Extended Abstract

Emergence of Information and Value Formation – Important Categories for Theory Development – About the Idle but Wrong Attempt to Teach War Robots Ethics

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Accepted:

If we want to grasp the essence of information, then we must take its emergence into account. ***[1],[2],[3]*** *This requires an interaction between form (syntax), content (semantics) and effect (pragmatics) of information as three qualitatively different, interdependent process stages of information production and its utilization: mapping, interpreting, evaluating.*

The emergence of information is a new category in the theory of biology ***[4]*** and organization. Cybernetics (1st order), control technology, always presupposed information. Informatics, which developed later, also recognizes the concept of information processing, but until now, the concept of information emergence was not or insufficiently acknowledged.

When we compare technical control with the regulation processes of cell metabolism, a comparison arises between the technical automaton and the living organism. *This leads us to a central conclusion: The living, developing organism is principally distinguished from the technical automaton by the processes of emerging information and formation of values in a process of self organization.* ***[5]***

The principle of creativity, of information generation, provides epistemological and methodological guidance. The principle of the generation of information has been of fundamental importance for the building of models and theories at the transition zone of physics, chemistry and biology. These questions about the characteristic features of information are particularly topical in molecular biology, in the neuron sciences, in linguistics, in the paradigm controversy of cognitive science and in AI research, and even in the modern theory of enterprise organization. This clearly shows that information emergence and value formation are very important categories for the theory development in the boundary between physics/chemistry and biology (to understand the origin of

life) and between computers (software) and the human mind, information systems and creative learning social organization. ***[6]***

The notion of complementarity was first presented by Niels Bohr 1927 to harmonize the conflicting views taken by different physicists. Bohr gradually extended the complementarity concept to a much wider domain, and it took on the character of a general theory on the nature of human knowledge, sometimes called the "Copenhagen Spirit". Many scientists, including Schrodinger and Delbrück, were fascinated by Niels Bohr's lecture 'Light and Life', and conjectured that for the ultimate understanding of life, some novel, fundamental property of matter must first be found, most likely via the discovery of an intuitively paradoxical biological phenomenon.

The development of molecular biology showed that such a paradox does not exist. It should be said, that N. Bohr, in his 1962 lecture: "Light and Life Revisited," acknowledged that meanwhile the success of molecular biology has transcended the instrumental limits on the understanding of life that he had foreseen thirty years earlier. Manfred Eigen1 clearly said [7] that we do not need a 'new physics' but something 'new in physics' – that is 'information'. We have an information theory but not a theory of 'information generation'.

The role that the concept of information generation plays in the theory of the origin of life as well as in model and theory formation at the boundaries between physics, chemistry and biology, and also between computer science and the humanities ***[7, [5], [1], [8], [9]*** has to be investigated still much more.

The epistemological and methodological implications of the concept of creativity, of information generation, can inspire ideas in nearly all areas of human interest. It provides methodological guidance to navigate between the Scylla of crude reductionism: reduction of life to pure physics and chemistry (physicalism) and 'mind–brain identity' (neurophilosophy), strong connectionist AI research, and the Charybdis of dualism: of mind-and-matter dualism and hardware-software-dualism, of strong cognitivist AI research.

With the example of the "molecular biologist and the chicken," we intend to illustrate the emergence of the biological information, for to show the basic ideas underlying our evolutionary stages concept of information. In this respect, we arrived at general affirmation: *Information is not a substance; it exists as relation between a sender and a receiver. A special aspect of this relation is the structure of the information carriers, generated by evolution* ***[9],[10],[11]*** *as e.g. DNA-Code. The information phenomenon cannot be reduced to the mapping or syntactic aspect on any of the different levels of complex systems.*

Indeed there is no information concept that can be reduced to one of the process stages: *mapping, interpreting, evaluating.* It is not possible to reduce the pragmatics of information to semantics, or semantics to syntax. Humans and humanity can not be reduced to machines

With the "evolutionary stage concept of information" developed by us, we consider the processes of information emergence and value formation in the processes of the self organization

The realization of a function has a complex structure as prerequisite, which can only be formed on the basis of information, which however in turn, is only created and preserved by this special function. This connection of structure and function is arranged by meanings, which are formed only in this process of interaction. Information therefore arises first, when with the realization of the function, by the effect, an assessment (and with that a selection) has been made, by which the information gets its meaning. It is a circle process - this process has information as prerequisite, which is generated only in this process. This chicken or egg problem dissolves in this complex circle interaction. [7]

