

2015-07-23

Information in Technique and Evolution

⇒ This article deals with the relation between meanings of information, technique and evolution. The terms lead towards mechanisms of self-organization and its deeper understanding.

The terms **information**, **technique** and **evolution** refer to linguistically largely fixed meanings. Moreover, the term evolution arises with partly understood mechanisms, for which proceeded clearing could be of interest.

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Approach

Statement 1: "Information is the immaterial medium for a defined effect and its proliferation in space and preservation in time."

Statement 2: "Evolution is the coaction of information and technique resulting in creation of self-organizing systems".

Note "Technique": The term technique shall herein mean an operation controlled by a living creature, which selectively drives changes by using information.

Note "Information": The term information is commonly understood as portion of knowledge, which a sender can convey to a recipient via a medium.

Note "Self-organization": The term self-organization shall herein mean the combined abilities for self-reproduction, growth and reactivity to environmental signals.

Note "Effect": The term effect is commonly understood as change produced by an operation of a system. Moreover the term effect shows relatedness to the term action in physics. In German meanings of both, effect and action in physics, even have the same term "Wirkung". In physics action means a quantity with the dimension energy times time or impulse times length of path. Physical action has magnitudes in half-integral or whole numbers of Planck's quantum of action, a fundamental physical constant.

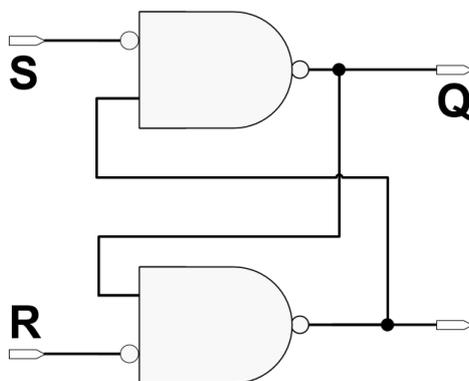
Building on the two statements at the beginning a comprehensive understanding shall be developed pulling together information, technique and evolution.

Stability and Fleetingness

Once a thought about a portion of knowledge is caught, the underlying information can be regarded as an eternal piece of immaterial something. Information in itself seems eternal and forever stable. However, without an effect in the material world the same information is of no worth. Thus information seems at the same time blank nothing unless coupled with a material expression of informational meaning. Quite opposite to the notion of information is an effect. It evidences a non-blank something in form of a material change. While matter can last for a while, a change or better: a material change is absolutely fleeting. Thus effect seems vast everything and meaningless unless it can be differentiated as a distinct result of a comprehensible operation. Information makes an effect comprehensible and an effect turns information into a material expression. Information and effect are two sides of a medal representing complementary natures. The medal itself is material existence. Now self-organizing systems bring literally live into material existence. And evolution is the overall step-by-step process. From an evolutionary point of view stability and fleetingness shall be more and more controlled. Stability of Information and Fleetingness of effects are starting point for a structured approach.

Stability of Information in Technology

The most important and basic component in information technology is the so called Flip-Flop. Flip-Flops internally feedback output signals back into input. The component is characterized by its ability to store a 0-or-1-information called binary digit or bit. Outer signals called Set and Reset (short: S, R) are taken as input. Signaling of 1 via S turns the content stored in the Flip-Flop into the information value 1. Signaling of 1 via R turns the content into 0. With R and S both held down to 0 the Flip-Flop and its stored information keeps absolutely stable.



Depiction: Flip-Flop

The principle of coupling and feedback circuits is fundamental. Its application in technology is a brilliant man-made utilization. Two components of the same kind co-act resulting in stabilizing each other. Conceptually transferred to evolution self-organizing systems are expected to build upon coupling mechanisms and feedback circuits. This gives ground for a more system theoretical investigation of live.

Control of Fleetingness of Effects

A coupling incidence by itself can be regarded as an organized operation. The principle behind gives it the potential for stabilizing information which in turn can find its expression in an effect driving a further distinct operation. However, nothing hinders regarding coupling operations and other distinct operations as mechanisms of the same kind. From another perspective the notion of information might even be seen as not-needed help-construction to bridge our understanding between two sides of the medal. The core-point is stability. And stability is delivered intrinsically when regarding coupling and operating with inner and outer effects as an inseparable unity. The difference between man-made technology and self-organization is the ahead thinking in technology which allows for tidily composed constructions. Hereby it improves overview and makes highly sense separating between information and operational mechanisms. This luxury is not foreseen in evolution. Evolutional material changes are driven by contingency. Stability is not planned ahead – it is a relentless prerequisite in evolution, even if the term self-organization might promise more. Mechanisms for achieving stability are – as in technology – based on the fundamental principle of coupling and feedback circuits. Evolution has the freedom of choice between hoping for a miracle and developing each and every effect-driving mechanism in one step with all further adaptations of coupling mechanisms needed for keeping the stability and integrity of the whole system.

