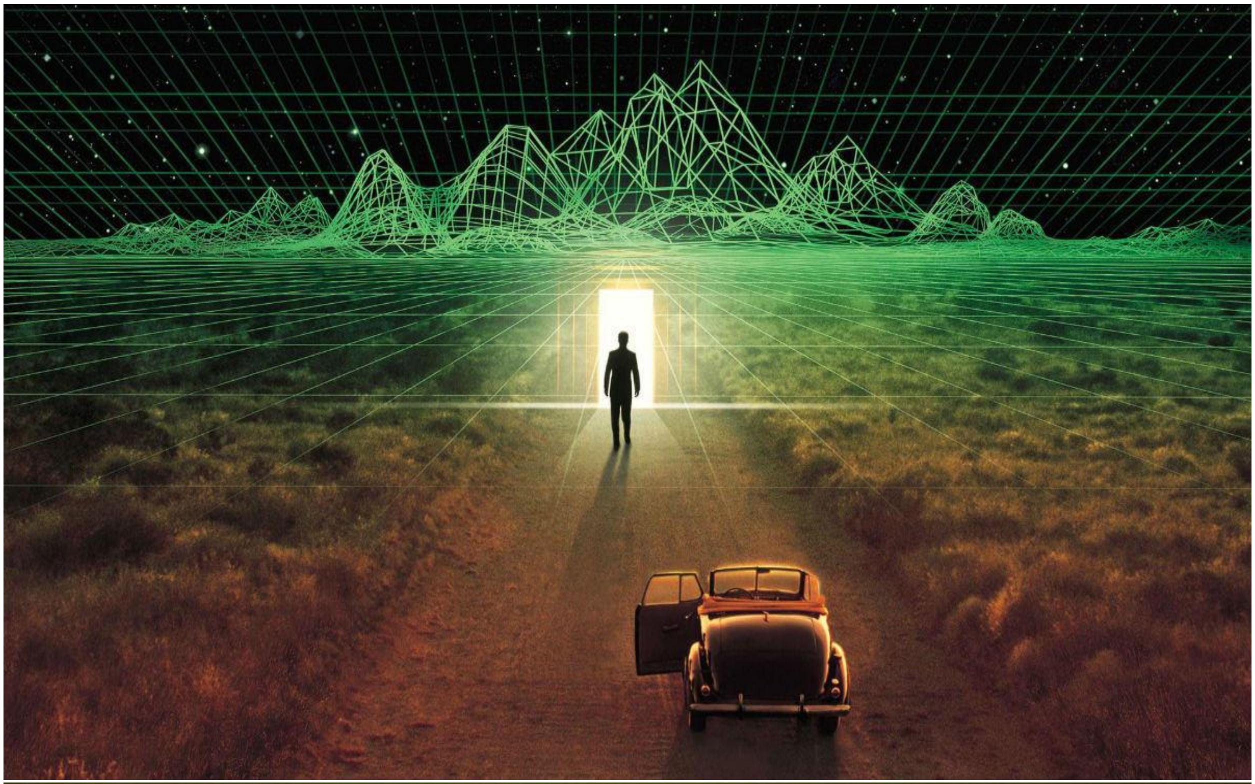
NEO-DESCARTIAN APOLOGETICS

By David Lee Burris



MUSK & MATRIX THINKING

Elon Musk says we may live in a simulation.

Oct. 2, 2018, 1:08 PM CDT / Updated Oct. 3, 2018, 4:55 AM CDT
By Corey S. Powell

Is the world around us real — or are we living in a simulation, like characters trapped inside some space alien's video game?

That sounds like a question you might hear at a midnight screening of "The Matrix," but lately it's become the subject of serious academic debate. High-profile proponents of what's known as the "simulation hypothesis" include SpaceX chief Elon Musk, who recently expounded on the idea during an interview for a popular podcast.

Could we be living in The Matrix? Warner Bros / Everett Collection

"If you assume any rate of improvement at all, games will eventually be indistinguishable from reality," Musk said before concluding, "We're most likely in a simulation."

Astrophysicist Neil deGrasse Tyson agrees, giving "better than 50-50 odds" that the simulation hypothesis is correct. "I wish I could summon a strong argument against it, but I can find none," he told NBC News MACH in an email.

Reality comes under attack

The current assault on reality began with University of Oxford philosopher Nick Bostrom's paper whereby he laid down some blunt logic: If there are long-lived technological civilizations in the universe, and if they run computer simulations, there must be a huge number of simulated realities complete with artificial-intelligence inhabitants who may have no idea they're living inside a game — inhabitants like us, perhaps.

These beings might imagine themselves real but would have no physical form, existing only within the simulation.

If computer-loving aliens truly exist, Bostrum argued, “we are almost certainly living in a computer simulation.” And then people like Tyson and Musk found their minds blown.

Looking for gaps in the sim

Any bugs in our Matrix world would have to be extremely subtle, or else we would have noticed them by now. Silas Beane, a nuclear physicist at the University of Washington in Seattle, proposes that we may be able to ferret out previously overlooked flaws by uncovering the mathematical structure used to build our simulated reality.

He points out that scientists in his field use a lattice-like set of coordinates to simulate the behavior of subatomic particles. Maybe whoever built our simulation used that approach, too. If our reality is built on top of a lattice, there’d be a fundamental coarseness to it, since there could be no details in our mock-universe smaller than the resolution of the simulation.

Is our world badly rendered?

Another way to sleuth for glitches in the simulation is by looking inward rather than outward. In a recently proposed test, former NASA engineer Thomas Campbell and his colleagues point out that human video game designers typically maximize efficiency of their programming by generating only the parts of the virtual world players can see. If our Matrix overlords are similarly focused, they may be meticulous about simulating details while we’re watching an event, but allow a looser style of simulation when they think nobody is looking.

Simulations all the way down?

That assessment seems to combine the worst of both worlds: We don't know if we're living in a simulation, but merely knowing that we might be in a simulation seems pretty depressing. Tyson calls it "a creepy concept." Bostrom adds that it "seems to foster a sense of absolute dependency."

But there are also constructive ways to look at the simulation hypothesis. Aaronson sees it as a fresh way to contemplate "the ancient mysteries of where our universe comes from, who or what created it, and why."

The rapid advance of AI research and computer modeling raises the possibility that one day we humans might create our own hyper-realistic simulations containing self-aware digital beings. That possibility is both inspiring and disconcerting. It also introduces a new set of brain-hurting questions. Would these simulations-within-a-simulation be the end? Or could our simulated beings keep going and create yet another layer of simulation, and so on?

"There could be an infinite stack of simulations if there were infinite serial computing power available at the bottom level and in each higher level," Bostrom says. Fortunately, in a finite-universe things can never get quite that crazy, he says: "As far as we can tell, the serial computing power available to a simulator in our universe is finite, in which case we could only create finitely many levels of simulations."

Phew. So maybe that's one small consolation: We might be in a simulation, or a simulation in a simulation, but at least we can be pretty sure that it's not simulations all the way down.

WHAT IS SIMULATION THEORY AND WHY DOES IT MATTER?

Are we living in a computer simulation? What is reality? Simulation theory tackles some heavy questions.

Mike Thomas

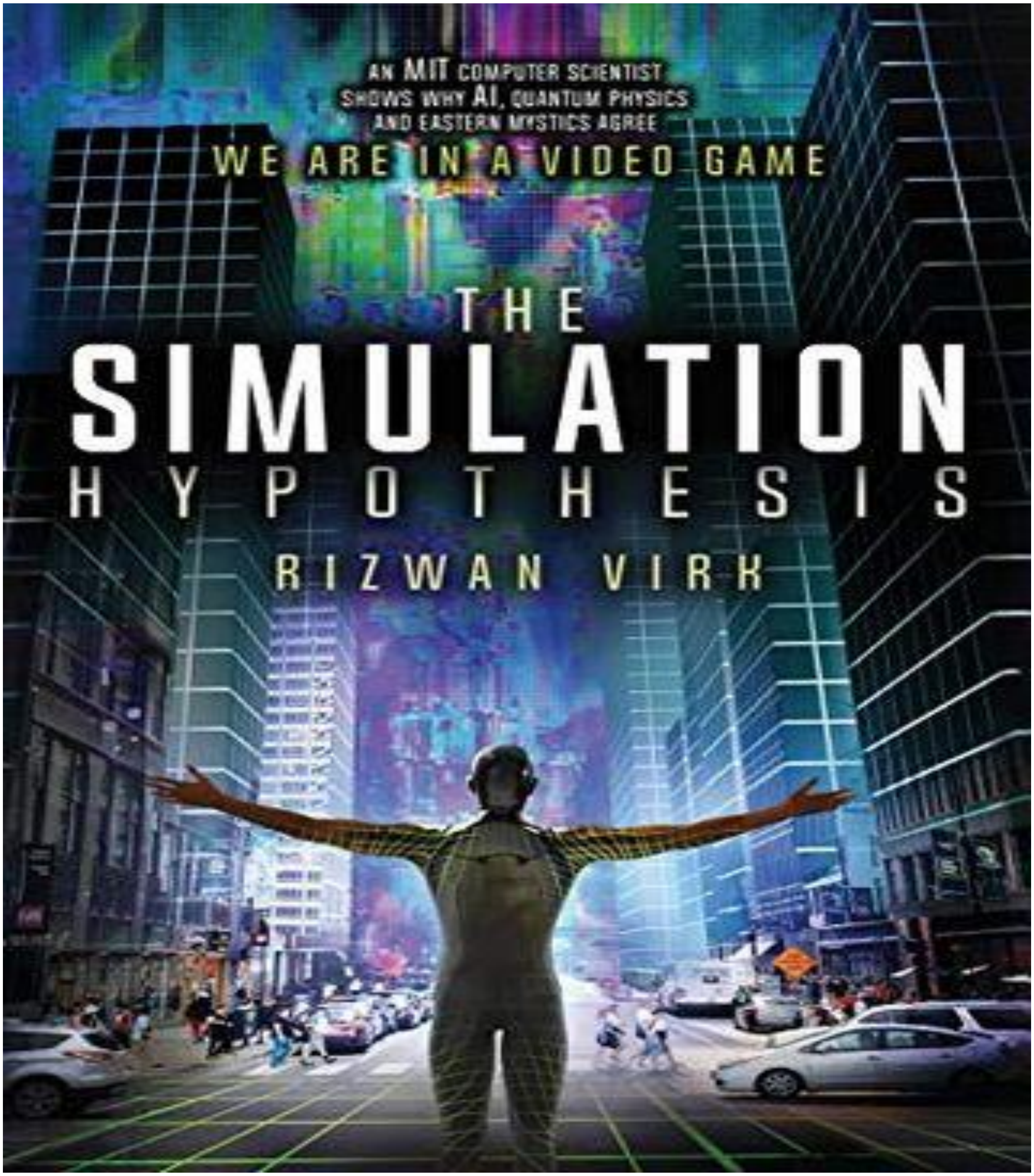
"It is possible that I am dreaming right now and that all of my perceptions are false." — René Descartes

"If we are living in a simulation, then the cosmos that we are observing is just a tiny piece of the totality of physical existence. While the world we see is in some sense 'real,' it is not located at the fundamental level of reality." — Nick Bostrom

What is reality?

From a purely empirical standpoint, the answer seems obvious: reality is anything we can perceive using one or more of the five senses: taste, smell, touch, hearing and sight. But some outside-the-box thinkers, including philosophers and physicists, contend that's not necessarily the case. It is possible, they theorize, that reality is merely an ultra-high-tech computer simulation in which we sim-live, sim-work, sim-laugh and sim-love.

From the time it entered popular consciousness, many have noted that simulation theory is essentially a modern offshoot of Plato's "Allegory of the Cave" story from the Greek philosopher's book "The Republic," and René Descartes's evil demon hypothesis from the French philosopher & scientist's "First Meditation." Both contain ruminations on perception and the nature of being — subjects that continue to puzzle and provoke.


AN MIT COMPUTER SCIENTIST
SHOWS WHY AI, QUANTUM PHYSICS
AND EASTERN MYSTICS AGREE
WE ARE IN A VIDEO GAME
THE
SIMULATION
HYPOTHESIS
RIZWAN VIRK

WHAT IS SIMULATION THEORY?

Simulation theory, a modern hypothesis with ancient roots, posits that we're actually living in an advanced digital construct, such as a computer simulation, that's overseen by some higher form of intelligence.

"Simply because we perceive the world as 'real' and 'material' doesn't mean that it is so," said Rizwan Virk, a tech entrepreneur and author of *The Simulation Hypothesis*. "In fact, the findings of quantum physics may shed some doubt on the fact that the material universe is real. The more that scientists look for the "material" in the material world, the more they find that it doesn't exist."

Rizwan Virk

"The findings of quantum physics may shed some doubt on the fact that the material universe is real."

Virk mentioned the renowned physicist John Wheeler, who worked with Albert Einstein decades ago. **In his lifetime, Wheeler said, physics had evolved from the premise that "everything is a particle" to "everything is information." He also coined a phrase that's well-known in scientific circles: "It from bit" — meaning everything is based on information.** Even the definition of a particle in physics is "kind of fuzzy," Virk added, "and may be in fact just be a qubit — a quantum computing bit."

New York University philosophy professor David Chalmers has described the being responsible for this hyper-realistic simulation we may or may not be in as a **"programmer in the next universe up,"** perhaps one we mortals might consider a god of some sort — though not necessarily in the traditional sense.

Even more mind-meltingly, theoretical physicist David Bohm once posed this tortuous notion: "Reality is what we take to be true. What we take to be true is what we believe. What we believe is based upon our perceptions. What we perceive depends on what we look for. What we look for depends on what we think. What we think depends on what we perceive. What we perceive determines what we believe. What we believe determines what we take to be true. What we take to be true is our reality."

And what we take to be true, more than a few folks believe — among them tech entrepreneur Elon Musk, who famously said the odds that we're *not* simulated are "one in billions" — might now or at least someday be merely the effect of simulated brains and nervous systems processing a simulated world. To Musk's unique way of thinking, the strongest argument for our *probably* being in a simulation is that, as he put it in 2016, "Forty years ago, we had Pong, two rectangles and a dot…That is what games were. Now, 40 years later, we have photorealistic 3D simulations with millions of people playing simultaneously, and it's getting better every year… soon we'll have virtual reality, augmented reality. If you assume any rate of improvement at all, the games will become indistinguishable from reality."

In a seminal 2003 paper titled "Are You Living in a Computer Simulation?", Swedish philosopher Nick Bostrom explained that future generations might have mega-computers that can run detailed simulations of their forebears in which the simulated beings are imbued with a sort of artificial consciousness. It is then possible to argue that, if this were the case, we would be rational to think we are among the simulated minds rather than among the original biological ones."

That type of "posthuman simulator," Bostrom also wrote, would need sufficient computing power to keep track of "the detailed believe-states in all human brains at all times." Why? Because it would essentially need to sense observations (of birds, cars, etc) *before* they happened and provide simulated detail of whatever was about to be observed. In the event of a simulation breakdown, the director — whether teenager or giant-headed alien — could simply "edit the states of any brains that have become aware of an anomaly before it spoils the simulation. Alternatively, the director could skip back a few seconds and rerun the simulation in a way that avoids the problem."

SKEPTICISM ABOUNDS

It was widely thought the simulation hypothesis had been disproven once and for all when, in 2017, physicists Zohar Ringel and Dmitry Kovrizhi published an article in the journal Science Advances titled "Quantized gravitational responses, the sign problem, and quantum complexity." Here's the catch: their work was at most only indirectly relevant to simulation, which Zohar dismissed as "not even a scientific question."

Specifically, they proved that a classical computing technique called "quantum Monte Carlo," which is used to simulate quantum particles (photons, electrons and other types of particles that comprise the universe), was insufficient to simulate a quantum computer itself — a breakthrough that would negate the need to physically build these next-level machines, which is no easy task. And if it's impossible to simulate a quantum computer, forget about simulating the universe.
Per Cosmos.com, "The researchers calculated that just storing information about a couple of hundred electrons would require a computer memory that would physically require more atoms than exist in the universe."

SIM OR NO SIM: WHO CARES?

Then again, you might be wondering, why does any of this matter? What is the purpose of proving or disproving that life as we know it is merely a digital construct and existence itself simply an immensely complex experiment in someone's virtual terrarium?

The broad answer, Virk said, is that which all good science pursues: truth. More specifically, our truth. If we do in fact exist inside a video game that requires our characters to perform certain quests & achievements in order to progress ("level up"), Virk posited, wouldn't it be useful to know what kind of game we're in so as to increase our chances of surviving and thriving?

Scientific American points out that *The Matrix* and its sequels did a lot to push the simulation theory forward, but philosophers have speculated in this direction for thousands of years. There are also many theories that flirt with simulation in the guise of radical solipsism and skepticism.

"I THINK THEREFORE I AM!"

- RENE DESCARTES COGNITO

VIRTUAL MINDS

A popular argument for the simulation hypothesis came from University of Oxford philosopher Nick Bostrum in 2003, when he suggested that members of an advanced civilization with enormous computing power might decide to run simulations of their ancestors. They would probably have the ability to run many, many such simulations, to the point where the vast majority of minds would actually be artificial ones within such simulations, rather than the original ancestral minds. So simple statistics suggest it is much more likely that we are among the simulated minds.

And there are other reasons to think we might be virtual. For instance, the more we learn about the universe, the more it appears to be based on mathematical laws. Perhaps that is not a given, but a function of the nature of the universe we are living in. “If I were a character in a computer game, I would also discover eventually that the rules seemed completely rigid and mathematical,” said Max Tegmark, a cosmologist at the Massachusetts Institute of Technology (MIT). **“That just reflects the computer code in which it was written.”**

Furthermore, ideas from information theory keep showing up in physics. “In my research I found this very strange thing,” said James Gates, a theoretical physicist at the University of Maryland. “I was driven to error-correcting codes—they’re what make browsers work. So why were they in the equations I was studying about quarks and electrons and supersymmetry? This brought me to the stark realization that I could no longer say people like Max are crazy.”

And the statistical argument that most minds in the future will turn out to be artificial rather than biological is also not a given, said Lisa Randall, a theoretical physicist at Harvard University. “It’s just not based on well-defined probabilities. The argument says you’d have lots of things that want to simulate us. I actually have a problem with that. We mostly are interested in ourselves. I don’t know why this higher species would want to simulate us.”

Randall admitted she did not quite understand why other scientists were even entertaining the notion that the universe is a simulation. **"I actually am very interested in why so many people think it's an interesting question."** She rated the chances that this idea turns out to be true "effectively zero."

Such existential-sounding hypotheses often tend to be essentially untestable, but some researchers think they can find experimental evidence that we are living in a computer game. One idea is that the programmers might cut corners to make the simulation easier to run… **"Then we go back and see what kind of signatures we find that tell us we started from non-continuous spacetime." That evidence, for example, might come in the form of an unusual distribution of energies among the cosmic rays hitting Earth suggests spacetime is not continuous, but made of discrete points. "That's the kind of evidence that would convince me as a physicist," Gates said. Yet proving the opposite—that the universe is real—might be harder. "You're not going to get proof that we're not in a simulation, because any evidence that we get could be simulated," said David Chalmers, a professor of philosophy at New York University.**

But some were more contemplative, saying the possibility raises some weighty spiritual questions. "If the simulation hypothesis is valid then we open the door to eternal life and resurrection and things that formally have been discussed in the realm of religion," Gates suggested.