Information is indeed on the one hand a condition for the origin of the life and information arises first with the origin of the life

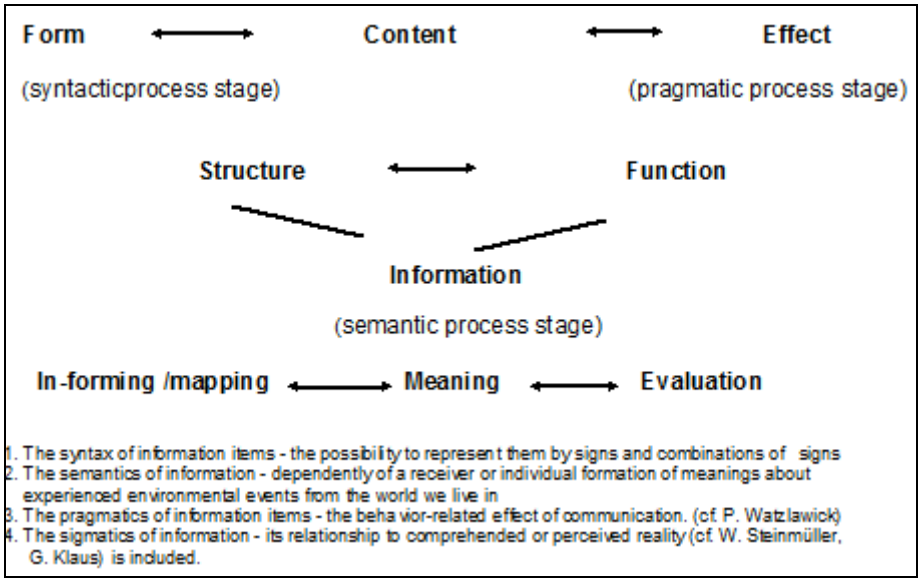

Figure 1

We represent the evolution of information, the emergence of the meaning of information, in the interaction of (syntactic) pattern, (semantic) meaning and (pragmatic) evaluation, as an evolution of different (5) levels of organismic/human and social communication processes.

1. Level Macromolecules, 2. Nervous system, 3. Consciousness of environment, 4. Consciousness of society, 5. Consciousness of values.

The Evolutionary Stage Conception of Information

Process stages of the generation, utilization, and preservation of information

Characteristics of information	**FORM** (Syntax) Formation **Structure** Spatial form of existence	**CONTENTS** (Semantics) Interpretation **Meaning** Temporal form of existence (Simultaneousness)	**EFFECT** (Pragmatics) *Evaluation* **Behavior** Spatial temporal form of existence
Levels of Organization			
MACRO-MOLECULES	Arrangement of molecules (e.g. DNA)	Interaction in a molecular interpretation system -	Functionaliation of the molecules with selection and survival of the adapted feature
NERVOUS SYSTEM	Arrangement of nerve cells and impulse patterns in the brain	mental and sentimental structures of as indivisible quality recorded programs	Control of behavior
CONSCIOUSNESS OF THE OUTSIDE WORLD	Arrangement of objects in the environment	Perception of objects as indivisible qualities	Interpretation of the environment
SOCIAL CONSCIOUSNESS	Arrangement of signs and symbols of language, also stored digitally	Interpretation of sound signals & selected language symbols (social contents of language)	Knowledge (education), social strategy & behavior, also Man- Computer interaction
SELF-AWARNESS COUNSIOUSNES of VALUES	Arrangement of the mental signs & symbols in metastructures, Objectification in, social structures tools, software	Interpretation of mental signs & symbols by means of auto communication	Determining one's own behavior and formation of values--

Figure 2

We have to recognize a relatively new form of universal interconnection. Just as quantum physics had to learn that the motion of an electron is only one aspect of the whole, and just as biology had to learn that living organization does not simply consist of parts which can be analyzed and subsequently recomposed, we need to

take into account the interconnection of mapping, interpretation and evaluation as specific and interrelated process stages in the generation, use and preservation of information.