Concept of Decoupling and Re-coupling

Man-made technology separates between **technique** and **information**. This concept supports powerful control over operation of a system by creating informational awareness of its internal health and external output by means of information processing. Evolution-made live from its beginning separates between **effect** and creature-immanent **knowledge**. This is aside from miracles the only concept to start with. On one hand the evolutional starting-concept provides preservation of information by means of storing it all over creature-immanent material expressions. On the other hand information starts being stored and kept in a hopeless mess. Today's brain-research tries to bring more and more order into creature-immanent knowledge by categorizing it into declarative knowledge about knowing that something is the case and procedural knowledge on how to do something. This in turn will bring us back to a separation between information, = something declarative, and technique, = something procedural. Unfortunately this separation can only be the end-point of evolution. However, the point is that the equation no stability means no live overrules every other nice-to-have concept at the start of evolutional development. Evolution at its start opens development being driven by completely uncontrolled contingency while at the same time shielding it from running into disastrous and chaotic paths. As coupling and feedback mechanisms are a prerequisite for stability it is key, that new components driving evolutional innovations have to have the ability for a coupling coaction with other components right from the start of appearance. This as an immanent rule self-controls and safeguards an evolution of coupling-technique. The trick therein is that coupling-technique is the best medium for storing creature-immanent knowledge. With growing strength of coupling technique living creatures open for random changes. Changes are accompanied by respective expressions of those changes. As a result the unfolding effects upon changes are now separated from creature-immanent knowledge. Evolutional knowledge can thus always be seen as coupling-knowledge while at the same time being knowledge about something new as well. Commonality between many identified leaps in evolution is the concept of decoupling and re-coupling of components of the same kind. Decoupling some parts of something and re-coupling them again is a two-state-mechanism and thus a basic mean for differentiation. How more and more complex systems can develop from this very binary concept is seen in powerful evolutional innovations and the mechanisms behind (see next paragraph).

Powerful evolutionary Innovations

Well known evolutionary steps reveal an admirable insight into how-to-build knowledge starting from almost nothing in the beginning. What makes it now easier is a systematic reinterpretation of evolutionary knowledge as coupling-knowledge. This sheds more light on evolution-born effects and underlying technique and information. Pace-making examples are:

Decoupled, re-coupled component	Coupling effect	Coupling operation, technique	Survival critical ability	Subject of protection	Gained evolutionary advance
Male and Female (1)	Reproduction	Merge of chromosome sets	Stabilize building plan	Genetic material (DNA)	Trial and error of cutting-edge changes
Two-way symmetric body parts and organs (2)	Mutual growth control	FGF-signal-proteins via JAK-STAT pathway	Stabilize and control differentiation during growth	Balance of biological supply cycle	Constructive step-wise evolution of complexity
Symmetric body parts of same kind (3)	Development of size or length in a direction	Reuse of proven DNA sections	Stabilize overall metabolism	Coaction and supply between all body parts	Trial of promising growth directions
Vertebrae of human spine with 34 components (partly grown together) (4)	Creation of a forming axis	Copy steps betw. down-/upwards drive Fibonacci-sequence-like growth	Stabilize supply of the head and keeping it in contact with the body	Head and brain serving with survival critical functions	Spread into space for differentiation of upper and lower extremities
Neuron (5)	Turning into efficiency for conveyance of electrical stimuli from in- to output	Strengthening synapses to link neurons enhancing neuronal efficiency	Stabilize advances of earlier developments in evolution, growth, thinkg.	Autonomic nervous system and survival-critical control circuits	Ability for faster adaptation and reaction on environmental signals
Idea (6)	Filing in respect to self	Thinkg. about Platon's ideas	Stabilize image of world	Self-perception	Technique-free information

Reference for further Deliberations

The above article leads to a key-finding herein: (a) Evolution is simultaneous evolution of stability and integration of something new. (b) Evolution is evolution by stability-providing couplings and integration-ready differentiations. Basic deliberations leading to this highly compressed formulation are collected in a comprehensible article on growth, symmetry and integration (unfortunately written in German language), source/web-address:

www.kruegergold.de/texte/wachstum-integration.pdf ... far-reaching further deliberations deal with thinking and differentiating, which will lead to a comprehensible system theoretical approach to neuronal mechanisms (in German), source/web-address:

www.kruegergold.de/texte/sechster-sinn.pdf ... contributions helping to deliver readable editions in English are highly welcome. Please send text-parts in English to [bruno\(at\)brunok\(dot\)de](mailto:bruno(at)brunok(dot)de). Thank you so much for reading this.

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