And if someone somewhere created our simulation, would that make this entity God? "We in this universe can create simulated worlds and there's nothing remotely spooky about that," Chalmers said. "Our creator isn't especially spooky, it's just some teenage hacker in the next universe up." Turn the tables & we're essentially gods over our own computer creations. "We don't think of ourselves as deities when we program Mario, even though we have power over how high Mario jumps," Tyson said. "There's no reason to think they're all-powerful just because they control everything we do." **And a simulated universe introduces another disturbing possibility… "What happens," Tyson said, "if there's a bug that crashes the entire program?"**
- Clara Moskow

Echoes of Genesis

Yet, there's a familiar ring to the idea that there's a simulator, or creator, who does care about us. Similarly, the idea of a superior being forging a simulated universe parallels the notion of a deity creating the world — for example, as described in the Book of Genesis.

Some thinkers, including Terrile, welcome the analogy to religion. If the simulation hypothesis is correct, he says, then "there's a creator, an architect — someone who designed the world." It's an ancient idea recast in terms of "mathematics & science rather than just faith."

But for other scholars, including University of Maryland physicist Sylvester James Gates, the similarity between the simulation hypothesis and religious belief should be taken as a warning that we're off track. Science, as he said in a recent radio interview, has taken us "away from this idea that we are puppets" controlled by an unseen entity. The simulation hypothesis, he said, "starts to look like a religion," with a programmer substituting for god.

"Just as you can simulate anything else, you can simulate brains," Bostrom says. True, we don't yet have the technology to pull it off, but he says there's no conceptual barrier to it. And once we create brain simulations "sufficiently detailed and accurate," he says, "it **is possible those simulations would generate conscious experiences.**" – *Dan Falk*

???


Higher Law & Highest Order Of Love:
Generative & Co-Creative
• The Three Things Modern Science Cannot Explain:
• 1st – Unified Field Theory Or An "Everything Explanation" That Applies In Its Isolation The Scientific Method Only.
• 2nd – Utilizing Quantum Physics Exclusively: The Lowest Common Denominator Of Matter Or Energy - That Glue That Holds The "Multiverse" Together – That "Thing" – Object Of Force Or Piece Of Information - That "Power Unit" Or "Data Byte" – That "It" Or "Bit" – Identification Of That Which Sustains Physical Reality From Moment-To-Moment
• 3rd – The Original Source Of Our Human Consciousness & The Increasing Evidence Of Its Afterlife Continuance.
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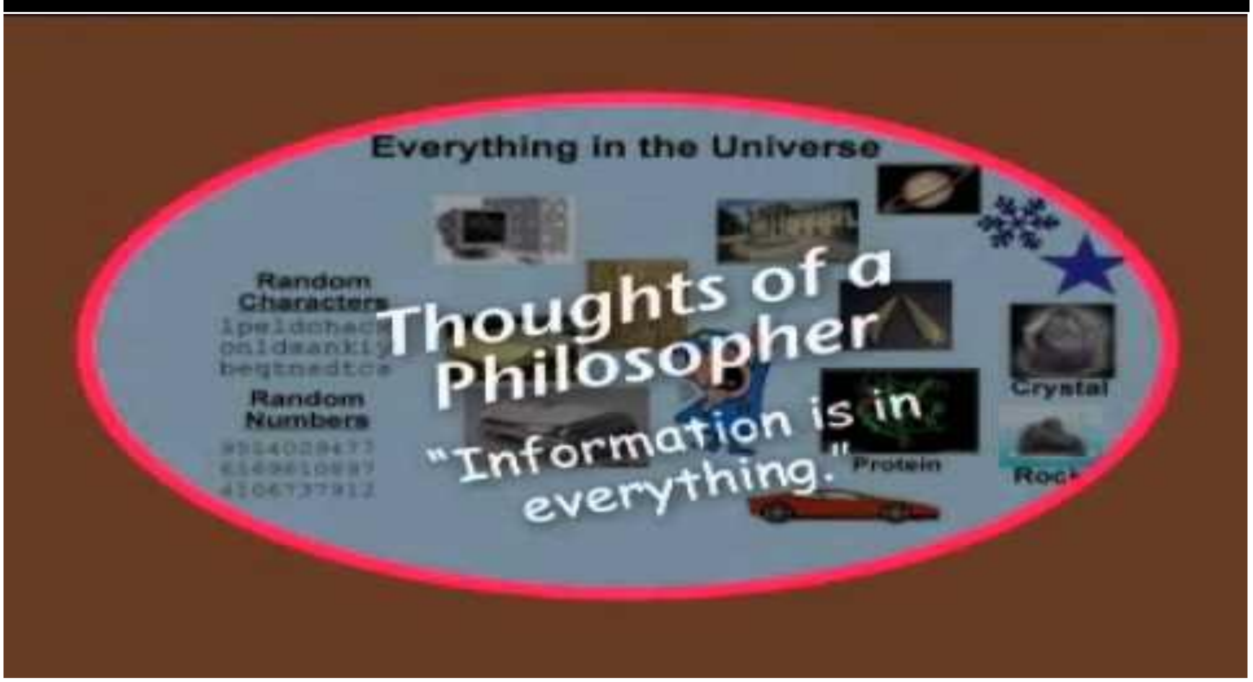
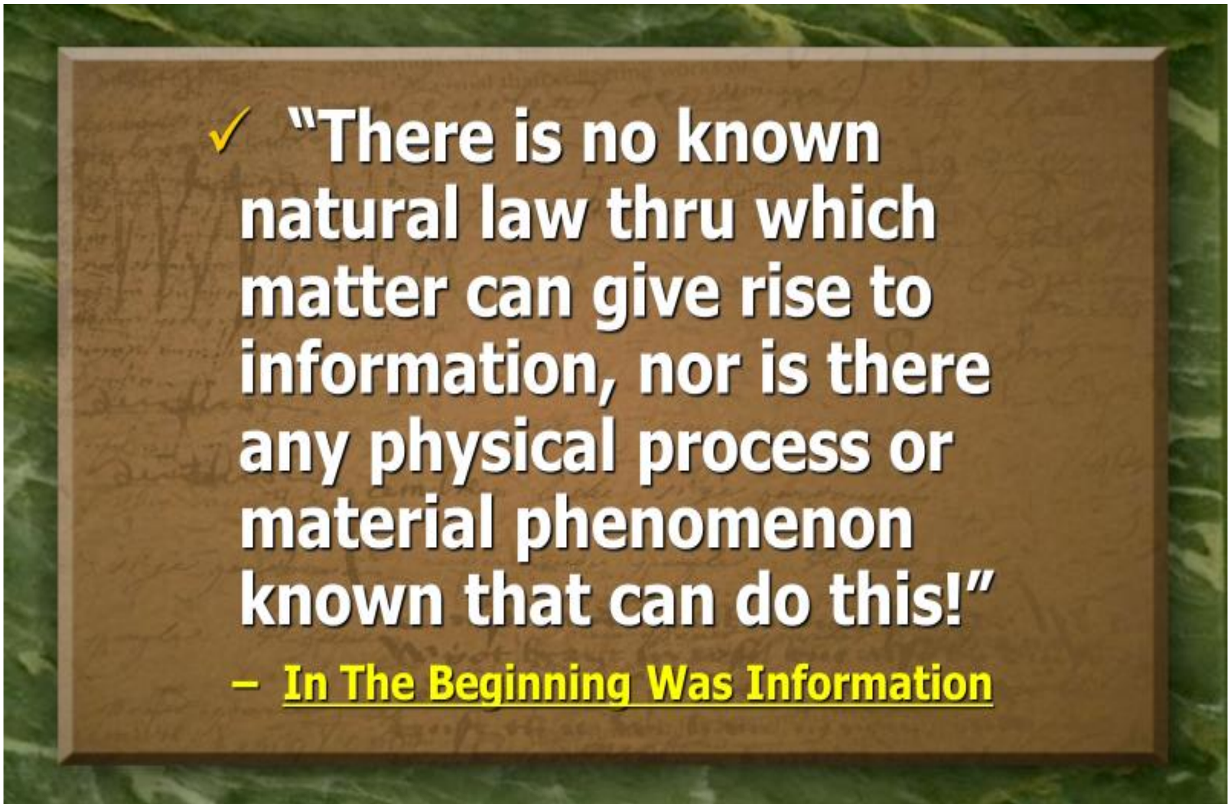
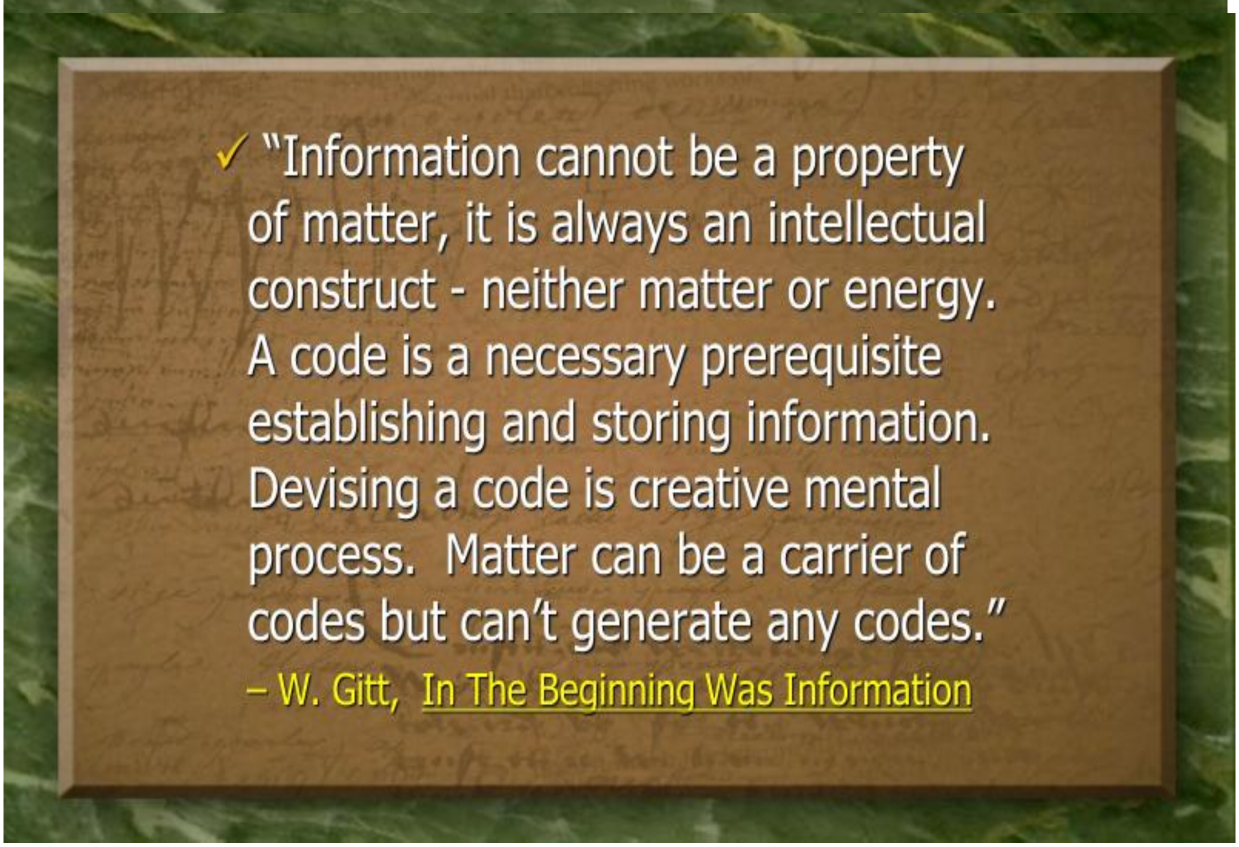
"It From Bit" Evidences God!

"In the Beginning Was Information!"



	human	mouse	chicken	fish	frog	fly	plant	yeast	worm
human									
mouse	91								
chicken	87	92							
fish	84	87	89						
frog	82	85	87	95					
fly	76	79	81	85	90				
plant	62	68	71	73	76	83			
yeast	61	63	68	70	72	75	84		
worm	56	58	60	63	69	71	72	76	


✓ "There is no known natural law thru which matter can give rise to information, nor is there any physical process or material phenomenon known that can do this!"
– In The Beginning Was Information


✓ "Information cannot be a property of matter, it is always an intellectual construct - neither matter or energy. A code is a necessary prerequisite establishing and storing information. Devising a code is creative mental process. Matter can be a carrier of codes but can't generate any codes."
– W. Gitt, In The Beginning Was Information

The Origin of Biological Information

Chaos

does not

give rise to order

Noise

does not

give rise to information

The Origin of Biological Information

Letters
(nucleotides)
Words
(codons - amino acids)
Sentences
(genes - protein)
Book
(chromosome)
Library
(genome)

The Third Crisis:
The Origin of Biological Information

"The reason that there are principles of biology that cannot be deduced from the laws of physics and of chemistry lies . . . in the mathematical fact that the genetic information content of the genome for constructing the simplest organisms is much larger than the information content of these laws."

H. Yockey *Information Theory and Molecular Biology,* 1992, p. 335

Information Is a Fundamental Entity

by Dr. Werner Gitt on March 12, 2009

Many scientists therefore justly regard information as the third fundamental entity alongside matter and energy.

3.1 Information: A Fundamental Quantity

The trail-blazing discoveries about the nature of energy in the 19th century caused the first technological revolution, when manual labor was replaced on a large scale by technological appliances—machines which could convert energy. In the same way, knowledge concerning the nature of information in our time initiated the second technological revolution where mental "labor" is saved through the use of technological appliances—namely, data processing machines. The concept "information" is not only of prime importance for informatics theories and communication techniques, but it is a fundamental quantity in such wide-ranging sciences as cybernetics, linguistics, biology, history, and theology. Many scientists, therefore, justly regard information as the third fundamental entity alongside matter and energy.

Claude E. Shannon was the first researcher who tried to define information mathematically. The theory based on his findings had the advantages that different methods of communication could be compared and that their performance could be evaluated. In addition, the introduction of the bit as a unit of information made it possible to describe the storage requirements of information quantitatively. The main disadvantage of Shannon's definition of information is that the actual contents and impact of messages were not investigated. Shannon's theory of information, which describes information from a statistical viewpoint only, is discussed fully in the appendix (chapter A1).

The true nature of information will be discussed in detail in the following chapters, and statements will be made about information and the laws of nature. After a thorough analysis of the information concept, it will be shown that the fundamental theorems can be applied to all technological and biological systems and also to all communication systems, including such diverse forms as the gyrations of bees and the message of the Bible. There is only one prerequisite—namely, that the information must be in coded form.

Since the concept of information is so complex that it cannot be defined in one statement (see Figure 12), we will proceed as follows: We will formulate various special theorems which will gradually reveal more information about the “nature” of information, until we eventually arrive at a precise definition (compare chapter 5). Any repetitions found in the contents of some theorems (redundance) is intentional, and the possibility of having various different formulations according to theorem N8 (paragraph 2.3), is also employed.

3.2 Information: A Material or a Mental Quantity

We have indicated that Shannon’s definition of information encompasses only a very minor aspect of information. Several authors have repeatedly pointed out this defect, as the following quotations show:

> Karl Steinbuch, a German information scientist [S11]: “The classical theory of information can be compared to the statement that one kilogram of gold has the same value as one kilogram of sand.”
>
> Warren Weaver, an American information scientist [S7]: “Two messages, one of which is heavily loaded with meaning and the other which is pure nonsense, can be exactly equivalent . . . as regards information.”
>
> Ernst von Weizsäcker [W3]: “The reason for the ‘uselessness’ of Shannon’s theory in the different sciences is frankly that no science can limit itself to its syntactic level.”[1]

The essential aspect of each and every piece of information is its mental content, and not the number of letters used. If one disregards the contents, then Jean Cocteau’s facetious remark is relevant: “The greatest literary work of art is basically nothing but a scrambled alphabet.”

At this stage we want to point out a fundamental fallacy that has already caused many misunderstandings and has led to seriously erroneous conclusions, namely the assumption that information is a material phenomenon. The philosophy of materialism is fundamentally predisposed to relegate information to the material domain, as is apparent from philosophical articles emanating from the former DDR (East Germany) [S8 for example]. Even so, the former East German scientist J. Peil [P2] writes: “Even the biology based on a materialistic philosophy, which discarded all vitalistic and metaphysical components, did not readily accept the reduction of biology to physics. . . . Information is neither a physical nor a chemical principle like energy and matter, even though the latter are required as carriers.”

Also, according to a frequently quoted statement by the American mathematician Norbert Wiener (1894–1964) information cannot be a physical entity [W5]: “Information is information, neither matter nor energy. Any materialism which disregards this, will not survive one day.”

Werner Strombach, a German information scientist of Dortmund [S12], emphasizes the nonmaterial nature of information by defining it as an “enfolding of order at the level of contemplative cognition.”

The German biologist G. Osche [O3] sketches the unsuitability of Shannon's theory from a biological viewpoint, and also emphasizes the nonmaterial nature of information: "While matter and energy are the concerns of physics, the description of biological phenomena typically involves information in a functional capacity. In cybernetics, the general information concept quantitatively expresses the information content of a given set of symbols by employing the probability distribution of all possible permutations of the symbols. But the information content of biological systems (genetic information) is concerned with its 'value' and its 'functional meaning,' and thus with the semantic aspect of information, with its quality."

Hans-Joachim Flechtner, a German cyberneticist, referred to the fact that information is of a mental nature, both because of its contents and because of the encoding process. This aspect is, however, frequently underrated [F3]: "When a message is composed, it involves the coding of its mental content, but the message itself is not concerned about whether the contents are important or unimportant, valuable, useful, or meaningless. Only the recipient can evaluate the message after decoding it."

3.3 Information: Not a Property of Matter!

It should now be clear that information, being a fundamental entity, cannot be a property of matter, and its origin cannot be explained in terms of material processes. We therefore formulate the following fundamental theorem:

Theorem 1: The fundamental quantity information is a non-material (mental) entity. It is not a property of matter, so that purely material processes are fundamentally precluded as sources of information.

Figure 8 illustrates the known fundamental entities—mass, energy, and information. Mass and energy are undoubtedly of a material-physical nature, and for both of them important conservation laws play a significant role in physics and chemistry and in all derived applied sciences. Mass and energy are linked by means of Einstein's equivalence formula, $E = m \times c^2$. In the left part of Figure 8, some of the many chemical and physical properties of matter in all its forms are illustrated, together with the defined units. The right hand part of Figure 8 illustrates nonmaterial properties and quantities, where information, *I*, belongs.
What is the causative factor for the existence of information? What prompts us to write a letter, a postcard, a note of felicitation, a diary, or a comment in a file? The most important prerequisite is our own volition, or that of a supervisor. In analogy to the material side, we now introduce a fourth fundamental entity, namely "will" (volition), *W*. Information and volition are closely linked, but this relationship cannot be expressed in a formula because both are of a nonmaterial (mental, intellectual, spiritual) nature. The connecting arrows indicate the following:

Information is always based on the will of a sender who issues the information. It is a variable quantity depending on intentional conditions. Will itself is also not constant, but can in its turn be influenced by the information received from another sender.

Conclusion:
Theorem 2: Information only arises through an intentional, volitional act.