In this paper we specially look at the fifth level. As the level of self-awareness, it can also be described as the consciousness of the values.

If we are concerned with the self-development of the human personality, we proceed from the assumption that human beings live in society and follow the social values which have been formed in the process of social development. Values serve to reduce the complexity of human behavior, of human actions and interests. At the same time, the development of society is also the development of its system of values. With the development of social information and communication, also a development of societal and of self-confidence, of social and individual values takes place.

This signifies that indeed the information processing approach (of cognitionistic and connectionist AI research) provides too narrow an understanding of information and values. In the case of the "New AI", the development of relatively autonomous systems like robots, it is necessary to differentiate between pre-rational (intuitive), rational , post-rational (intuitive) and irrational action. Only the objective rational actions are the subject of rationalization and only formalized actions are the subject of automation. Analytic (rule-based) approaches use in novel situations or when problems occur a selection of known possible actions.

The paradox of safety shows; that by increasing the degree of automation we derive more safety and stability but at the same time we create vulnerability of society as a whole, by its increased dependence on such sophisticated technological systems. ***[12]***

The paradox of safety makes clear that informatics has to adopt a different image of man: The concept of complete or super-automation in the sense of a complete reduction (or exclusion) of human participation is misleading. The concept of Man as a faulty living being, as the unsafe element to be replaced is misleading.

Man must not be seen as a disturbing factor which can be more ore less completely replaced by modern information technologies, but rather as the only creative productive force, as the subject of all progress and of all development. "Since information generation is a process that allows novelty to emerge, it goes beyond a mechanical process that can be formalised, expressed by mathematical function, or carried out by a computer." ***[3 S. 171]***

The intuition of man represents an essential component for coping with complex tasks. Human intuition extends the possibilities of decision making beyond what would be possible with rational abilities alone.

Differentiation of actions and the value of intuition

Intuition as essential component to master complex tasks. Human intuition extends the possibilities of decision making beyond what would be possible rational (formalized) abilities alone.

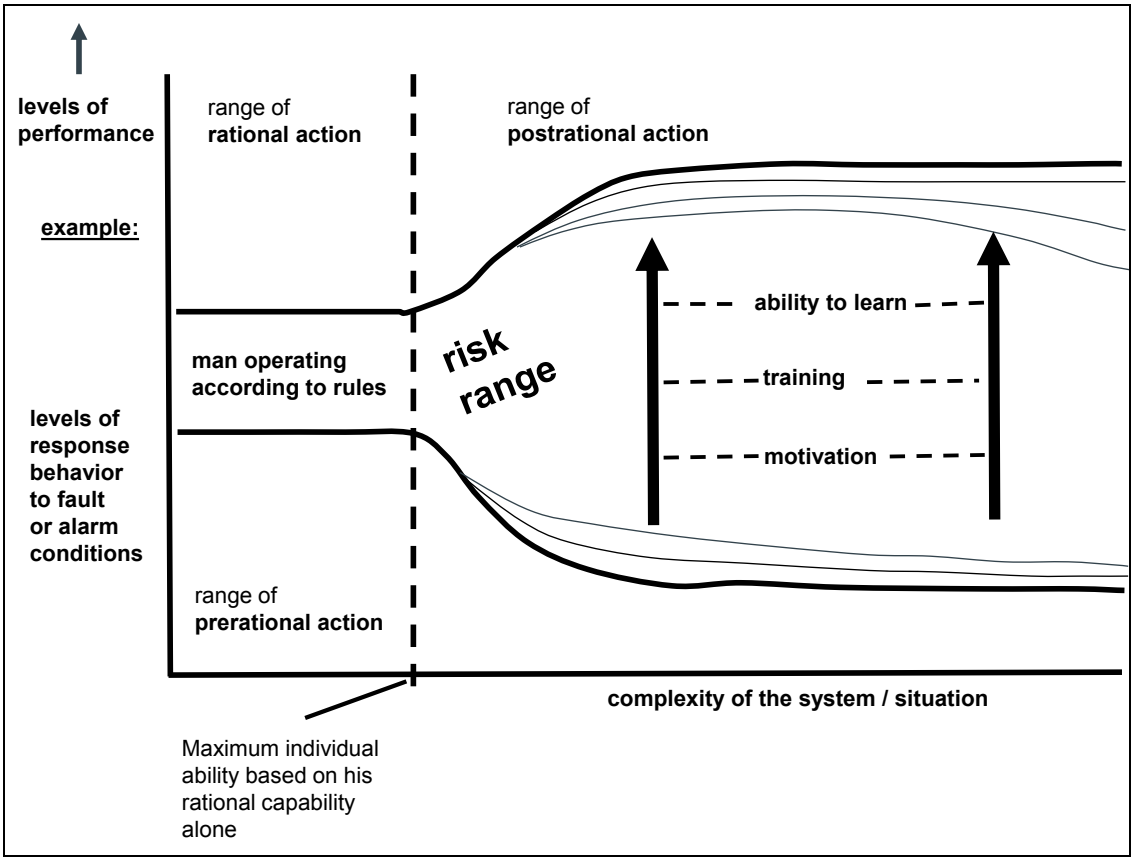

Figure 3

Also ethical decisions of Man are not only based on (formal) rules, the possibilities of making ethical decisions goes beyond the (formal) rational abilities of the computers - the war robots. This is especially important to respond to alarm or fault conditions in a battle.

The Five-Stage of the Skill-Acquisition Model of Hubert and Stuart Dreyfus has also ethical implications. ***[13]***

Parallelism between the acquisition of skills (H. Dreyfus, S. Dreyfus [13]) and the levels of performance (J.R. Blau, K. Fuchs-Kittowski [12])

At a low level of complexity, the response is likely to be linear and parallel to the complexity of the situation. As complexity increases, however, the response to alarm or fault conditions become unstable and eventually will become unbounded.

The only way to bound the response is to introduce the post rational criteria into the system design. A differentiation between pre rational, rational, post rational and irrational actions is necessary.