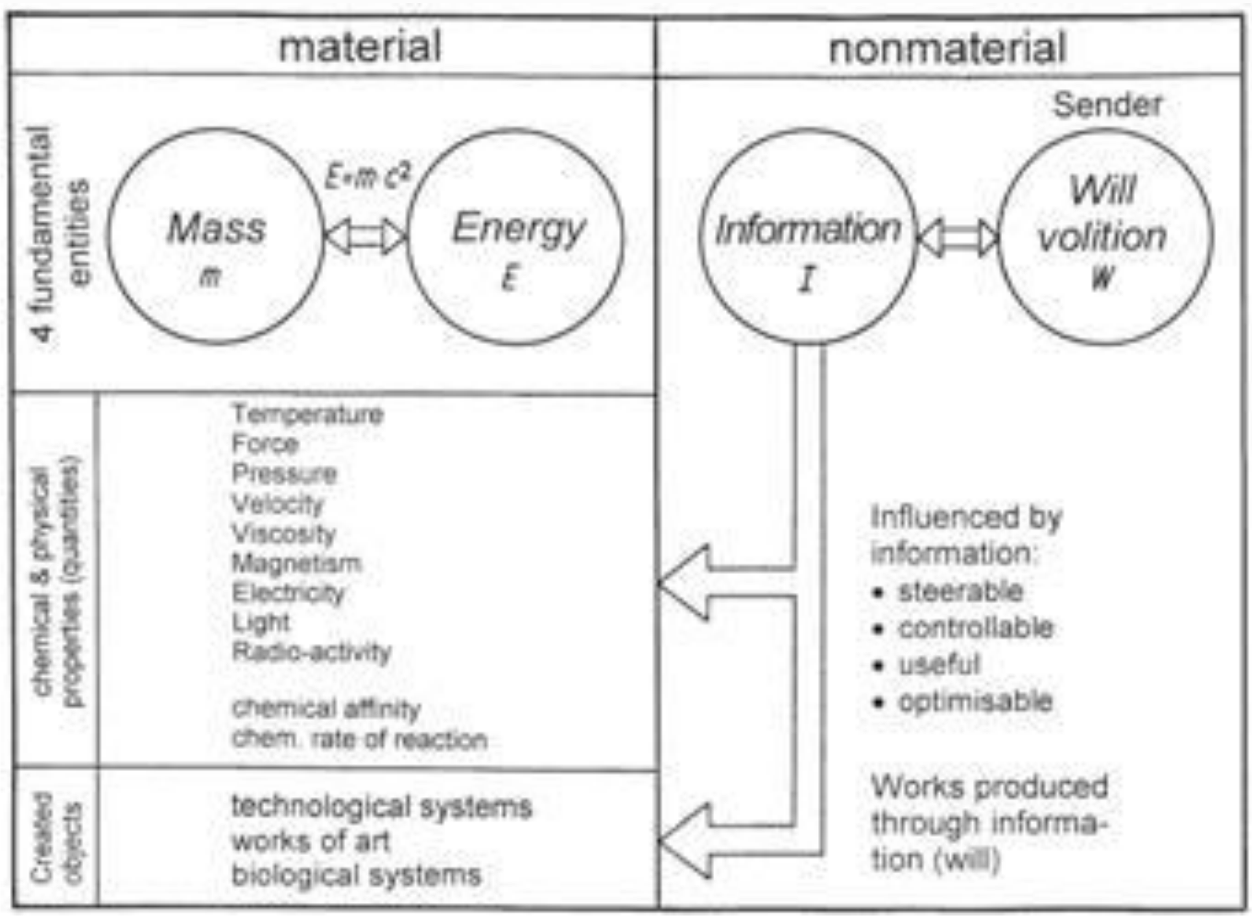


Figure 8: The four fundamental entities are mass and energy (material) and information and will (nonmaterial). Mass and energy comprise the fundamental quantities of the physical world; they are linked through the well-known Einstein equation, E = m x c². On the nonmaterial side we also have two fundamental entities, namely information and volition, which are closely linked. Information can be stored in physical media and used to steer, control, and optimize material processes. All created systems originate through information. A creative source of information is always linked to the volitional intent of a person; this fact demonstrates the nonmaterial nature of information.

It is clear from Figure 8 that the nonmaterial entity information can influence the material quantities. Electrical, mechanical, or chemical quantities can be steered, controlled, utilized, or optimized by means of intentional information. The strategy for achieving such control is always based on information, whether it is a cybernetic manufacturing technique, instructions for building an economical car, or the utilization of electricity for driving a machine. In the first place, there must be the intention to solve a problem, followed by a conceptual construct for which the information may be coded in the form of a program, a technical drawing, or a description, etc. The next step is then to implement the concept. All technological systems as well as all constructed objects, from pins to works of art, have been produced by means of information. None of these artifacts came into existence through some form of self-organization of matter, but all of them were preceded by establishing the required information. We can now conclude that information was present in the beginning, as the title of this book states.

Theorem 3: Information comprises the nonmaterial foundation for all technological systems and for all works of art.

What is the position in regard to biological systems? Does theorem 3 also hold for such systems, or is there some restriction? If we could successfully formulate the theorems in such a way that they are valid as laws of nature, then they would be universally valid according to the essential characteristics of the laws of nature, N2, N3, and N4.

The Five Levels of the Information Concept

by Dr. Werner Gitt on March 19, 2009

The question is whether these pictures represent information or not.

Figure 9: Egyptian hieroglyphics.

Figure 9 is a picture of icons cut in stone as they appear in the graves of pharaohs and on obelisks of ancient Egypt. The question is whether these pictures represent information or not. So, let us check them against the three necessary conditions (NC) for identifying information (discussed in more detail in paragraph 4.2):

NC 1: A number of symbols are required to establish information. This first condition is satisfied because we have various different symbols like an owl, water waves, a mouth, reeds, etc.

NC 2: The sequence of the symbols must be irregular. This condition is also satisfied, as there are no regularities or periodic patterns.

NC 3: The symbols must be written in some recognizable order, such as drawn, printed, chiseled, or engraved in rows, columns, circles, or spirals. In this example, the symbols appear in columns.

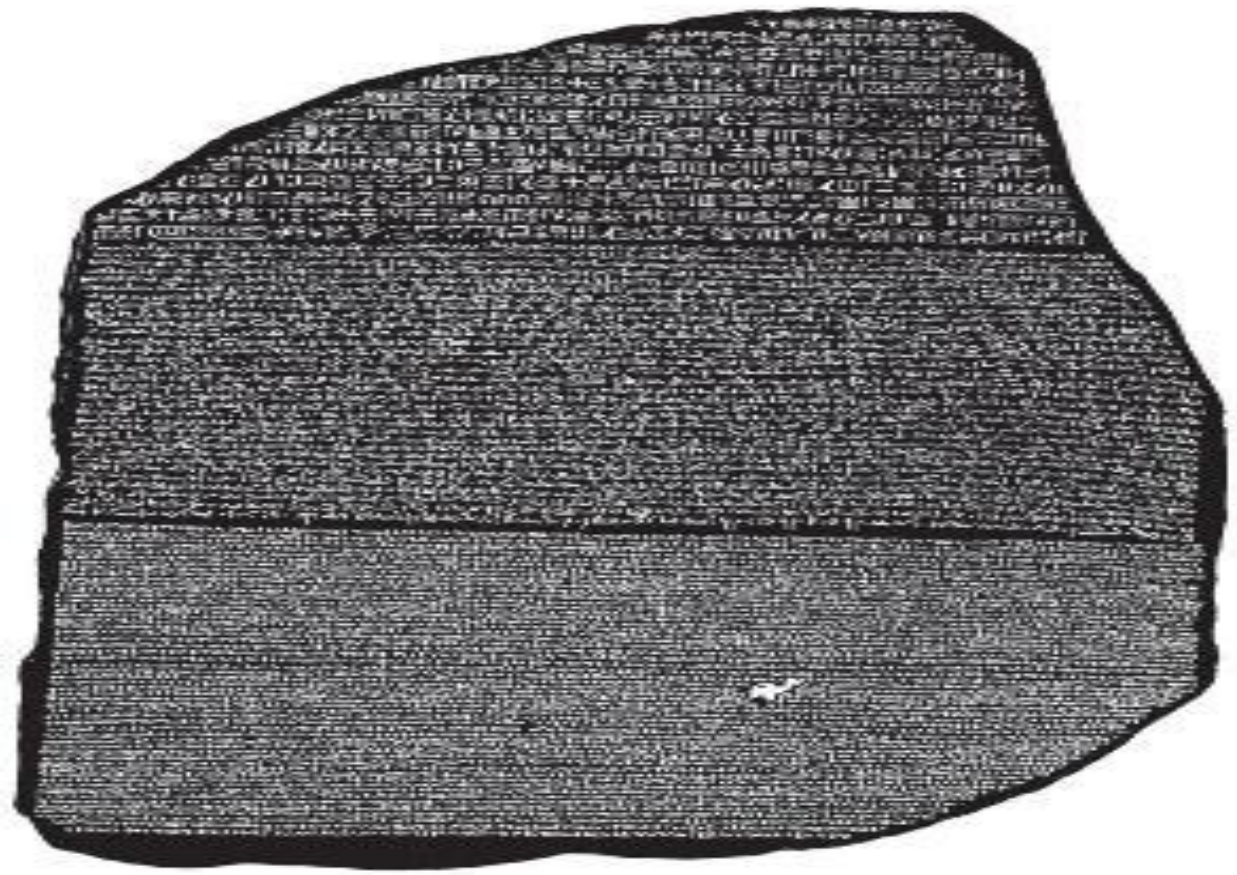


Figure 10: The Rosetta Stone.

It now seems possible that the given sequence of symbols might comprise information because all three conditions are met, but it could also be possible that the Egyptians simply loved to decorate their monuments. They could have decorated their walls with hieroglyphics,[1] just like we often hang carpets on walls. The true nature of these symbols remained a secret for 15 centuries because nobody could assign meanings to them. This situation changed when one of Napoleon's men discovered a piece of black basalt near the town of Rosetta on the Nile in July 1799. This flat stone was the size of an ordinary dinner plate and it was exceptional because it contained inscriptions in three languages: 54 lines of Greek, 32 lines of Demotic, and 14 lines of hieroglyphics. The total of 1,419 hieroglyphic symbols includes 166 different ones, and there are 468 Greek words. This stone, known as the Rosetta Stone (Figure 10), is now in the possession of the British Museum in London. It played a key role in the deciphering of hieroglyphics, and its first success was the translation of an Egyptian pictorial text in 1822.[2]

Because the meaning of the entire text was found, it was established that the hieroglyphics really represented information. Today, the meanings of the hieroglyphic symbols are known, and anybody who knows this script is able to translate ancient Egyptian texts. Since the meaning of the codes is known, it is now possible to transcribe English text into hieroglyphics, as is shown in Figure 11, where the corresponding symbols have been produced by means of a computer/plotter system.

Figure 11: A computer printout of some proverbs (in German) translated into hieroglyphics. Translation of the German text: It is better to receive one helping from God, than 5,000 dishonestly. Do not speak evil, then you will be loved by everybody. Take care that you do not rob a distressed person, nor do violence to somebody in poor health.

This illustrative example has now clarified some basic principles about the nature of information. Further details follow.

4.1 The Lowest Level of Information: Statistics

When considering a book B, a computer program C, or the human genome (the totality of genes), we first discuss the following questions:

–How many letters, numbers, and words make up the entire text?

–How many single letters does the employed alphabet contain (e. g. a, b, c . . . z, or G, C, A, T)?

–How frequently do certain letters and words occur?

To answer these questions, it is immaterial whether we are dealing with actual meaningful text, with pure nonsense, or with random sequences of symbols or words. Such investigations are not concerned with the contents, but only with statistical aspects. These topics all belong to the first and lowest level of information, namely the level of statistics.

As explained fully in appendix A1, Shannon's theory of information is suitable for describing the statistical aspects of information, e.g., those quantitative properties of languages which depend on frequencies. Nothing can be said about the meaningfulness or not of any given sequence of symbols. The question of grammatical correctness is also completely excluded at this level.

Conclusions:

Definition 1: According to Shannon's theory, any random sequence of symbols is regarded as information, without regard to its origin or whether it is meaningful or not.

Definition 2: The statistical information content of a sequence of symbols is a quantitative concept, measured in bits (binary digits).

According to Shannon's definition, the information content of a single message (which could be one symbol, one sign, one syllable, or a single word) is a measure of the probability of its being received correctly. Probabilities range from 0 to 1, so that this measure is always positive. The information content of a number of messages (signs for example) is found by adding the individual probabilities as required by the condition of summability. An important property of information according to Shannon is:

Theorem 4: A message which has been subject to interference or "noise," in general comprises more information than an error-free message.

This theorem follows from the larger number of possible alternatives in a distorted message, and Shannon states that the information content of a message increases with the number of symbols (see equation 6 in appendix A1). It is obvious that the actual information content cannot at all be described in such terms, as should be clear from the following example: When somebody uses many words to say practically nothing, this message is accorded a large information content because of the large number of letters used. If somebody else, who is really knowledgeable, concisely expresses the essentials, his message has a much lower information content.

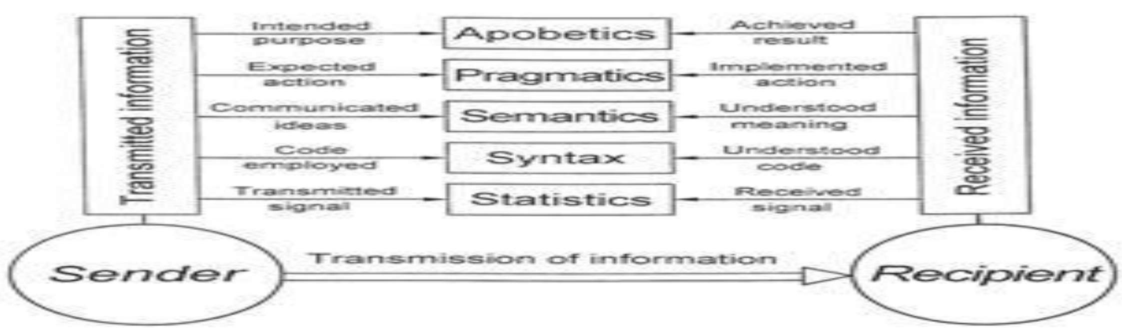


Figure 12: The five aspects of information. A complete characterization of the information concept requires all five aspects—statistics, syntax, semantics, pragmatics, and apobetics, which are essential for both the sender and the recipient. Information originates as a language; it is first formulated, and then transmitted or stored. An agreed-upon alphabet comprising individual symbols (code), is used to compose words. Then the (meaningful) words are arranged in sentences according to the rules of the relevant grammar (syntax), to convey the intended meaning (semantics). It is obvious that the information concept also includes the expected/implemented action (pragmatics), and the intended/achieved purpose (apobetics).

Some quotations concerning this aspect of information are as follows: French President Charles De Gaulle (1890–1970), "The Ten Commandments are so concise and plainly intelligible because they were compiled without first having a commission of inquiry." Another philosopher said, "There are about 35 million laws on earth to validate the ten commandments." A certain representative in the American Congress concluded, "The Lord's Prayer consists of 56 words, and the Ten Commandments contain 297 words. The Declaration of Independence contains 300 words, but the recently published ordinance about the price of coal comprises no fewer than 26,911 words."

Theorem 5: Shannon's definition of information exclusively concerns the statistical properties of sequences of symbols; meaning is completely ignored.

It follows that this concept of information is unsuitable for evaluating the information content of meaningful sequences of symbols. We now realize that an appreciable extension of Shannon's information theory is required to significantly evaluate information and information processing in both living and inanimate systems. The concept of information and the five levels required for a complete description are illustrated in Figure 12. This diagram can be regarded as a nonverbal description of information. In the following greatly extended description and definition, where real information is concerned, Shannon's theory is only useful for describing the statistical level (see chapter 5).

4.2 The Second Level of Information: Syntax

When considering the book B mentioned earlier, it is obvious that the letters do not appear in random sequences. Combinations like "the," "car," "father," etc. occur frequently, but we do not find other possible combinations like "xcy," "bkaln," or "dwust." In other words:

Only certain combinations of letters are allowed (agreed-upon) English words. Other conceivable combinations do not belong to the language. It is also not a random process when words are arranged in sentences; the rules of grammar must be adhered to.

Both the construction of words and the arrangement of words in sentences to form information-bearing sequences of symbols, are subject to quite specific rules based on deliberate conventions for each and every language.[3]

Definition 3: Syntax is meant to include all structural properties of the process of setting up information. At this second level, we are only concerned with the actual sets of symbols (codes) and the rules governing the way they are assembled into sequences (grammar and vocabulary) independent of any meaning they may or may not have.

Note: It has become clear that this level consists of two parts, namely:

A) Code: Selection of the set of symbols used

B) The syntax proper: inter-relationships among the symbols

A) The Code: The System of Symbols Used for Setting Up Information

A set of symbols is required for the representation of information at the syntax level. Most written languages use letters, but a very wide range of conventions exists: Morse code, hieroglyphics, international flag codes, musical notes, various data processing codes, genetic codes, figures made by gyrating bees, pheromones (scents) released by insects, and hand signs used by deaf-mute persons.

Several questions are relevant: What code should be used? How many symbols are available? What criteria are used for constructing the code? What mode of transmission is suitable? How could we determine whether an unknown system is a code or not?

The number of symbols:

The number of different symbols q, employed by a coding system, can vary greatly, and depends strongly on the purpose and the application. In computer technology, only two switch positions are recognized, so that binary codes were created which are comprised of only two different symbols. Quaternary codes, comprised of four different symbols, are involved in all living organisms. The reason why four symbols represent an optimum in this case is discussed in chapter 6. The various alphabet systems used by different languages consist of from 20 to 35 letters, and this number of letters is sufficient for representing all the sounds of the language concerned. Chinese writing is not based on elementary sounds, but pictures are employed, every one of which represents a single word, so that the number of different symbols is very large. Some examples of coding systems with the required number of symbols are:

–Binary code (q = 2 symbols, all electronic DP codes)

–Ternary code (q = 3, not used)

–Quaternary code (q = 4, e.g., the genetic code consisting of four letters: A, C, G, T)

–Quinary code (q = 5)

–Octal code (q = 8 octal digits: 0, 1, 2, . . . , 7)

–Decimal code (q = 10 decimal digits: 0, 1, 2, . . . , 9)

–Hexadecimal code[4] (q = 16 HD digits: 0, 1, 2, . . . , E, F)

–Hebrew alphabet (q = 22 letters)

–Greek alphabet (q = 24 letters)

–Latin alphabet (q = 26 letters: A, B, C, . . . , X, Y, Z)

–Braille (q = 26 letters)

–International flag code (q = 26 different flags)

–Russian alphabet (q = 32 Cyrillic letters)

–Japanese Katakana writing (q = 50 symbols representing different syllables)

–Chinese writing (q > 50,000 symbols)

–Hieroglyphics (in the time of Ptolemy: q = 5,000 to 7,000; Middle Kingdom, 12th Dynasty: q = approximately 800)

Criteria for selecting a code:

Coding systems are not created arbitrarily, but they are optimized according to criteria depending on their use, as is shown in the following examples:

- Pictorial appeal (e.g., hieroglyphics and pictograms)
- Small number of symbols (e.g., Braille, cuneiform script, binary code, and genetic code)
- Speed of writing (e.g., shorthand)
- Ease of writing (e.g., cuneiform)
- Ease of sensing (e.g., Braille)
- Ease of transmission (e.g., Morse code)
- Technological legibility (e.g., universal product codes and postal bar codes)
- Ease of detecting errors (e.g., special error detecting codes)
- Ease of correcting errors (e.g., Hamming code and genetic code)
- Ease of visualizing tones (musical notes)
- Representation of the sounds of natural languages (alphabets)
- Redundance for counteracting interference errors (various computer codes and natural languages; written German has, for example, a redundancy of 66 %)
- Maximization of storage density (genetic code)

The choice of code depends on the mode of communication. If a certain mode of transmission has been adopted for technological reasons depending on some physical or chemical phenomenon or other, then the code must comply with the relevant requirements. In addition, the ideas of the sender and the recipient must be in tune with one another to guarantee certainty of transmission and reception (see Figures 14 and 15). The most complex setups of this kind are again found in living systems. Various existing types of special message systems are reviewed below: Acoustic transmission (conveyed by means of sounds):

–Natural spoken languages used by humans

–Mating and warning calls of animals (e.g., songs of birds and whales)

–Mechanical transducers (e.g., loudspeakers, sirens, and fog horns)

–Musical instruments (e.g., piano and violin)

Optical transmission (carried by light waves):

–Written languages

–Technical drawings (e.g., for constructing machines and buildings, and electrical circuit diagrams)

–Technical flashing signals (e.g., identifying flashes of lighthouses)

–Flashing signals produced by living organisms (e.g., fireflies and luminous fishes)

–Flag signals

–Punched cards, mark sensing

–Universal product code, postal bar codes

–hand movements, as used by deaf-mute persons, for example

–body language (e.g., mating dances and aggressive stances of animals)

–facial expressions and body movements (e.g., mime, gesticulation, and deaf-mute signs)

–dancing motions (bee gyrations)

Tactile transmission (Latin *tactilis* = sense of touch; signals: physical contact):

–Braille writing

–Musical rolls, barrel of barrel-organ

Magnetic transmission (carrier: magnetic field):

–magnetic tape

–magnetic disk

–magnetic card

Electrical transmission (carrier: electrical current or electromagnetic waves):

–telephone

–radio and TV

Chemical transmission (carrier: chemical compounds):

–genetic code (DNA, chromosomes)

–hormonal system

Olfactory transmission (Latin *olfacere* = smelling, employing the sense of smell; carrier: chemical compounds):

–scents emitted by gregarious insects (pheromones)

Electro-chemical transmission:

–nervous system

How can a code be recognized?

In the case of an unknown system, it is not always easy to decide whether one is dealing with a real code or not. The conditions required for a code are now mentioned and explained, after having initially discussed hieroglyphics as an example. The following are necessary conditions (NC), all three of which must be fulfilled simultaneously for a given set of symbols to be a code:

NC 1: A uniquely defined set of symbols is used.

NC 2: The sequence of the individual symbols must be irregular.

Examples: –.– – –.– * – – * * . – .. – (aperiodic) qrst werb ggtzut

Counter examples:

– – –...– – –...– – –...– – –... (periodic)

– – – – – – – – – – – – – – (the same symbol constantly repeated)

r r r r r r r r r r r r r r r r r r r

NC 3: The symbols appear in clearly distinguishable structures (e.g., rows, columns, blocks, or spirals).

In most cases a fourth condition is also required:

NC 4: At least some symbols must occur repeatedly.

It is difficult to construct meaningful sentences without using some letters more than once.[5] Such sentences are often rather grotesque, for example:

Get nymph; quiz sad brow; fix luck (i, u used twice, j, v omitted).

In a competition held by the Society for the German Language, long single words with no repetitions of letters were submitted. The winner, comprised of 24 letters, was: *Heizölrückstoßabdämpfung* (Note that *a* and *ä*, for example, are regarded as different letters because they represent different sounds.)
There is only one sufficient condition (SC) for establishing whether a given set of symbols is a code:

SC 1: It can be decoded successfully and meaningfully (e.g., hieroglyphics and the genetic code).

There are also sufficient conditions for showing that we are *not* dealing with a code system. A sequence of symbols cannot be a code, if:

- it can be explained fully on the level of physics and chemistry, i.e., when its origin is exclusively of a material nature. Example: The periodic signals received in 1967 by the British astronomers J. Bell and A. Hewish were thought to be coded messages from space sent by “little green men.” It was, however, eventually established that this “message” had a purely physical origin, and a new type of star was discovered: pulsars.

  or

- it is known to be a random sequence (e.g., when its origin is known or communicated). This conclusion also holds when the sequence randomly contains valid symbols from any other code.

Example 1: Randomly generated characters: AZTIG KFD MAUER DFK KLIXA WIFE TSAA. Although the German word *MAUER* and the word *WIFE* may be recognized, this is not a code according to our definition, because we know that it is a random sequence.
Example 2: In the Kornberg synthesis (1955) a DNA polymerazae resulted when an enzyme reacted with *Coli* bacteria. After a considerable time, two kinds of strings were found:

1. alternating strings:

   ... TATATATATATATATATATATATAT ...

   ... ATATATATATATATATATATATATA ...

2. homopolymere strings:

   ... GGGGGGGGGGGGGGGGGGGGGG ...

   ... CCCCCCCCCCCCCCCCCCCCCCCC ...

Although both types of strings together contained all the symbols employed in the genetic code, they were nevertheless devoid of information, since necessary condition (NC) 2 is not fulfilled.

The fundamentals of the “code” theme were already established by the author in the out-of-print book having the same name as the present one [G5, German title: *Am Anfang war die Information*]. A code always represents a mental concept and, according to our experience, its assigned meaning always depends on some convention. It is thus possible to determine at the code level already whether any given system originated from a creative mental concept or not.
We are now in a position to formulate some fundamental empirical theorems:[6]

Theorem 6: A code is an essential requirement for establishing information.

Theorem 7: The allocation of meanings to the set of available symbols is a mental process depending on convention.7

Theorem 8: If a code has been defined by a deliberate convention, it must be strictly adhered to afterward.

Theorem 9: If the information is to be understood, the particular code must be known to both the sender and the recipient.

Theorem 10: According to Theorem 6, only structures which are based on a code can represent information. This is a necessary but not sufficient condition for the establishment of information.

Theorem 11: A code system is always the result of a mental process (see footnote 8) (it requires an intelligent origin or inventor).

The expression "rejoice" appears in different languages and coding systems in Figure 13. This leads to another important empirical theorem:

Theorem 12: Any given piece of information can be represented by any selected code.

Comment: Theorem 12 does not state that a complete translation is always possible. It is an art to suitably translate and express metaphors, twists of logic, ambiguities, and special figurative styles into the required language.

It is possible to formulate fundamental principles of information even at the relatively low level of codes by means of the above theorems. If, for example, one finds a code underlying any given system, then one can conclude that the system had a mental origin. In the case of the hieroglyphics, nobody suggested that they were caused by a purely physical process like random mechanical effects, wind, or erosion; Theorem 11 is thus validated.

The following is a brief list of some properties common to all coding systems:

–A code is a necessary prerequisite for establishing and storing information.

–Every choice of code must be well thought out beforehand in the conceptual stage.

–Devising a code is a creative mental process.

–Matter can be a carrier of codes, but it cannot generate any codes.

B) The Actual Syntax

Definition 4: The actual syntax describes the construction of sentences and phrases, as well as the structural media required for their formation. The set of possible sentences of a language is defined by means of a formalized or formalizable assemblage of rules. This comprises the morphology, phonetics, and vocabulary of the language.

The following questions are relevant:

- Concerning the sender:

  –Which of the possible combinations of symbols are actual defined words of the language (lexicon and notation)?

  –How should the words be arranged (construction of the sentences, word placement, and stylistics), linked with one another, and be inflected to form a sentence (grammar)?

  –What language should be used for this information?

  –Which special modes of expression are used (stylistics, aesthetics, precision of expression, and formalisms)?

  –Are the sentences syntactically correct?

- Concerning the recipient:

  –Does the recipient understand the language? (Understanding the contents is not yet relevant.)

The following two sample sentences illustrate the syntax level once again:

- The bird singed the song.
- The green freedom prosecuted the cerebrating house.

Sentence B is perfectly correct syntactically, but it is semantically meaningless. In contrast, the semantics of sentence A is acceptable, but its syntax is erroneous.

By the syntax of a language is meant all the rules which describe how individual language elements could and should be combined. The syntax of natural languages is much more complex (see appendix A2) than that of formal artificial languages. The syntactic rules of an artificial language must be complete and unambiguous because, for example, a compiler program which translates written programs into computer code cannot call the programmer to clarify semantic issues.

Knowledge of the conventions applying to the actual encoding as well as to the allocation of meanings is equally essential for both the sender and the recipient. This knowledge is either transferred directly (e.g., by being introduced into a computer system or by being inherited in the case of natural systems), or it must be learned from scratch (e.g., mother tongue or any other natural language).

No person enters this world with the inherited knowledge of some language or some conceptual system. Knowledge of a language is acquired by learning the applicable vocabulary and grammar as they have been established in the conventions of the language concerned.

4.3 The Third Level of Information: Semantics

When we read the previously mentioned book B, we are not interested in statistics about the letters, neither are we concerned with the actual grammar, but we are interested in the meaning of the contents. Symbol sequences and syntactic rules are essential for the representation of information, but the essential characteristic of the conveyed information is not the selected code, neither is it the size, number, or form of the letters, or the method of transmission (in writing, or as optical, acoustic, electrical, tactile or olfactory signals), but it is the message being conveyed, the conclusions, and the meanings (semantics). This central aspect of information plays no role in storage and transmission, since the cost of a telegram, for example, does not depend on the importance of the message, but only on the number of letters or words. Both the sender and the recipient are mainly interested in the meaning; it is the meaning that changes a sequence of symbols into information. So, now we have arrived at the third level of information, the semantic level (Greek *semantikós* = characteristic, significance, aspect of meaning).
Typical semantic questions are:

a) Concerning the sender:

–What are the thoughts in the sender's mind?

–What meaning is contained in the information being formulated?

–What information is implied in addition to the explicit information?

–What means are employed for conveying the information (metaphors, idioms, or parables)?

b) Concerning the recipient:

–Does the recipient understand the information?

–What background information is required for understanding the transmitted information?

–Is the message true or false?

–Is the message meaningful?

Theorem 13: Any piece of information has been transmitted by somebody and is meant for somebody. A sender and a recipient are always involved whenever and wherever information is concerned.

Comment: Many kinds of information are directed to one single recipient (like a letter) and others are aimed at very many recipients (e.g., a book, or newspaper). In exceptional cases, the information never reaches the recipient (e.g., a letter lost in the mail).

It is only at the semantic level that we really have meaningful information; thus, we may establish the following theorem:

Theorem 14: Any entity, to be accepted as information, must entail semantics; it must be meaningful.

Semantics is an essential aspect of information because the meaning is the only invariant property. The statistical and syntactical properties can be altered appreciably when information is represented in another language (e.g., translated into Chinese), but the meaning does not change.

Meanings always represent mental concepts; therefore, we have:

Theorem 15: When its progress along the chain of transmission events is traced backward, every piece of information leads to a mental source, the mind of the sender.

Sequences of letters generated by various kinds of statistical processes are shown in Figure 38 (appendix A1.5). The programs used for this purpose were partially able to reproduce some of the syntactic properties of the language, but in the light of Theorems 16 and 17 these sequences of letters do not represent information. The next theorem enables one to distinguish between information and noninformation:

Theorem 16: If a chain of symbols comprises only a statistical sequence of characters, it does not represent information.

Information is essentially linked to a sender (a mental source of information) according to Theorems 13 and 15. This result is independent of whether the recipient understands the information or not. When researchers studied Egyptian obelisks, the symbols were seen as information long before they were deciphered because it was obvious that they could not have resulted from random processes. The meaning of the hieroglyphics could not be understood by any contemporaries (recipients) before the Rosetta Stone was found in 1799, but even so, it was regarded as information. The same holds for the gyrations of bees which were only understood by humans after being deciphered by Karl von Frisch. In contrast, the genetic code is still mostly unknown, except for the code allocations between the triplets and the amino acids.

All suitable ways of expressing meanings (mental substrates, thoughts, or nonmaterial contents of consciousness) are called languages. Information can be transmitted or stored in material media only when a language is available. The information itself is totally invariant in regard to the transmission system (acoustic, optical, or electrical) as well as the system of storage (brain, book, data processing system, or magnetic tape). This invariance is the result of its nonmaterial nature.

There are different kinds of languages:

- Natural languages used for communication: at present there are approximately 5,100 living languages on earth.
- Artificial communication languages and languages used for signaling: Esperanto, deaf-mute languages, flag codes, and traffic signs.
- Formal artificial languages: logical and mathematical calculi, chemical symbols, musical notation, algorithmic languages, programming languages like Ada, Algol, APL, BASIC, C, C++, Fortran, Pascal, and PL/1.
- Special technical languages: building and construction plans, block diagrams, diagrams depicting the structure of chemical compounds, and electrical, hydraulic, and pneumatic circuit diagrams.
- Special languages found in living organisms: genetic languages, bee gyrations, pheromonal languages of various insects, hormonal languages, signaling systems in the webs of spiders, the language of dolphins, and instincts (e.g., the migration routes of birds, salmon, and eels). As is explained in appendix A2, the latter examples should rather be regarded as communication systems.

A common property of all languages is that defined sets of symbols are used, and that definite agreed-upon rules and meanings are allocated to the single signs or language elements. Every language consists of units like morphemes, lexemes, expressions, and entire sentences (in natural languages) that serve as carriers of meaning (formatives). Meanings are internally assigned to the formatives of a language, and both the sender and the recipient should be in accord about these meanings. The following can be employed for encoding meanings in natural languages: morphology, syntax (grammar and stylistics), phonetics, intonation, and gesticulation, as well as numerous other supplementary aids like homonyms, homophones, metaphors, synonyms, polysemes, antonyms, paraphrasing, anomalies, metonymy, irony, etc.

Every communication process between sender and recipient consists of formulating and understanding the sememes (Greek *sema* = sign) in one and the same language. In the formulation process, the information to be transmitted is generated in a suitable language in the mind of the sender. In the comprehension process, the symbol combinations are analyzed by the recipient and converted into the corresponding ideas. It is universally accepted that the sender and the recipient are both intelligent beings, or that a particular system must have been created by an intelligent being (Figures 23 and 24, chapter 7).

4.4 The Fourth Level of Information: Pragmatics

Let us again consider book B mentioned initially to help us understand the nature of the next level. There is a Russian saying that "The effect of words can last one hour, but a book serves as a perpetual reminder." Books can have lasting effects. After one has read a software manual, for example, one can use the described system. Many people who read the Bible are moved to act in entirely new ways. In this regard, Blaise Pascal said, "There are enough passages in Scripture to comfort people in all spheres of life, and there are enough passages that can horrify them." Information always leads to some action, although, for our purposes, it is immaterial whether the recipient acts according to the sender's wishes, responds negatively, or ignores it. It often happens that even a concise but striking promotional slogan for a washing powder can result in a preference for that brand.

Up to the semantic level, the purpose the sender has with the transmitted information is not considered. Every transmission of information indicates that the sender has some purpose in mind for the recipient. In order to achieve the intended result, the sender describes the actions required of the recipient to bring him to implement the desired purpose. We have now reached an entirely new level of information, called pragmatics (Greek *pragmatike* = the art of doing the right thing; taking action).

Some examples of pragmatic aspects are:[8]

- Concerning the sender:

  –What actions are desired of the recipient?

  –Has a specific action been formulated explicitly, or should it be implicit?

  –Is the action required by the sender to be taken in only one predetermined way, or is there some degree of freedom?

- Concerning the recipient:

  –To what extent does the received and understood meaning influence the behavior of the recipient?

  –What is the actual response of the recipient?

Theorem 17: Information always entails a pragmatic aspect.

The pragmatic aspect could:

–be unnegotiable and unambiguous without any degree of freedom, e.g., a computer program, activities in a cell, or a military command;

–allow a limited freedom of choice, like instinctive acts of animals;

–allow considerable freedom of action (only in the case of human beings).

Note: Even if there is considerable variation in the pragmatics resulting from the semantics, it does not detract anything from the validity of Theorem 17.

When language is used, it does not simply mean that sentences are jumbled together, but that requests, complaints, questions, instructions, teachings, warnings, threats, and commands are formulated to coerce the recipient to take some action. Information was defined by Werner Strombach [S12] as a structure which achieves some result in a receiving system. He thus referred to the important aspect of taking action.

We can distinguish two types of action:

- Fixed:

  –programmed actions (e.g., mechanical manufacturing processes, the operation of data processing programs, construction of biological cells, respiration, blood circulation, and the functioning of organs)

  –instinctive acts (behavior of animals)

  –trained actions (e.g., police dogs, and circus performances involving lions, elephants, horses, bears, tigers, dogs, seals, dolphins, etc.)

- Flexible and creative:

  –learned activities like social manners and manual skills

  –sensible actions (humans)

  –intuitive actions (humans)

  –intelligent actions based on free will (humans)

All the activities of the recipient can depend on information that has previously been conceptualized by the sender for the intended purpose. On the other hand, intelligent actions that do not derive from a sender are also possible.

A relevant theorem is the following:

Theorem 18: Information is able to cause the recipient to take some action (stimulate, initialize, or implement). This reactive functioning of information is valid for both inanimate systems (e.g., computers or an automatic car wash) as well as living organisms (e.g., activities in cells, actions of animals, and activities of human beings).

4.5 The Fifth Level of Information: Apobetics

We consider book B for the last time to illustrate one further level of information. Goethe once said, "Certain books seem to have been written not so much to enable one to learn something, but to show that the author knew something." This reason for writing a book, which is of course not worth emulating, does, however, express something of fundamental importance: The sender has some purpose for the recipient. The purpose of a promotional slogan is that the manufacturing firm can have a good turnover for the year. In the New Testament, John mentions a completely different purpose for his information: “I write these things to you who believe in the name of the Son of God so that you may know that you have eternal life” (*1 John 5:13*). We conclude that some purpose is pursued whenever information is involved.

We now realize that any piece of information has a purpose, and have come to the last and highest level of information, namely apobetics (the teleological aspect, the question of the purpose; derived from the Greek *apobeinon* = result, success, conclusion). The term “apobetics” was introduced by the author in 1981 [G4] to conform to the titles of the other four levels. For every result on the side of the recipient there is a corresponding conceptual purpose, plan, or representation in the mind of the sender. The teleological aspect of information is the most important, because it concerns the premeditated purpose of the sender. Any piece of information involves the question: “Why does the sender communicate this information, and what result does he want to achieve for or in the recipient?” The following examples should elucidate this aspect:

–The male bird calls a mate by means of his song, or he establishes his territory.

–Computer programs are written with a purpose (e.g., solution of a set of equations, inversion of matrices, or to manipulate some system).

–The manufacturer of chocolate A uses a promotional slogan to urge the recipient to buy his brand.

–The Creator gave gregarious insects a pheromonal language for the purpose of communication, for example to identify intruders or indicate the location of a new source of food.

–Man was gifted with a natural language; this can be used for communicating with other people, and to formulate purposes.

–God gives us a purpose in life through the Bible; this is discussed more fully in Part 3 of this book.

Examples of questions concerning apobetics, are:

- Concerning the sender:

  –Has an unambiguous purpose been defined?

  –What purpose is intended for the recipient?

  –Can this purpose be recognized directly, or could it only be deduced indirectly?

- Concerning the recipient:

  –What purpose is achieved through the actions of the recipient?

  –Does the result obtained in the recipient correspond to the purpose which the sender had in mind?