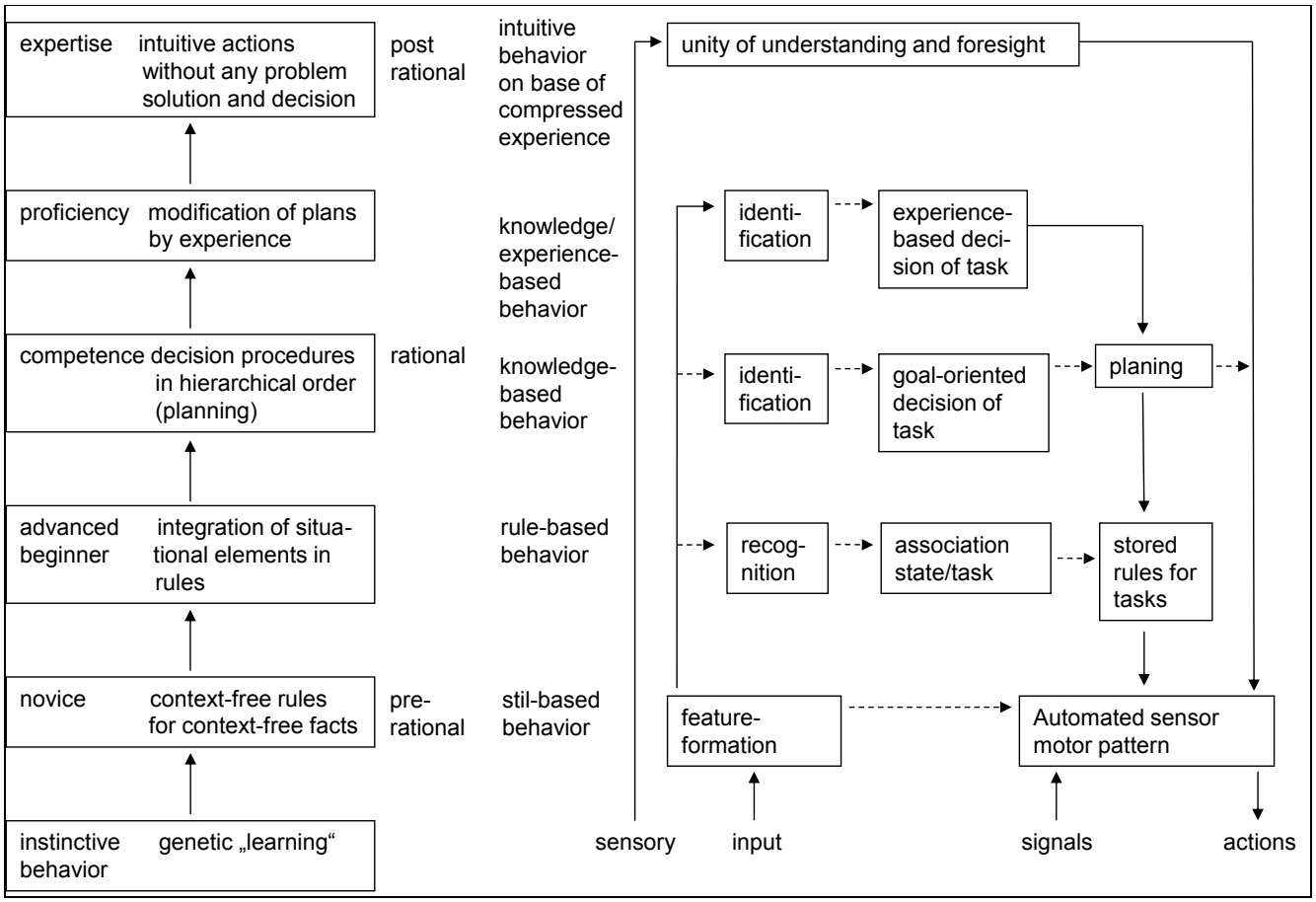

Figure 4

We assume with Hubert and Stuart Dreyfus ***[14]*** that acting ethically is a skill. We use their phenomenological description of the five stages of skill acquisition to show that an ethics based on principles corresponds to a beginner's reliance on rules and so is developmentally inferior to an ethics based on expert response that claims that, after long experience, the ethical expert learns to respond appropriately to each unique situation.

Also civilian autonomous vehicles can get into complicated accident situations. They must be programmed to behave so, that as many human life's as possible are spared. Is this already a moral behaviour? Of course one can programme a war robot that he stops shooting, if a man stands with raised hands in front of him, certainly it is possible to teach an armed drone to stop with bombing, if it sees a Red Cross on the roof of a house. Is this however really moral behaviour, do these systems follow ethical principles? Are they thus really equal to the complex situations in the combat mission? Surely not!

Ethics often exists in terms of a set of rules that are intended to supplement the basic laws of the community. Such rules, like those of professional societies, e.g. the "A.C.M. Code of Ethics And Professional Conduct" are important, but certainly not designed, to help in such serious ethical decisions as Joseph Parnas ore Edward Snowden had to make.

But also if we not follow the phenomenological approach and think, like I. Kant and others, that there is a rational basis of morality and ethics, so that also complicated, deeper ethical decisions are based on rules and principles, one is not able to teach the computer moral behavior, because the basic principles are very general, can only be followed with a deep understanding of the situation. On the basis of the evolutionary stage concept of Information it becomes obviously, that the level of self-awareness or consciousness of the values is a meta-level of information generation and value formation, based on the syntax of syntax, the semantic of semantic and the pragmatics of pragmatics.

Ethical values are rooted in empathy that has "its real depth and width in the deep respect for life," as was pointed out above all by A. Schweitzer, in his Nobel Peace Prize acceptance speech in Oslo,1954 ***[15]***.

However, computers are not participants in a social process; they are not personalities whose development is shaped by living a life that involves an interweavement of biological, psychological and social processes.

As can be demonstrated on the basis of the evolutionary stage concept of information, on the stage of self-consciousness, (the "stage of values"), on the level of ethical expertise the ethical decision-making requires post-rational actions which are not the subject of automation, because they include intuition, information generation. Expert (ethical) decisions, no longer rely on rules, guidelines or maxims, they rely on intuitive grasp of situations, based on deep tacit understanding.

Some scientists therefore have an unrealistic claim that they could teach ethics to war robots. It is an idle but wrong attempt! Deeper reflections on the relationship between technology and intelligence, computer (software) and the human mind in its social context show that the process of information generation and value formation is far more complicated. To ensure an interhuman understanding, to be able to generate social meanings and meta meanings, to form social values, the robot would require a long period of socialization in the human community.

War robots, armed drones will not have any ethics; they should be banned as soon as possible, to prevent a new senseless arms race!

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