  –Did the recipient find a purpose which the sender had not intended (e.g., the evaluation of historical documents could serve a purpose which was never thought of by the author)?

The sender's intention can be achieved in various ways by the recipient:

–completely (doing exactly what the sender requested)

–partly

–not at all

–doing exactly the opposite

The response to an unambiguously formulated purpose (e.g., computer program, commands given personally, or promotional material) could be any one of these different actions. The purpose could, however, not even be mentioned, or could not have been imagined by the sender (e.g., documents with trivial contents surviving from previous centuries which provide researchers with important clues not intended by the original author).

In this case also we can formulate significant empirical theorems:

Theorem 19: Every piece of information is intentional (the teleological aspect).[9]

Theorem 20: The teleological aspect of information is the most important level, since it comprises the intentions of the sender. The sum total of the four lower levels is that they are only a means for attaining the purpose (apobetics).

Note: The teleological aspect may often overlap and coincide with the pragmatic aspect to a large extent, but it is theoretically always possible to distinguish the two.

Theorem 21: The five aspects of information (statistics, syntax, semantics, pragmatics, and apobetics) are valid for both the sender and the recipient. The five levels are involved in a continuous interplay between the two.

Theorem 22: The separate aspects of information are interlinked in such a way that every lower level is a necessary prerequisite for the realization of the next one above it.

Whenever the teleological aspect is minimized or deliberately ignored, we should be aware of the fact that Theorem 19 is violated. Evolutionary doctrine deliberately denies any purposefulness that might be apparent. In the words of G.G. Simpson, an American zoologist, "Man is the result of a materialistic process having no purpose or intent; he represents the highest fortuitous organizational form of matter and energy."

In this respect, one more theorem is required:

Theorem 23: There is no known natural law through which matter can give rise to information, neither is any physical process or material phenomenon known that can do this.

Synopsis: It should be clear that information is a multi-layered concept. Shannon's theory embraces only a very small fraction of the real nature of information, as can easily be ascertained in terms of the five levels that we discussed. Contradictory statements and erroneous conclusions of many authors are a result of discussing information without being clear about the relevant level, nor whether the appropriate level lends itself to wide ranging conclusions. It is, for example, not possible to find answers about the origin of biological systems, when one only considers the statistical level. Even when impressive mathematical formulations are forthcoming, they will bring no clarification if they are restricted to the level of Shannon's theory. Well-founded conclusions are only possible when the sender/recipient problem is treated fully at all five information levels.

All of the Theorems 1 to 23 formulated thus far, as well as Theorems 24 to 30, which will follow, are based on empirical reality. They may thus be regarded as natural laws, since they exhibit the characteristics of natural laws as explained in chapter 2. These theorems have been tested in real situations (compare Theorem N1 in paragraph 2.3). Any natural law can be rejected the moment a single counter example is found, and this also holds for these information theorems. After many talks by the author at colleges and universities, both abroad and at home, no researcher could mention one single counter example. In one case, somebody said that it might be possible that one of these theorems could be negated a few million years in the future, when a counter example may be found. My answer was that it was possible, as in the case of all natural laws. However, even if one or more of the theorems could be nullified by a counter example after a few million years, we still have to accept them and live with them now.

The seven most important results are repeated once more:

- There can be no information without a code.
- Any code is the result of a free and deliberate convention.
- There can be no information without a sender.
- Any given chain of information points to a mental source.
- There can be no information without volition (will).
- There can be no information unless all five hierarchical levels are involved: statistics, syntax, semantics, pragmatics, and apobetics.
- Information cannot originate in statistical processes.

These seven theorems can also be formulated as impossibility theorems, as has been shown in paragraph 2.5 for practically all laws of nature:

- It is impossible to set up, store, or transmit information without using a code.
- It is impossible to have a code apart from a free and deliberate convention.
- It is impossible that information can exist without having had a mental source.

- It is impossible for information to exist without having been established voluntarily by a free will.
- It is impossible for information to exist without all five hierarchical levels—statistics, syntax, semantics, pragmatics, and apobetics.
- It is impossible that information can originate in statistical processes.

We still have to describe a domain of definition for all these theorems; this will be done in the next chapter.

Figure 14 may serve the purpose of ordering the proposed theorems. Three phenomena are represented hierarchically, namely matter, information, and life, with matter at the lowest level. All known natural laws belong here (e.g., conservation of energy, strength of materials, and electric charge). According to Theorem 1, information is not a property of matter, and thus requires a next higher level. All information theorems belong to this level. The highest level is that of life. Natural laws belonging to this level may be called life theorems. A fundamental theorem at this level was formulated by Louis Pasteur (1822–1895), and it has not yet been contradicted by any experiment: “Life can only come from life.” The following statements can be made about the three hierarchical levels shown in Figure 14:

- Information is nonmaterial, but it requires material media for storage and transmission.
- Information is not life, but the information in cells is essential for all living beings. Information is a necessary prerequisite for life.
- Life is nonmaterial, and it is not information, but both entities, matter and information, are essential for life.

Figure 14: Certain natural laws are valid for each of the three hierarchical levels; the main concern of this book is the information theorems. The meaning of the arrows are:

1. *Information requires matter for storage and transmission.*
2. *Life requires information.*
3. *Biological life requires matter as necessary medium. Information and matter fall far short in describing life, but life depends on the necessary conditions prevailing at the lower levels.*

Because of the philosophical bias, both information and life itself are regarded as purely material phenomena in the evolutionary view. The origin and the nature of life is reduced to physical-chemical causes. In the words of Jean B. de Lamarck (1744–1829), "Life is merely a physical phenomenon. All manifestations of life are based on mechanical, physical, and chemical causes, being properties of organic matter" (*Philosophie Zoologique*, Paris, 1809, Vol. 1, p. 104 f). The German evolutionist Manfred Eigen expressed a similar view [E2, p. 149]: "The logic of life originates in physics and chemistry." His pupil, Bernd-Olaf Küppers, paved the way for molecular Darwinism, but the present author has already responded to this materialistic view [G14, p. 90–92]. All such ideas have in common that biological facts are interwoven with subjective representations which cannot be justified scientifically. The information theorems formulated in this book, should enable the reader to distinguish between truth and folly.

The code systems used for communication in the animal kingdom have not been "invented" by them, but were created fully functional according to Figure 24.

Delineation of the Information Concept

by Dr. Werner Gitt on March 26, 2009

Information always plays a substitutionary role. The encoding of reality is a mental process.

The question now arises as to the region in which the derived theorems are valid. Do they only hold for computers or also above and beyond that in all technological domains? Are living systems included or not?

What is the position with regard to unknown systems that we might like to evaluate? Are there criteria which enable us to determine beforehand whether the theorems may be applied, or whether we have left the domain of validity? We, thus, require an unambiguous definition.

We have already considered a number of examples which we have tacitly included in the domain, namely a computer program, a book, flag codes, and hieroglyphics. What about the crystalline structure of a metal or a salt or of a snowflake, all of which become visible under magnification? The starry skies are investigated by means of telescopes and we obtain “information” about the stars in this way. A detective gathers “information” at the scene of a crime and deduces circumstantial evidence from meaningful clues. A paleontologist may observe the mussel-bearing shale in a geological layer. The scientist “studies the book of nature” and obtains new knowledge in this way. New technological regularities are discovered, and, when formulated, they comprise a lot of information. Now, which of the above examples belong to our domain?

Every scientific definition of a concept requires precise formulation, as in everyday communications. A definition serves to fix matters, but it also brings limitations. The same holds for the information concept.

To be able to define a domain, we require a peculiar property of information, namely its representational function. Information itself is never the actual object or fact, neither is it a relationship (event or idea), but the encoded symbols merely represent that which is discussed. Symbols of extremely different nature (see paragraph 4.2) play a substitutionary role with regard to reality or a system of thought. Information is always an abstract representation of something quite different. For example, the symbols in today’s newspaper represent an event which happened yesterday; this event is not contemporaneous, moreover, it might have happened in another country and is not at all present where and when the information is transmitted. The genetic letters in a DNA molecule represent the amino acids which will only be constructed at a later stage for subsequent incorporation into a protein molecule. The words appearing in a novel represent persons and their activities.

We can now formulate two fundamental properties of information:

Property 1: Information is not the thing itself, neither is it a condition, but it is an abstract representation of material realities or conceptual relationships, such as problem formulations, ideas, programs, or algorithms. The representation is in a suitable coding system and the realities could be objects or physical, chemical, or biological conditions. The reality being represented is usually not present at the time and place of the transfer of information, neither can it be observed or measured at that moment.

Property 2: Information always plays a substitutionary role. The encoding of reality is a mental process.

It is again clear from Property 2 that information cannot be a property of matter; it is always an intellectual construct (see Theorems 1 to 3, paragraph 3.3). An intelligent sender who can abstractly encode reality is required.

Both the above salient properties now enable us to delineate the information concept unambiguously. Figure 15 clearly illustrates the domains of information (A) and non-information (B and C). Whenever any reality is observed directly by seeing, hearing, or measuring, then that process falls outside our domain. Whenever a coding system that represents something else is employed, then we are inside our domain A, and then all the mentioned theorems are completely valid as laws of nature. The following basic definition has now been established:

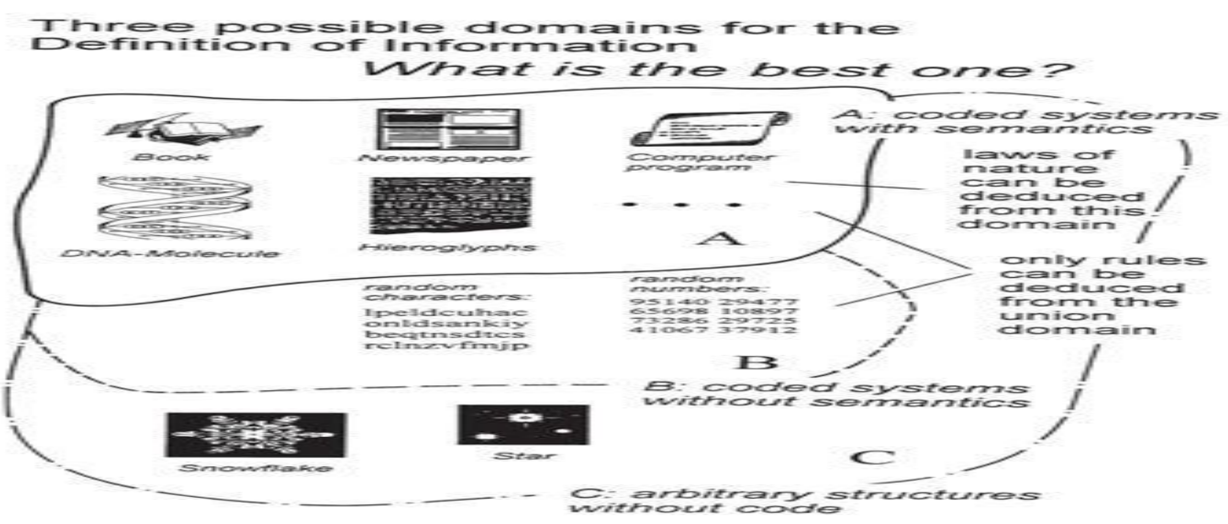


Figure 15: Part A is the domain of definition of information (see Definition D5 for an explanation). In this domain, all the laws of nature about information are valid. The domains B and C fall outside of the definition domain. B represents random characters or random numbers and therefore also lies outside

.

Definition D5: The domain A of definition of information includes only systems which encode and represent an abstract description of some object or idea as illustrated in Figure 15. This definition is valid in the case of the given examples (book, newspaper, computer program, DNA molecule, or hieroglyphics), which means that these lie inside the described domain. When a reality is observed directly, this substitutionary and abstract function is absent, and examples like a star, a house, a tree, or a snowflake do not belong to our definition of information (Part B). The proposed theorems are as valid as natural laws inside the domain we have just defined.

It should be noted that the DNA molecule with its genetic information lies inside the domain A. We shall see later that this is a true coding system. Three chemical letters comprise the code for a certain amino acid, but the acid itself is not present, neither spatially nor temporally, as required by Property 1; it is not even present elsewhere. The actual acid is only synthesized at a later stage, according to the code which substitutes for it.

The energy law is valid and exists regardless of our knowledge about it. It only became information after it had been discovered and formulated by means of a coding system (everyday language or formulas). Information, thus, does not exist by itself—it requires cognitive activity to be established.

We can now formulate another information theorem:

Theorem 24: Information requires a material medium for storage.

If one writes some information with chalk on a blackboard, the chalk is the material carrier. If it is wiped off, the total quantity of chalk is still there, but the information has vanished. In this case, the chalk was a suitable material medium, but the essential aspect was the actual arrangement of the particles of the chalk. This arrangement was definitely not random—it had a mental origin. The same information that was written on the blackboard could also have been written on a magnetic diskette. Certain tracks of the diskette then became magnetized, and also in this case there is a carrier for the information as stated by Theorem 24. The quantity of material involved is appreciably less than for the chalk and blackboard, but the amount of material is not crucial. Moreover, the information is independent of the chemical composition of the storage medium. If large neon letter signs are used for displaying the same information, then the amount of material required is increased by several orders of magnitude.

Information in Living Organisms

by Dr. Werner Gitt on April 2, 2009

There is an extreme multiplicity of life-forms around us, and even a simple unicellular organism is much more complex and purposefully designed than anything that human inventiveness can produce. Matter and energy are basic prerequisites for life, but they cannot be used to distinguish between living and inanimate systems. The central characteristic of all living beings is the "information" they contain, and this information regulates all life processes and procreative functions. Transfer of information plays a fundamental role in all living organisms. When, for example, insects carry pollen from one flower to another, this is in the first place an information-carrying process (genetic information is transferred); the actual material employed is of no concern. Although information is essential for life, information alone does not at all comprise a complete description of life. Man is undoubtedly the most complex information-processing system existing on earth. The total number of bits handled daily in all information-processing events occurring in the human body is 3×10^{24}. This includes all deliberate as well as all involuntary activities, the former comprising the use of language and the information required for controlling voluntary movements, while the latter includes the control of the internal organs and the hormonal systems. The number of bits being processed daily in the human body is more than a million times the total amount of human knowledge stored in all the libraries of the world, which is about 10^{18} bits.

6.1 Necessary Conditions for Life

The basic building blocks of living beings are the proteins, which consist of only 20 different amino acids. These acids have to be arranged in a very definite sequence for every protein. There are inconceivably many possible chains consisting of 20 amino acids in arbitrary sequences, but only some very special sequences are meaningful in the sense that they provide the proteins which are required for life functions. These proteins are used by and built into the organism, serving as building materials, reserves, bearers of energy, and working and transport substances. They are the basic substances comprising the material parts of living organisms and they include such important compounds as enzymes, anti-bodies, blood pigments, and hormones. Every organ and every kind of life has its own specific proteins and there are about 50,000 different proteins in the human body, each of which performs important functions. Their structure as well as the relevant "chemical factories" in the cells have to be encoded in a way that protein synthesis can proceed optimally, combining correct quantities of the required substances.

The structural formulas of the 20 different amino acids that serve as chemical building blocks for the proteins found in all living beings appear in the book *In sechs Tagen vom Chaos zum Men-schen* [G10, p. 143]. If a certain specific protein must be manufactured in a cell, then the chemical formula must be communicated to the cell as well as the chemical procedures for its synthesis. The exact sequence of the individual building blocks is extremely important for living organisms, so that the instructions must be in written form. This requires a coding system as well as the necessary equipment which can decode the information and carry out the instructions for the synthesis. The minimal requirements are:

Amino acid	Genetic code	Abbr
Alanine	GCA GCC GCG GCU	Ala
Arginine	AGA AGG CGA CGC CGG CGU	Arg
Asparagine	AAC AAU	Asn
Aspartic acid	GAC GAU	Asp
Cysteine	UGC UGU	Cys
Glutamine	CAA CAG	Gln
Glutamic acid	GAA GAG	Glu
Glycine	GGA GGC GGG GGU	Gly
Histidine	CAC CAU	His
Isoleucine	AUA AUC AUU	Ile
Leucine	CUA CUC CUG CUU UUA UUG	Leu
Lysine	AAA AAG	Lys
Methionine	AUG	Met
Phenylalanine	UUC UUU	Phe
Proline	CCA CCC CCG CCU	Pro
Serine	AGC AGU UCA UCC UCG UCU	Ser
Threonine	ACA ACC ACG ACU	Thr
Tryptophan	UGG	Try
Tyrosine	UAC UAU	Tyr
Valine	GUA GUC GUG GUU	Val
STOP sign	UAA UAG UGA	

Figure 16: The 20 amino acids which are present in living systems, given in alphabetic order, together with their international three-letter abbreviations. The code combinations (triplets) which give rise to the relevant acid are indicated in the right-hand column.

—According to Theorem 6, a coding system is required for compiling information, and this system should be able to identify uniquely all the relevant amino acids by means of a standard set of symbols which must remain constant.

—As required by Theorems 14, 17, and 19, for any piece of information, this information should involve precisely defined semantics, pragmatics, and apobetics.

—There must be a physical carrier able to store all the required information in the smallest possible space, according to Theorem 24.

The names of the 20 amino acids occurring in living beings and their internationally accepted three-letter abbreviations are listed in Figure 16 (e.g., Ala for alanine). It is noteworthy that exactly this code with four different letters is employed; these four letters are arranged in “words” of three letters each to uniquely identify an amino acid. Our next endeavor is to determine whether this system is optimal or not.

The storage medium is the DNA molecule (deoxyribonucleic acid), which resembles a double helix as illustrated in Figure 17. A DNA fiber is only about two millionths of a millimeter thick, so that it is barely visible with an electron microscope. The chemical letters A, G, T, and C are located on this information tape, and the amount of information is so immense in the case of human DNA that it would stretch from the North Pole to the equator if it was typed on paper, using standard letter sizes. The DNA is structured in such a way that it can be replicated every time a cell divides in two. Each of the two daughter cells must have identically the same genetic information after the division and copying processes. This replication is so precise that it can be compared to 280 clerks copying the entire Bible sequentially, each one from the previous one, with, at most, one single letter being transposed erroneously in the entire copying process.

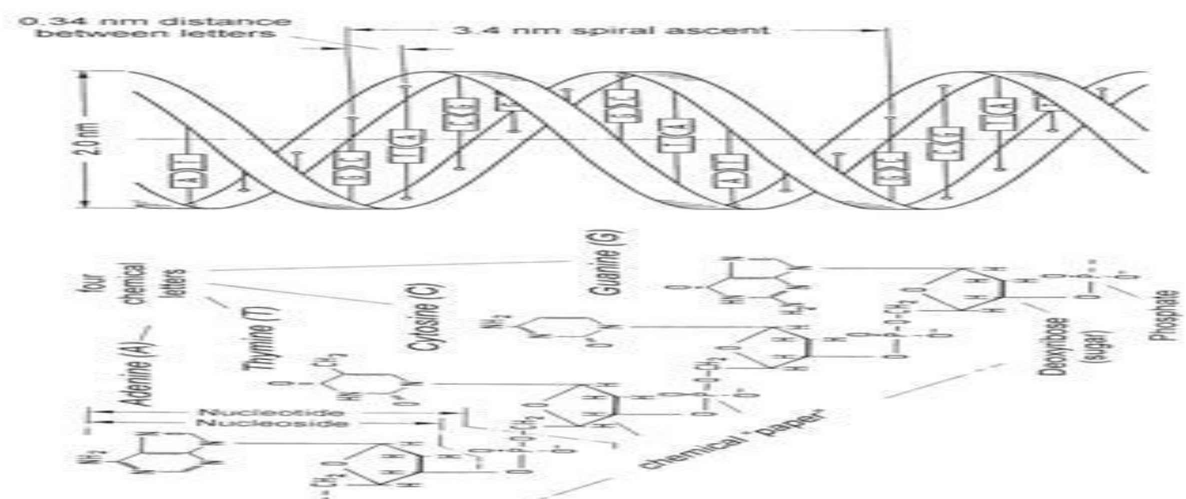


Figure 17: The way in which genetic information is stored. At the left, the “chemical paper” is shown in the form of a long sugar-phosphate chain with the four chemical letters, A, T, C, and G. The actual structure and dimensions of a DNA molecule can be seen at the top.

When a DNA string is replicated, the double strand is unwound, and at the same time a complementary strand is constructed on each separate one, so that, eventually, there are two new double strands identical to the original one. As can be seen in Figure 17, A is complementary to T, and C to G.

One cell division lasts from 20 to 80 minutes, and during this time the entire molecular library, equivalent to one thousand books, is copied correctly.

6.2 The Genetic Code

We now discuss the question of devising a suitable coding system. For instance, how many different letters are required and how long should the words be for optimal performance? If a certain coding system has been adopted, it should be strictly adhered to (theorem 8, par 4.2), since it must be in tune with extremely complex translation and implementation processes. The table in Figure 19 comprises only the most interesting 25 fields, but it can be extended indefinitely downward and to the right. Each field represents a specific method of encoding, for example, if n = 3 and L = 4, we have a ternary code with 3 different letters. In that case, a word for identifying an amino acid would have a length of L = 4, meaning that quartets of 4 letters represent one word. If we now want to select the best code, the following requirements should be met:

—The storage space in a cell must be a minimum so that the code should economize on the required material. The more letters required for each amino acid, the more material is required, as well as more storage space.

—The copying mechanism described above requires n to be an even number. The replication of each of the two strands of DNA into complementary strands thus needs an alphabet having an even number of letters. For the purpose of limiting copying errors during the very many replication events, some redundance must be provided for (see appendix A 1.4).

—The longer the employed alphabet, the more complex the implementing mechanisms have to be. It would also require more material for storage, and the incidence of copying errors would increase.

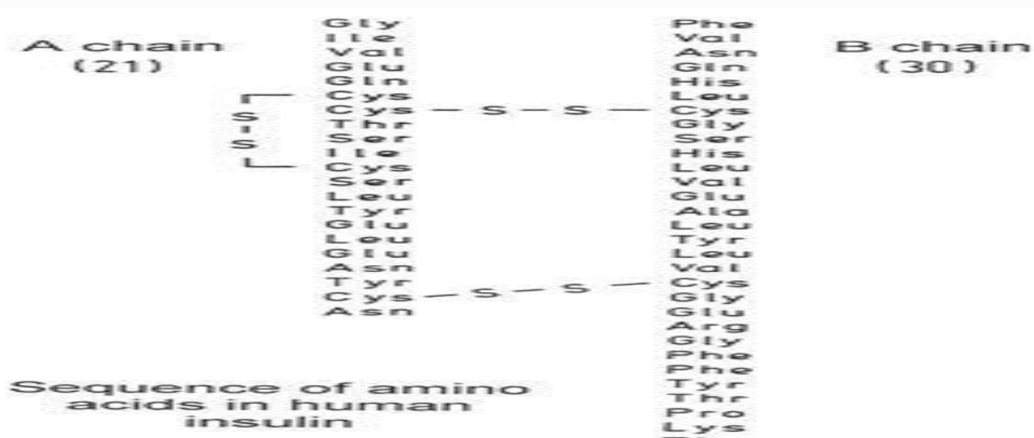


Figure 18: The chemical formula of insulin. The A chain consists of 21 amino acids and the B chain is comprised of 30 amino acids. Three of the 20 amino acids present in living organisms, are absent (Asp, Met, Try), two occur six times (Cys, Leu), one five times (Glu), three occur four times (Gly, Tyr, Val), etc. The two chains are linked by two disulphide bridges. Insulin is an essential hormone, its main function being to maintain the normal sugar content of the blood at 3.9 to 6.4 mmol/l (70–115 mg/dl).

In each field of Figure 19, the number of possible combinations for the different words appears in the top left corner. The 20 amino acids require at least 20 different possibilities and, according to Shannon's theory, the required information content of each amino acid could be calculated as follows: For 20 amino acids, the average information content would be $i_A \equiv i_W \equiv$ ld 20 = log 20/log 2 = 4.32 bits per amino acid (ld is the logarithm with base 2).

L = Word Length = Number of Letters per Word / n = Number of Different Letters		$L = 2$ Dublet	$L = 3$ Triplet	$L = 4$ Quartet	$L = 5$ Quintet	$L = 6$ Sextet
		Word Length L →				
Binary Code $n = 2$ $i_B = \text{ld}\, n = 1$ bit	Lenght of the Alphabet n ↓	$m = n^L = 4$ $i_W = L\, \text{ld}\, n$ 2bit/word	$2^3 = 8$ 3bit/word	$2^4 = 16$ 4bit/word	$2^5 = 32$ 5bit/word	$2^6 = 64$ 6bit/word
Ternary Code $n = 3$ $i_B = 1{,}585$ bit		$3^2 = 9$ 3.170	$3^3 = 27$ 4.755	$3^4 = 81$ 6,340	$3^5 = 243$ 7,925	$3^6 = 729$ 9.510
Quaterny Code $n = 4$ $i_B = 2$ bit		$4^2 = 16$ 4,0	$4^3 = 64$ 6,0	$4^4 = 256$ 8,0	$4^5 = 1024$ 10,0	$4^6 = 4096$ 12,0
Quinary Code $n = 5$ $i_B = 2{,}322$ bit		$5^2 = 25$ 4,644	$5^3 = 125$ 6,966	$5^4 = 625$ 9,288	$5^5 = 3125$ 11,610	$5^6 = 15625$ 13,932
Senary Code $n = 6$ $i_B = 2{,}585$ bit		$6^2 = 36$ 5,170	$6^3 = 216$ 7,755	$6^4 = 1296$ 10,340	$6^5 = 7776$ 12,925	$6^6 = 46656$ 15,510

$i_B = \text{ld}\, n$ Information content of *one* word [bit/word]
$i_W = L\, \text{ld}\, n$ Information content of *one* letter [bit/letter]
$m = n^L$ Number of possible combinations to make one word with the lenght L by n different letters

Figure 19: The theoretical possibility of constructing a code consisting of words of equal length. Every field (block) represents a definite coding system as indicated by the number of different letters n, and the word length L.

If four letters (quartets) are represented in binary code (n = 2), then (4 letters per word)x(1 bit per letter) = 4 bits per word, which is less than the required 4.32 bits per word. This limit is indicated by the hatched boundary in Figure 19. The six fields adjacent to this line, numbered 1 to 6, are the best candidates. All other fields lying further to the right could also be considered, but they would require too much material for storage. So, we only have to consider the six numbered cases.

It is, in principle, possible to use quintets of binary codes, resulting in an average of 5 bits per word, but the replication process requires an even number of symbols. We can thus exclude ternary code (n = 3) and quinary code (n = 5). The next candidate is binary code (No. 2), but it needs too much storage material in relation to No. 4 (a quaternary code using triplets), five symbols versus three implies a surplus of 67%. At this stage, we have only two remaining candidates out of the large number of possibilities, namely No. 4 and No. 6. And our choice falls on No. 4, which is a combination of triplets from a quaternary code having four different letters. Although No. 4 has the disadvantage of requiring 50% more material than No. 6, it has advantages which more than compensate for this disadvantage, namely:

—With six different symbols, the recognition and translation requirements become disproportionately much more complex than with four letters, and thus requires much more material for these purposes.

—In the case of No. 4, the information content of a word is 6 bits per word, as against 5.17 bits per word for No. 6. The resulting redundancy is thus greater, and this ensures greater accuracy for the transfer of information.

Conclusion: The coding system used for living beings is optimal from an engineering standpoint. This fact strengthens the argument that it was a case of purposeful design rather than fortuitous chance.

6.3 The Origin of Biological Information

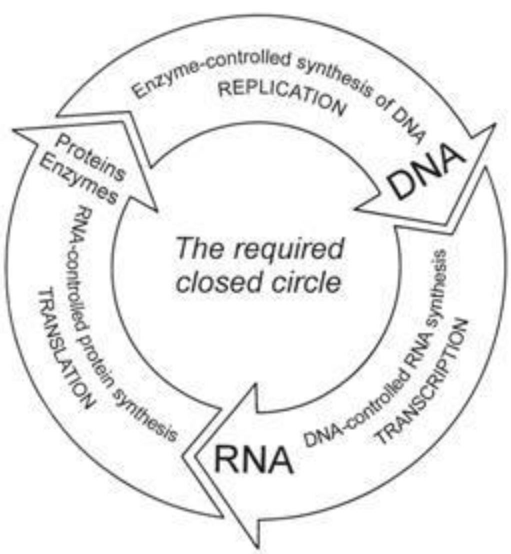


Figure 20: A simplified representation of the cyclic information controlled process occurring in living cells. The translation is based on pragmatics, but it is involved in the cyclic process of semantic information, since the DNA synthesis can only take place under enzymatic catalysis. This sketch clearly illustrates that such a cyclic process must have been complete right from the start, and could not have originated in a continuous process. The structure of this example of a complex information transfer system also corresponds to Figure 24.

We find a unique coding system and a definite syntax in every genome.[1] The coding system is composed of four chemical symbols for the letters of the defined alphabet, and the syntax entails triplets representing certain amino acids. The genetic syntax system also uses structural units like expressors, repressors, and operators, and thus extends far beyond these two aspects (4 symbols and triplet words). It is not yet fully understood. It is known that the information in a cell goes through a cyclic process (Figure 20), but the semantics of this process is not (yet) understood in the case of human beings. The locations of many functions of chromosomes or genes are known, but we do not yet understand the genetic language. Because semantics is involved, it means that pragmatics also have to be fulfilled. The semantics are invariant, as can be seen in the similarity (not identity!) of uni-ovular twins. If one carefully considers living organisms in their entirety as well as in selected detail, the purposefulness is unmistakable. The apobetics aspect is thus obvious for anybody to see; this includes the observation that information never originates by chance, but is always conceived purposefully.

The substitutionary function of information is also satisfied (see Definition D5 in chapter 5), since the triplets in the DNA molecule represent those amino acids that will be synthesized at a later stage for incorporation into proteins (the amino acids themselves are not present). We can now establish an important theorem:

Theorem 25: Biological information is not an exceptional kind of information, but it differs from other systems in that it has a very high storage density and that it obviously employs extremely ingenious concepts.

In accordance with the theorems formulated in chapters 3 to 5, in particular the impossibility theorems at the end of chapter 4, it is clear that the information present in living organisms requires an intelligent source. Man could not have been this source; so, the only remaining possibility is that there must have been a Creator. We can now formulate the following theorems:

Theorem 26: The information present in living beings must have had a mental source.

A corollary of Theorem 26 is:

Theorem 27: Any model for the origin of life (and of information) based solely on physical and/or chemical processes, is inherently false.

In their school textbook, R. Junker and S. Scherer establish a basic type that must have been “ready-made” [J3]. This result, which requires the information content of living beings to be complete right from the beginning, is biologically sound. The derived theorems about the nature of information fit this model.

6.4 Materialistic Representations and Models of the Origin of Biological Information

The question "How did life originate?" which interests us all, is inseparably linked to the question "Where did the information come from?" Since the findings of James D. Watson (*1928) and Francis H.C. Crick (*1916), it was increasingly realized by contemporary researchers that the information residing in the cells is of crucial importance for the existence of life. Anybody who wants to make meaningful statements about the origin of life would be forced to explain how the information originated. All evolutionary views are fundamentally unable to answer this crucial question.

The philosophy that life and its origin are purely material phenomena currently dominates the biological sciences. Following are the words of some authors who support this view.

Jean-Baptiste de Lamarck (1744–1829), a French zoologist and philosopher, wrote, "Life is nothing but a physical phenomenon. All life features originate in mechanical, physical, and chemical processes which are based on the properties of organic matter itself " (*Philosophie Zoologique,* Paris, 1809, Vol. 1).
The German microbiologist R.W. Kaplan holds a similar materialistic view [K1]: "Life is effected by the different parts of a system which work together in a certain way. . . . Life can be completely explained in terms of the properties of these parts and their inevitable interactions. . . . The origin of life can be explained in terms of hypotheses describing fully the sequence of events since the origin of protobionts, and the fact that all these events could be deduced from physical, chemical, and other laws which are valid for material systems."

Manfred Eigen (*1927), a Nobel laureate of Göttingen, discusses questions about life from the molecular biology view, with as point of departure the unwarranted postulate that natural laws controlled the origin of life. In his work on the self-organization of matter [E1], he uses an impressive array of formulas, but does not rise above the level of statistical information. This voluminous work is thus useless and does not answer any questions about the origin of information and of life. He writes in [E2, p 55], "Information arises from non-information." This statement is nothing but a confession of materialism, and it fails the tests required by reality.

Franz M. Wuketits defines the target readership of his book [W8] as follows: ". . . not only biologists and theoretical scientists, but in equal measure scientists and philosophers, and everybody who is interested in the adventures of contemporary science." He then presents a so-called "evolutionary theoretical science," claiming to initiate a new Copernican revolution. Up to the present time, great scientific results were obtained by means of observation, measuring, and weighing, as was done for example by Copernicus, Galilei, Newton, Einstein, Born, and Planck. In his system, Wuketits follows the backward route: His point of departure is to assume that evolution is true, so that all natural phenomena have to be interpreted through these spectacles.

He writes in the introduction of his book [W8, p. 11–12]:

> The fundamental truth of biological evolution is accepted beforehand, yes, we assume in advance that the principle of evolution is universally valid, that it is just as valid in the preorganic domain as in the organic, and that it can be extended to the spheres of psychology, sociology, and culture. If we accept that the evolutionary view also holds for the human mind and cognition, then evolutionary ideas can also be applied to the analysis of those phenomena which are usually regarded as belonging to theoretical science. As a result this view then becomes relatively more important in the evaluation of the progress of scientific research. We thus arrive at an evolutionary theory of science, a theory of human knowledge which relates to an evolutionary establishment of itself.

If such statements were based on a sufficient body of facts, then one might perhaps agree with the conclusions, but the reverse process was followed: All phenomena of nature are placed under the all-encompassing evolutionary umbrella. Scientists who submit themselves to such a mental corset and support it uncritically, degrade themselves to mere vassals of a materialistic philosophy. Science should, however, only be subservient to the truth, and not to pre-programmed folly. Evolutionary theory bans any mention of a planning Spirit as a purposeful First Cause in natural systems, and endeavors to imprison all sciences in the straightjacket called the "self-organization of matter." Wuketits supports evolutionary theory with a near ideological fervor, and accuses everybody of fable mongering who claims to be scientific and speak of "planning spirits" or of a "designer" in nature. He wishes to ban thoughts of "finality" and of "final and purposeful causes" from science and from the domain of all serious schools of thought.

An appreciable fraction of all scientists who concern themselves with cosmological questions and with questions of origins, support the evolutionary view, to such an extent that the well-known American bio-informaticist Hubert P. Jockey [J1] bemoans the fact that the literature in this area is blandly and totally supportive. He writes in the *Journal of Theoretical Biology* [vol. 91, 1981, p. 13]:

> Since science does not have the faintest idea how life on earth originated. . . . it would only be honest to confess this to other scientists, to grantors, and to the public at large. Prominent scientists speaking ex cathedra, should refrain from polarizing the minds of students and young productive scientists with statements that are based solely on beliefs.

The doctrine of evolution is definitely not a viable scientific *leitmotiv* (guiding principle); even the well-known theoreticist Karl Popper [H1], once characterized it as a "metaphysical research program." This assertion is just as noteworthy as it is honest, because Popper himself supports evolution.
We now discuss some theoretical models which suggest that information can originate in matter.

Dawkins's example: Initial sequence: WDLMNLT DTJBKWIRZREZLMQCO P Predetermined target sentence: METHINKS IT IS LIKE A WEASEL	*Küppers*'s example: Initial sequence: ELWWSJILAKLAFTYJ:/ELWWSJILAKLAFTYJ:/ Predetermined target sentence: EVOLUTIONSTHEORIE/ (twice)
First test: *Gen. 01* WDLMNLT DTJBKWIRZREZLMQCO P *Gen. 02* WDLTMNLT DTJBSWIRZREZLMQLO P *Gen. 10* MDLDMNLS ITJISWHRZREZ MECS P *Gen. 20* MELDINLS IT ISWPRKE Z WECSEL *Gen. 30* METHINGS IT ISWLIKE B WECSEL *Gen. 40* METHINKS IT IS LIKE I WEASEL *Gen. 43* METHINKS IT IS LIKE A WEASEL *Second test:* *Gen. 01* Y YVMQKZPFJXWVHGLAWFVCHHQXYOPY *Gen. 10* Y YVMQKSPFTXWSHLIKEFV HQYSPY *Gen. 20* YETHINKSPITXISHLIKEFA WOYSEY *Gen. 30* METHINKS IT ISSLIKE A WEFSEY *Gen. 40* METHINKS IT ISBLIKE A WEASES *Gen. 50* METHINKS IT ISJLIKE A WEASEO *Gen. 60* METHINKS IT IS LIKE A WEASEP *Gen. 64* METHINKS IT IS LIKE A WEASEL	*Gen. 01* ELWWSJILAKLAFTYJ:/ELWWSJILAKLAFTYJ:/ ELYWSJILAK?AFTYJ:/ELWOSBCSEKLAJSYK:/ ELWOSBCKEKLKUTII:/ELWOTBCKYKLIFTYJ:/ ELWOSBDKEKLAJTYI:/ELWOTBCKZKLIJTYJ: *Gen. 05* EVQLVDGONS?HEOQUI/EVOKVDGONSLHE.QIC/ ETOLVDGONS?HEOQIE/EVOLVDGONS?LUOQUC/ EVQLVDGONC?HEOQIE/EVOLVDIONKLHEKQIC/ EVOLVDGONSLHEOQIC/EVOLVDGONS?HEOQIE/ EVOLVEDONSLHEOQIC/EVOLVDGONS?HEOQIE *Gen. 30* EVOLUTIONSTHEORIE/EVOLUTIONSTHEORIE/ EVOLUTIONSTHEORIE/EVOLUTIONSTHEORIE/ EVOLUTIONSTHEORIE/EVOLVDIONSTHEORIE/ EVOLUTIONSTHEORJE/EVOPUTIONSTHEORIE/ EVOLVTIONSTHEORIE/EVO?UTIONSKXHEORI

Figure 21: Molecular-Darwinistic representations of the origin of information according to R. Dawkins and B.O. Küppers.

Cumulative selection (Latin *cumulare* = gather): Richard Dawkins, a British neo-Darwinist, revives the historical example of the typewriter-thrumming monkeys (see appendix A1.5) and replaces them with "computer monkeys." As shown in Figure 21, he begins with a random sequence of 28 letters [D2 p. 66–67] and seeks to demonstrate how a predetermined phrase selected from Shakespeare, "Methinks it is like a weasel," can be derived through mutation and selection. The random initial sequence with the required number of letters is copied repeatedly, allowing for random copying errors (representing mutations). The computer program checks all the "daughter" sentences and selects that one which most resembles the target sentence. The process is subsequently repeated for the resulting "winning sentences," until eventually, after 43 "generations," the goal is reached.

There is a spate of new Jesus books which constantly present strange new and false ideas contrary to the New Testament. Prof. Klaus Berger of the Heidelberg School of Theology remarked (1994): "Please buy and read such a book, then you will realize what degree of gullibility is ascribed to you." With equal zeal, Dawkins publishes his easily detectable fallacies about the way information originates. It is therefore necessary to discuss his representation fully so that you, the reader, can see what feeble-mindedness is ascribed to you.

In the initial pages of his book, Dawkins [D2, p. 13] softens the reader to the purposelessness of living structures: "Biology is the study of complex matters that appear to have been designed purposefully." Further along he selects a target sentence and his entire program is designed toward this goal. This game can be played with any random initial sequence and the goal will always be reached, because the programming is fixed. Even the number of letters is given in advance. It is obvious that no information is generated; on the contrary, it has been predetermined. B.O. Küppers plays a similar evolution game [K3]: The predetermined target word is *evolutionstheorie* appearing twice (see the right hand part of Figure 21). It should be clear from Theorem 27 that random processes cannot give rise to information.

Genetic algorithms: The so-called "genetic algorithms" are yet another way of trying to explain how information could originate in matter [F5, M4]. The combination of words is deliberately chosen from biology and numerical mathematics to suggest that evolutionary events are described mathematically. What is actually involved is a purely numerical method used for the optimization of dynamic processes. This method can be used to find, by repeated approximations, the maximum value of an analytic function numerically (e.g., $f(x,y) = yx - x^4$), or the optimal route of a commercial traveler. The effects of mutation and selection can thus be simulated by computer. Using predetermined samples of bits (sequences of noughts and ones), each position is regarded as a gene. The sample is then modified (mutated) by allowing various genetic operators to influence the bit string (e.g., crossover). A "fitness function," assumed for the process of evolution, is then applied to each result. It should be pointed out that this genetic algorithm is purely a numerical calculation method, and definitely not an algorithm which describes real processes in cells. Numerical methods cannot describe the origin of information.

Evolutionary models for the origin of the genetic code: We find proposals for the way the genetic code could have originated in very many publications [e.g., O2, E2, K1], but up to the present time, nobody has been able to propose anything better than purely imaginary models. It has not yet been shown empirically how information can arise in matter, and, according to Theorem 11, this will never happen.

6.5 Scientists Against Evolution

Fortunately, the number of scientists who repudiate evolutionary views and dilemmas is increasing. This number includes internationally renowned experts, of whom some quotations follow. In *New Scientist*, the British astrophysicist Sir Fred Hoyle, one of today's best known cosmologists, expresses his concern about the customary representations under the title "The Big Bang in Astronomy" [H4, p. 523–524]:

> But the interesting quark transformations are almost immediately over and done with, to be followed by a little rather simple nuclear physics, to be followed by what? By a dull-as-ditchwater expansion which degrades itself adiabatically until it is incapable of doing anything at all. The notion that galaxies form, to be followed by an active astronomical history, is an illusion. Nothing forms, the thing is as dead as a door-nail. . . . The punch line is that, even though outward speeds are maintained in a free explosion, internal motions are not. Internal motions die away adiabatically, and the expanding system becomes inert, which is exactly why the big-bang cosmologies lead to a universe that is dead-and-done-with almost from its beginning.

These views correspond with the findings of Hermann Schneider, a nuclear physicist of Heidelberg, who has critically evaluated the big bang theory from a physical viewpoint. He concludes [S5]: "In the evolution model the natural laws have to describe the origin of all things in the macro and the micro cosmos, as well as their operation. But this overtaxes the laws of nature."

Fred Hoyle makes the following remarks about the much-quoted primeval soup in which life supposedly developed according to evolutionary expectations [H4, p 526]:

> I don't know how long it is going to be before astronomers generally recognize that the combinatorial arrangement of not even one among the many thousands of biopolymers on which life depends could have been arrived at by natural processes here on the earth. Astronomers will have a little difficulty at understanding this because they will be assured by biologists that it is not so, the biologists having been assured in their turn by others that it is not so. The "others" are a group of persons who believe, quite openly, in mathematical miracles. They advocate the belief that tucked away in nature, outside of normal physics, there is a law which performs miracles.

In his book *Synthetische Artbildung (The Synthetic Formation of Kinds)*, Professor Dr. Heribert Nilsson, a botanist at Lund University in Sweden, describes evolutionary doctrine as an obstacle which prevents the development of an exact biology:

> The final result of all my researches and discussions is that the theory of evolution should be discarded in its entirety, because it always leads to extreme contradictions and confusing consequences when tested against the empirical results of research on the formation of different kinds of living forms and related fields. This assertion would agitate many people. Moreover: my next conclusion is that, far from being a benign natural-philosophical school of thought, the theory of evolution is a severe obstacle for biological research. As many examples show, it actually prevents the drawing of logical conclusions from even one set of experimental material. Because everything must be bent to fit this speculative theory, an exact biology cannot develop.

Professor Dr. Bruno Vollmert of Karlsruhe, an expert in the field of macro-molecular chemistry, has shown that all experiments purporting to support evolution miss the crux of the matter [V1]:

> All hitherto published experiments about the poly-condensation of nucleotides or amino acids are irrelevant to the problem of evolution at the molecular level, because they were based on simple monomers, and not on "primeval soups" derived from Miller experiments. But poly-condensation experiments with primeval soups or the dissolved mix of substances of them are just as superfluous as attempts to construct perpetual motion machines.

A French Nobel laureate, A. Lwoff [L2], pointed out that every organism can only function in terms of the complex net of available information:

> An organism is a system of interdependent structures and functions. It consists of cells, and the cells are made of molecules which have to cooperate smoothly. Every molecule must know what the others are doing. It must be able to receive messages and act on them.

When considering the source of this information, we can now formulate the following theorem which is based on research of many thousands of man-years:

> **Theorem 28:** There is no known law of nature, no known process, and no known sequence of events which can cause information to originate by itself in matter.

This was also the conclusion of the seventh "International Conference on the Origins of Life" held together with the fourth congress of the "International Society for the Study of the Origin of Life (ISSOL)" in Mainz, Germany. At such occasions, scientists from all over the world exchange their latest results. In his review of the congress, Klaus Dose [D3] writes: "A further puzzle remains, namely the question of the origin of biological information, i.e., the information residing in our genes today." Not even the physical building blocks required for the storage of the information can construct themselves: "The spontaneous formation of simple nucleotides or even of polynucleotides which were able to be replicated on the pre-biotic earth should now be regarded as improbable in the light of the very many unsuccessful experiments in this regard."

As early as 1864, when Louis Pasteur addressed the Sorbonne University in Paris, he predicted that the theory of the spontaneous generation of living cells would never recover from the fatal blow delivered by his experiments. In this regard, Klaus Dose makes an equally important statement: "The Mainz report may have an equally important historical impact, because for the first time it has now been determined unequivocally by a large number of scientists that all evolutionary theses that living systems developed from poly-nucleotides which originated spontaneously, are devoid of any empirical base."

The Three Forms in which Information Appears

by Dr. Werner Gitt on April 9, 2009

Information accosts us from all sides and presents itself over a wide range of manifestations.

Information accosts us from all sides and presents itself over a wide range of manifestations:

—From messages pounded out by drums in the jungle to telephone conversations by means of communications satellites.

—From the computer-controlled processes for producing synthetic materials to the adaptive control of rolling mills.

—In printed form from telephone directories to the Bible.

—From the technical drawings which specify the construction of a gas-driven engine to the circuit diagram of a large scale integrated computer chip.

—From the hormonal system of an organism to the navigational instincts of migrating birds.

—From the genome of a bacterium to the genetic information inherited by humans.

In addition to the five essential levels of information mentioned in chapter 4 (statistics, syntax, semantics, pragmatics & apobetics), it is also advantageous to consider a three-fold vertical division of types of information:

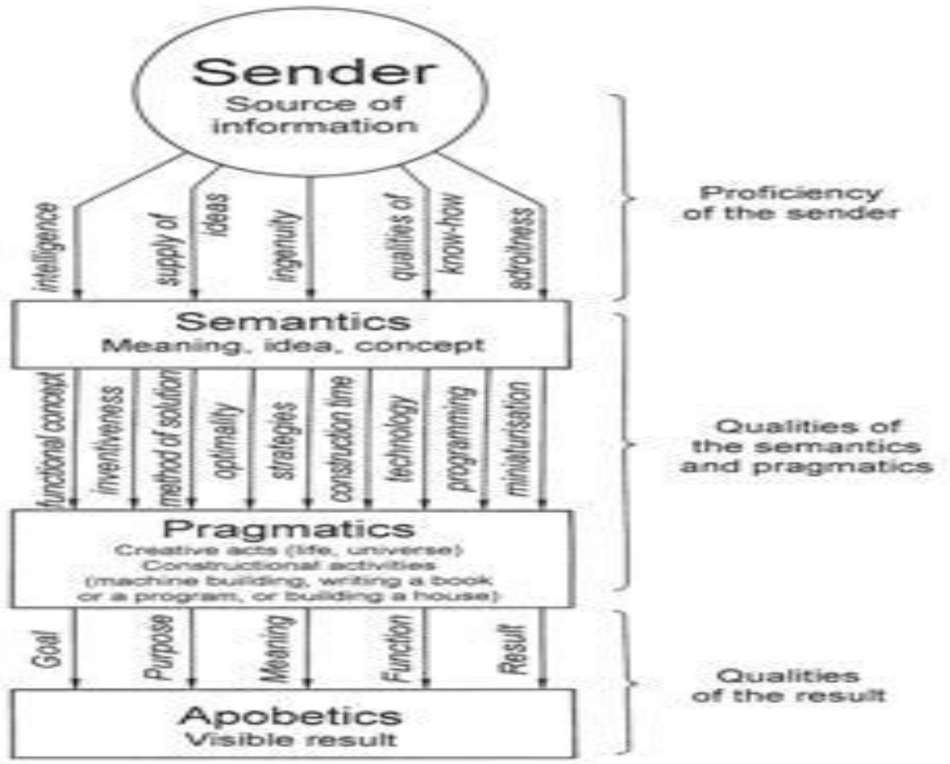


Figure 22: Qualitative properties of the sender and his information on the semantic, pragmatic, and apobetic levels. In this diagram we represent the qualitative properties of constructional/creative information, and include both the creative acts of God and human engineering concepts. It is obvious that there is a tight link between the qualitative aspects of the information and the capabilities of the sender. Similar qualitative properties can be formulated for the other two types of information, operational and communication information.

1. Constructional/creative information: This includes all information that is used for the purpose of producing something. Before anything can be made, the originator mobilizes his intelligence, his supply of ideas, his know-how, and his inventiveness to encode his concept in a suitable way. There are many types of encoded blueprints, e.g., technical drawings for the construction of a machine, a cake recipe, details of the chemical processes for synthesizing polyvinyl chloride, an electrical circuit diagram, or the genetic information required for the construction of a living cell.
The criteria for evaluating the searched-for solution are found both in the conceptual stage (semantic aspect of the information) and in the sophistication of the implementation (pragmatics). One or more of the following catchwords characterize these criteria depending on the situation, as shown in Figure 22:

underlying functional concept, degree of inventiveness, cleverness of the method of solution, achieved optimality, input strategy, brevity of construction time, applied technology, suitable programming, and degree of miniaturization (e.g., economical use of material and energy). The quality of the visible results (apobetics) can be evaluated in terms of the achieved goal, the efficiency of the input, the ingenuity of the operation, and the certainty of correct functioning (e.g., low susceptibility to interference).

3. **Operational information:** All concepts having the purpose of maintaining some "industry" in the widest sense of the word are included under this kind of information. Many systems require operational information in the form of programs for proper functioning. These programs are indispensable and ensure that the preconceived processes run as expected. A barrel-organ cannot function without the required cylinder, and the human body is viable only when the conceptual information is provided with all the interactions carried by the nervous system to and from the brain and all the bodily organs. The amount of information streaming through the deliberate as well as all involuntary activities of the human body is about 3×10^{24} bits per day. When this is compared with the total quantity of information stored in all the libraries of the world—10^{18} bits—we make an astounding discovery: The quantity of information processed in our bodies during the course of one day is one million times greater than all the knowledge represented in the books of the world.

<u>Further examples of operational information as found in technology and in nature:</u>

—the operating system of a computer (e.g., DOS programs),
—the program controlling a robot or a process computer,
—warning systems for airplanes and ships,
—pheromone languages of insects,
—bee dancing (see Figure 39 in appendix A2),
—the hormonal system of the body, and

—operational information in the animal kingdom, which we call "instincts" because of our lack of knowledge about their codes and methods of transfer (e.g., the navigational system of migrating birds as described in appendix A3.4.4.2).

3. Communication information: This is composed of all other kinds of information, e.g., letters, books, phone calls, radio transmissions, bird songs, and the message of the Bible. The apobetic aspect of such information does not include the construction of a product, neither is it involved in maintaining some process. The goals are transmission of a message, spreading joy, amusement, instruction, and personal confidences.

Three Kinds of Transmitted Information

by Dr. Werner Gitt on April 16, 2009

If someone presents a model for explaining the origin of life, but he cannot say where the creative information characteristic of all life-forms came from, the crucial question remains unanswered.

In our study of the nature of information we have come across various different distinguishing criteria:

- Distinction according to aspect: statistics, syntax, semantics, pragmatics, and apobetics
- Distinction according to purpose: constructional/creative information, operational, and communication information
- Distinction according to direction of flow: transmitted or received information.

Yet another distinction could also be made regarding the sender and the quality of the information processing involved. There are three types:

1. Copied information: This is comprised of the identical propagation of existing information. No new information arises during copying, so that it is a mechanical process and not an intellectual one. The equipment and methods used for copying were created by the initiative of one or more minds, and the copying process itself is also a deliberate and purposeful action, but it can be done by a machine. Examples of copied information: Duplication of a computer program in a data processing system (e.g., magnetic tape, magnetic disk, and real memory), replication of DNA molecules in living cells, the second printing of a book without any changes or additions, making a photocopy, and reading an extract or a letter. Every piece of copied information must, however, have been created somewhere along the line.
2. Reproduced information: In the arts, there is a clear distinction between the original composer, poet, or writer, and the subsequent performers of such works. An actor did not create the acts or the text, but he does contribute by employing his own talents of intonation, mimicry, and creativity. Similarly, when a Mozart symphony or a Bach cantata is performed, the musicians play a reproductive role—they do not alter the work of the composer, but they might introduce individual effects. We thus define reproduced information as a semantic entity which is elaborated and adapted by the actual sender without modifying in any real sense the originally created information. All animal languages can be included in this category, because all allocated meanings are fixed. The acts of performing animals are reproductive and not creative. Computer software functions according to this

principle, since all creative ideas like algorithms (methods of solution) and data structures had to be devised beforehand by the programmer and then implemented in the form of a written program. The various relevant parameters can be entered into a machine (computer) which does nothing more than reproduce the available information in the required form. Even the results obtained by means of AI programs (artificial intelligence; see appendix A2.3) are in the last instance nothing more than reproduced information. They may be quite complex and may appear to be "intelligent," but they cannot create information. Machines can reproduce information, since reproduction does not entail creative thought processes.

3. Creative information: This is the highest level of transmitted information: something new is produced. It does not involve copied or reproduced information. This kind of information always requires a personal mind exercising its own free will, as original source. This generally entails a nonmaterial intellectual process, which, thus, cannot be entrusted to a machine. Creative information can always be linked to a person who has cognitive capabilities, and it represents something new.

We can now formulate the following special theorem:

Theorem 29: Every piece of creative information represents some mental effort and can be traced to a personal idea-giver who exercised his own free will, and who is endowed with an intelligent mind.

This theorem can also be expressed as follows:

Theorem 30: New information can only originate in a creative thought process.

Examples of creative information: designing a coding system, designing a language, untrammeled discourse by means of natural languages, creating a programming language, writing a book, writing an original scientific paper, program instructions in DNA molecules, and the setting up of blueprints for living beings.

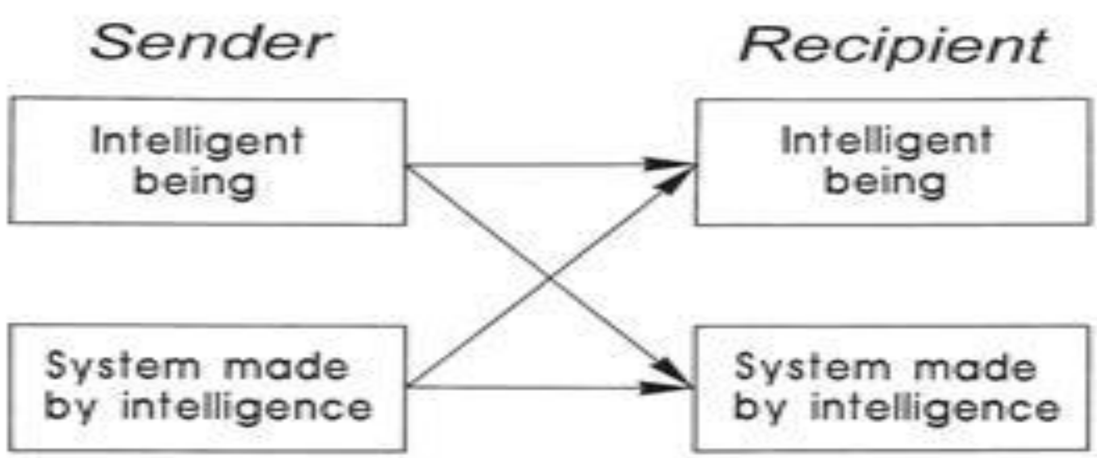


Figure 23: The four possible combinations of sender and recipient.

Conclusions: It should now be clear where the follies of evolutionary views lie. If someone presents a model for explaining the origin of life, but he cannot say where the creative information characteristic of all life-forms came from, then the crucial question remains unanswered. Somebody who looks for the origin of information only in physical matter ignores the fundamental natural laws about information; what is more, he scorns them. It is clear from the history of science that one can ignore the laws of nature for a limited time only.

There are only four different possible relationships between sender and recipient [G4], as illustrated in Figure 23. Only intelligent beings qualify as sender or recipient (God and man), or systems constructed by intelligent minds (e.g., man, other living beings, machines like computers or communication systems, and storage media). The four possible communication channels are shown in Figure 23. According to Theorem 29, senders of creative information can only be personal beings, while machines may serve as senders of copied or reproduced information.

There also are cases where both the sender and the recipient are parts of a complete transmission system (Figure 24).

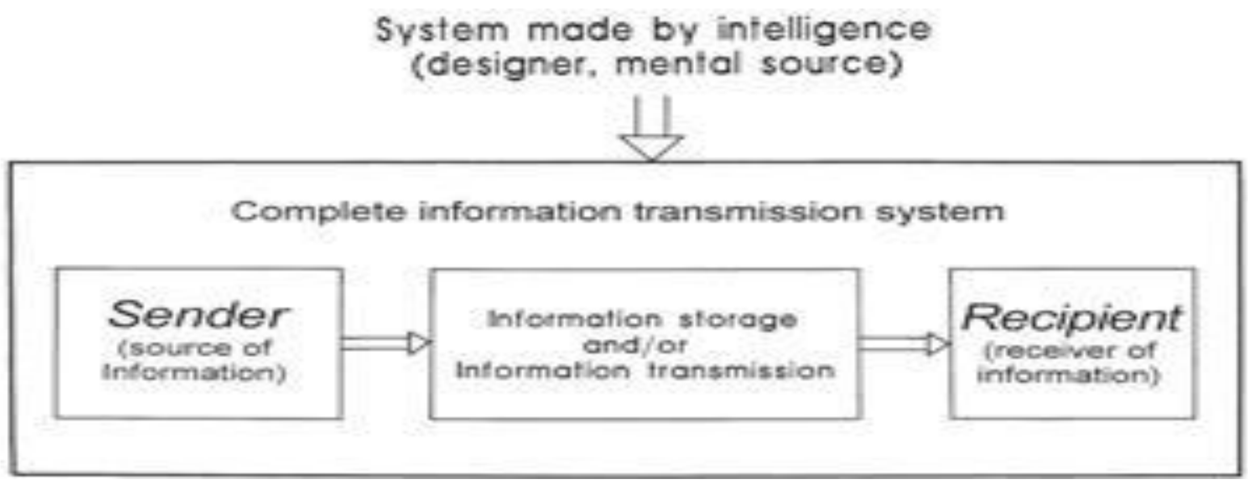


Figure 24: A complete transmission system in which sender and recipient are integrated. The entire system is based on conceptual ideas and always requires a mental source.

Example: In the system used for the transmission of exact (atomic) time in Germany, the atomic clock located at the Physikalisch-Technischen Bundesanstalt (Federal Institute of Physics and Technology) in Braunschweig, transmits the exact time over the transmitter designated as DCF77 in Mainflingen (near Frankfurt/Main). A specially designed code is employed (compare Theorems 6 to 11) and these signals can then be decoded by commercially available receiving equipment to provide time and date. Both the transmitter and the receiver are "systems created by intelligence" (the lower link in Figure 23). All the parts of this system have been produced by intelligent minds, as shown in Figure 24.

Life Requires a Source of Information

by Dr. Werner Gitt on May 14, 2009

The common factor present in all living organisms, from bacteria to man, is the information contained in all their cells. It has been discovered that nowhere else can a higher statistical packing density of information (see appendix A1.2.3) be found. The information present in living systems falls in the category of "operational information" as discussed in chapter 7. This information is exactly tuned in to the infinitude of life processes and situations, and its origin can be ascribed to creative constructional information (chapter 7). The different information aspects are depicted in Figure 26, where the statistical level has been omitted for the sake of simplicity. This diagram is of a general nature and can therefore be applied to any piece of information (see chapter 5 for domain of definition); it is in every case under consideration only necessary to identify the sender, the recipient, and the specifics of the various levels, syntax, semantics, pragmatics, and apobetics. The properties characteristic of life are indicated next to each level in Figure 26. In the case of the recipient, these levels can in principle be investigated scientifically, although we have to admit that our present knowledge only scratches the surface.

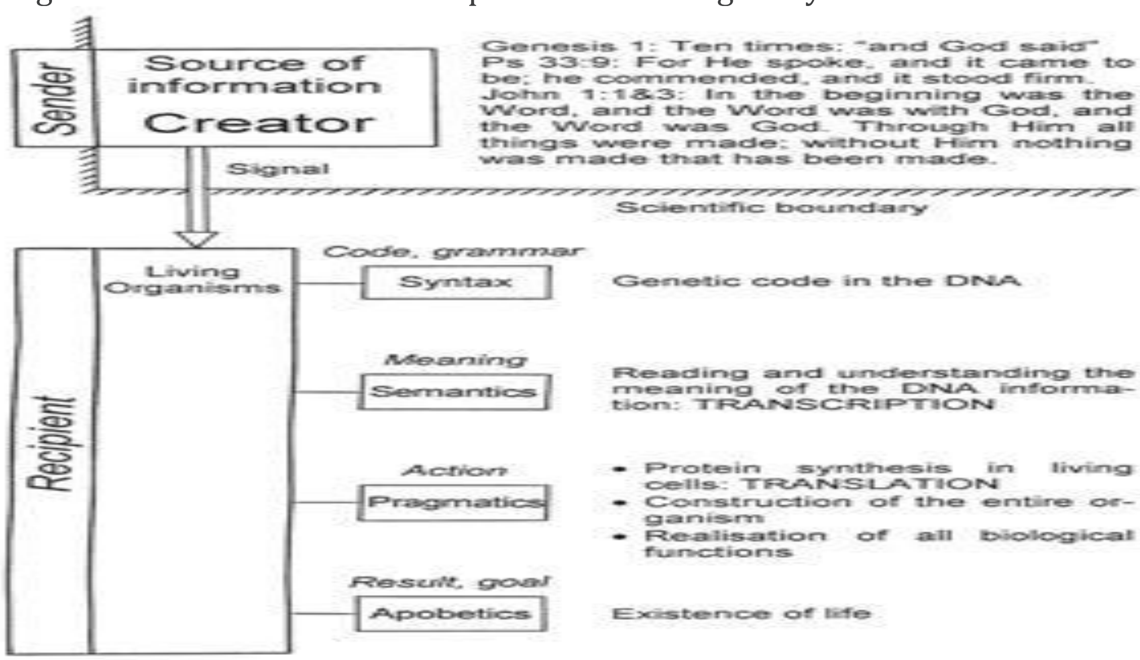


Figure 26: Concerning the origin of life. The biological information in living beings is obviously "operational information" which can be specified and investigated scientifically for the recipient on the known levels—syntax,

semantics, pragmatics, and apobetics. Its origin and nature is "creative information." Scientific analysis requires the existence of a sender, but we can only find Him in the revelation of the Bible.

According to the information laws, every piece of information requires a sender. The demarcated region in Figure 26 is in principle not accessible for scientific research, namely the person of the sender. Since the sender cannot be investigated by human means, many people erroneously conclude that He does not exist, and, thus, they contravene the information theorems. The requirement that there must be a personal sender exercising his own free will, cannot be relinquished. This sender, the Creator, has revealed himself so that we do have information about Him. He, Jesus, was in the world and the world was made through Him (*John 1:10*). Everything in the entire universe, without exception, was created by Him, as is stated in the first verses of John's Gospel and in *Colossians 1:16*: "For by him all things were created: things in heaven and on earth, visible and invisible, whether thrones or powers or rulers or authorities; all things were created by him and for him."

The close link between information and will was discussed in paragraph 3.3, and this idea is also clearly emphasized many times in the Bible. We read in *Revelation 4:11*, "You created all things, and by your will they were created and have their being." The intentional prerequisite of information is expressed in *Genesis 1:26*: "Let us make man in our image, in our likeness."

In the light of the information theorems, all materialistic evolution models are useless and are thus rejected.[1]

The British evolution theoreticist Richard Dawkins expresses the following expectation in his book *The Blind Watchmaker:* "The purpose of this book is to provide a non-supernatural explanation for the existence of complex living organisms" [D2]. As a consequence, we cannot expect to find a scientifically based answer in his discussion (e.g., because of Theorem 17).

A Biblical Analogy of the Four Fundamental Entities

Mass, Energy, Information, and Will

by Dr. Werner Gitt on June 11, 2009

The question about the origin of matter and the energies we observe in action is already answered in the first verse of the Bible.

The four basic quantities in creation: These four entities, namely mass (or matter), energy, information, and volition, were discussed in paragraph 3.3. The latter two were described as being non-material. Both material quantities, mass and energy, are subject to conservation laws, being linked by the equivalence formula $E = m \times c^2$. This means that they cannot be created by any natural process, neither can they be destroyed. Does this now mean that mass and energy are by nature eternal? No, it should be noted that none of the natural laws has existed forever, neither will any of them always be valid in the future. They were created together with everything else (see Theorem N10b in paragraph 2.3) and perform their wisely allocated functions only since creation week. "By the seventh day God had finished the work he had been doing" (*Genesis 2:2*).
The question about the origin of matter and the energies we observe in action is already answered in the first verse of the Bible: God created them! Everything came into being through His inconceivable power (*Jeremiah 10:12* and *Romans 1:20*). The active person at creation was Jesus, "through whom he made the universe" (*Hebrews 1:2*). Jesus is also the sustainer of the entire creation, "sustaining all things by his powerful word" (*Hebrews 1:3*). His creative and His sustaining acts are not restricted to matter and energy, but also hold for the information contained in biological systems.

We can now conclude (*John 1:1–3*; *Colossians 1:16*; *Hebrews 1:2*):

—Jesus is the source of all energy,

—Jesus is the source of all matter, and

—Jesus is the source of all biological information.

The totality of the information present in living organisms, designated I, represents a value characterized by high quality as well as a large volume. In the beginning, information was established through volition. The Bible tells us about the link between will and wisdom:

—"You created all things, and by your will they were created and have their being" (*Revelation 4:11*).

—"How many are your works, O LORD! In wisdom you made them all; the earth is full of your creatures" (*Psalm 104:24*).

—"Christ, in whom are hidden all the treasures of wisdom and knowledge" (*Colossians 2:2–3*).

In the light of *Colossians 1:17* and *Hebrews 1:3*, we can say that Jesus sustains all energy, all matter, and all biological information (i.e., He sustains all life). Everything that exists does so through Christ; He is the First Cause of all things. However, supporters of the doctrine of evolution deny each and every purposeful cause for this world and deny any possibility of a personal sustaining will. They thus mislead themselves and are forced to regard information as a material quantity which originated in matter. We have scientifically shown that this view is erroneous. According to His will, God gave us many creative gifts. For example: Our free will enables us to act creatively. The gift of language is the instrument through which we can produce new information (creative information!). There are two things which we cannot do: we cannot create mass (or energy), neither can we destroy it.

The spiritual meaning of the four basic entities: It should be noted that the above-mentioned four fundamental quantities have a spiritual dimension in the Bible where man is concerned. For example, in *1 Corinthians 2:14–15* a distinction is made between the natural man and the spiritual man. The former is exclusively concerned with this world, and is not bothered with the message of the Bible. His philosophy ignores God, and he thus does not consider Jesus Christ, neither is he concerned about God's purpose, salvation. He will be eternally lost without the Savior of sinners. Paul describes this situation in the following words: "For the message of the cross is foolishness to those who are perishing, but to us who are being saved it is the power of God" (*1 Corinthians 1:18*).
On the other hand, a spiritual person lives in close communion with God (*Ephesians 5:18–20*). The phrase "in Christ" occurs 196 times in the New Testament (e.g., *John 15:4*; *Romans 6:1*; *1 Corinthians 1:30*; *Galatians 3:28*), referring to somebody who has tied his life to Jesus and who is sure of his eternal life (*1 John 5:13*). Such a person eagerly hears and reads God's Word (*Rev. 1:3*) and has access to the spiritual dimension of the Bible.

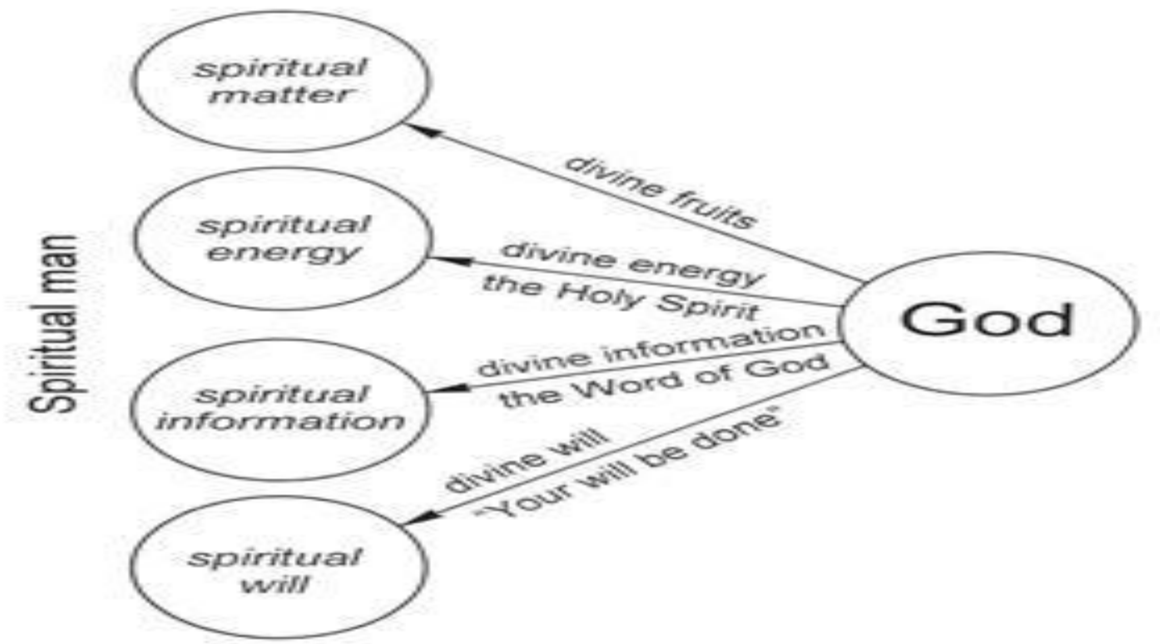


Figure 30: Basic units in the life of a spiritual person. The four fundamental entities—mass, energy, information, and will—as depicted in Figure 8, have been created by God. In the case of believers, we find a spiritual analogy for these entities, described by the Bible as divine in essence.

The four basic entities—mass, energy, information, and will—are illustrated in Figure 30, each time with the appellation "spiritual" in analogy to the biblical description of a spiritual person. It is now clear that these four created entities originated from God, the Creator. When a natural man is changed into a spiritual person, it is also a creative act of God, working through Jesus: "Therefore, if anyone is in Christ, he is a new creation; the old has gone, the new has come!" (*2 Corinthians 5:17*). This creative transformation from old to new, from the natural to the spiritual, and from lost to saved, is called both repentance in the Bible (*Luke 22:32*; *Acts 3:19*) and being born again (*John 3:3 and 1 Peter 1:23*). This act can only be accomplished through our own will (e.g., *Matthew 23:37*; *Luke 19:14*). Our willingness or our rejection is decisive for life and death, comprising the choice between heaven and hell. The four spiritual foundations take a central place for a born-again, a believing, or a spiritual person:

1. Spiritual information: In the Old Testament, God said parabolically that He has a fixed purpose when sending His Word to a recipient: "As the rain and the snow come down from heaven, and do not return to it without watering the earth and making it bud and flourish, so that it yields seed for the sower and bread for the eater, so is my word that goes out from my mouth: It will not return to me empty, but will accomplish what I desire and achieve the purpose for which I sent it" (*Isaiah 55:10–11*). This clearly illustrates the purpose-achieving and the human-assisting way of divine information.

By means of several technological and biological examples we will illustrate (see appendix A3) that in such systems, in each case:

—energy is *saved*,

—waste of energy is *prevented*,

—energy is *utilized*, and

—the consumption of energy is *optimized*.

The divine (or spiritual) information affects us in a similar way, because it

—*saves* us from being led astray,

—*prevents* us from wasting our lives,

—*uses* our gifts in life (natural talents, time, and money),

—*optimizes* our life situations (marriage, occupation, and pastimes), and

—*saves* our life from perdition, giving us eternal life.

2. Spiritual will: There is a saying which goes like this: "Whoever does what he desires, often does what he should not do." Martin Luther stated, "Whenever our free will does what is inherent, then we commit a deadly sin." Even the Apostle sent to many nations, Paul, confessed, "I know that nothing good lives in me, that is, in my sinful nature. For I have the desire to do what is good, but I cannot carry it out. For what I do is not the good I want to do; no, the evil I do not want to do—this I keep on doing" (*Romans 7:18–19*). Our best ethical intentions for doing good will not be successful if we rely on our own strength. Egoism is the most certain human characteristic.

Jesus described our will and nature much more strikingly than all philosophers, humanists, and psychologists: "The spirit is willing, but the body is weak" (*Matthew 26:41*). The deadly poison of sin is so deeply infused in us since Adam's fall, that we are "sold as a slave to sin" (*Romans 7:14*) in the truest sense of the word. "Good" intentions will not deliver us from this condition, but we require redemption through Him who conquered sin. The command "Be transformed by the renewing of your mind" (*Romans 12:2*) cannot be obeyed in our own power, but only through close ties with Jesus and by the constant influence of God's Word on our mind.

The principle mentioned by Goethe in his poem ("Erlkönig": King of the Elves) "And if you are unwilling, I will use force," does not hold for us. We gladly submit ourselves to God's will as Jesus taught us in the Lord's Prayer and as He lived daily right up to the Cross: "Yet not my will, but yours be done" (*Luke 22:42*). When your will is bound to God's Word through your conscience, then you are no longer egocentric (e.g., *Isaiah 53:6*: "each of us has turned to his own way") but Christ-centered (e.g., *Colossians 3:23*: "Whatever you do, work at it with all your heart, as working for the Lord, not for men").

3. Spiritual energy: There is no machine which can run continuously without input of energy. Similarly, a spiritual person is not a perpetual mobile. His source of spiritual energy is the Holy Spirit, without whom nobody can call Jesus Lord of his life (*1 Corinthians 12:3*). The ministry of the disciples was not based in themselves, but in the divine energy given to them: “You will receive power when the Holy Spirit comes on you; and you will be my witnesses” (*Acts 1:8*). Paul expresses the immense source of available energy when he refers to “his incomparably great power for us who believe. That power is like the working [Greek *energeia*] of his mighty strength, which he exerted in Christ” (*Ephesians 1:19–20*). Although Paul was weak of body (*2 Corinthians 12:9*), his spiritual achievements were incomparable: “To this end I labour, struggling with all his energy, which so powerfully works in me” (*Colossians 1:29*). God commands us to “be strong in the Lord and in his mighty power” (*Ephesians 6:10*).

4. Spiritual matter: Except for mass deficits occurring in nuclear processes, there is also a conservation law for matter. If, by way of analogy, we search for something permanent in our spiritual life, it will be found in the fruits of our labors for God according to the Bible. Heinrich Kemner always emphasized the difference between success and fruit. Natural man seeks success in life, but a spiritual person finds it in fruit. Success depends mainly on our efforts, but fruit stems from grace and it only grows when our life is linked with Jesus. He unlocked this secret in the parable of the vine: “No branch can bear fruit by itself; it must remain in the vine. Neither can you bear fruit unless you remain in me. I am the vine; you are the branches. If a man remains in me and I in him, he will bear much fruit; apart from me you can do nothing” (*John 15:4–5*). All our works will be revealed when God judges the world. Whatever we may regard as great successes in our life will be consumed in God’s testing fire; only fruit in Jesus will be conserved and earn rewards (*1 Corinthians 3:11–14*). It is God’s declared will that we should build our life on the fruit (*John 15:2*; *Romans 1:13*; *Galatians 5:22*; *Philippians 4:17*; *Colossians 1:10*), for Jesus said, “I chose you . . . to go and bear fruit—fruit that will last” (*John 15:16*).

Only one life, it will soon be past;

Only what’s done for Christ, will last!

The simulation hypothesis is elaborate, presuming realities nested upon realities, as well as simulated entities that can never tell they are inside a simulation. **"Because it is such an overly complicated, elaborate model in the first place, by Occam's razor, it really should be disfavored, compared to the simple natural explanation," David Kipping of Columbia University says. Maybe we are living in base reality after all—** *The Matrix,* Musk and weird quantum physics notwithstanding.