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Expert opinion on the dissertation of Mr. Federico Flueckiger

**!! Translation !!**

## **Contributions Towards a Unified Concept of Information**

It is astonishing that in the framework of the discipline of informatics so little thought is given to the term "information", where, after it all, it received part of its name (in 1960 in France as "informatique" to create a linguistic-political boundary in the face of the American "computer sciences"). "Information" is one of those terms (such as time, mass, or energy) whose meaning people "just know" and which people have found out that they can live with and use in their work without any need for more precise definitions. Without any genuine definition, information is an omniscient fact of our age anyway, from the media (information saturation...) to banks (money is a carrier of information ...) to the "information society", not to mention the technological-economic side of information and communication technology (ICT) and the ecological shadow it throws (telecommunicating instead of traveling ...).

For information communication technicians the matter of coming to terms with their information-relevant problems is already clear enough since 1948 when C.E. Shannon published his groundbreaking "information theory", which even came with a unit of measure and an energy equivalent: 1 bit is the information quantum necessary to precisely halve a given uncertainty; and this requires at least 10<sup>-21</sup> watt seconds (at room temperature) of energy. Everything which has been achieved at the cutting edge of communication and information processing and storage (for example, data and video transmission over billions of kilometers between space probes and Earth, or the compression of several hours of video film on a CD disk) can be interpreted as successive steps towards the physical limits postulated by Shannon. And, finally, the knowledge of genetic research and neurobiology teach that, here too, the existing instruments based on the Shannon model have served their purposes well, at least to date. But the unpleasant feeling remains that a concept which may be practicably heuristic unnecessarily limits the horizon of knowledge.

This is roughly the environment in which the Mr. Flueckiger's dissertation is located. Its strongly philosophical component (with corresponding, decisive references to philosophical source materials) is obvious, and its pure knowledge orientation is also a consequence of that (in contrast to the results orientation according to research classification). But the threshold to future applicability is perhaps not so far off: Flueckiger's theory may lead to deeper insights into, for example, the modeling of data bank designs.

In an historical overview, a first section summarizes presently known (besides Shannon, largely from philosophical sources) theories about information. A second, more detailed section, very tightly composed, is devoted to its fundamentals in a very broad sense. The focus is on, for one, semiology and the different notions of semantics, and for another, the continuative aspects of learning and knowledge from a psychological and neurobiological perspective. The comparative and evaluating summary of this section on the fundamentals provides the basis for the third section of the paper containing Flueckiger's approach of a unified term for information – a genuine (new) information theory. As a model intended to be used formally, it is both (in the terminological world

of Algebraic structures) mathematically supported and focusable on a type of "fundamental theorem of information theory" with astonishing parallels to the second law of thermodynamics.

Flueckiger's approach assumes the basic term "thing", defined on the basis of several principles, (individually associated and thus limited in time), which is embedded in an envelope of directed relationships to other things, which, if perceptible, can be things themselves and whose directions (away from the thing – towards the thing) state respectively 'semantic' or 'syntactic' relationships. Thus, perceptible objects as well as recognizable events (including any "fantasy structures"), in other words the structural-attributive as well as the functional-cybernetic aspects, are included. Flueckiger measures his model against three basic questions postulated at the beginning of his paper, which until now have been answered controversially and to which his theory is intended to provide clear answers (or decisions from among the controversial views). These three basic questions are: (1) Is information that process which enlarges knowledge or is it knowledge itself? (2) Is the (indivisible) information quantum the bit in Shannon's decision theory or the smallest unit of perception? (3) Is there one uniform metric of information or incompatible metrics of independent information theories?

The unusually highly interdisciplinary character of Flueckiger's dissertation is obvious. Its mentoring, support and evaluation would not have been possible without the hands-on and committed assistance of colleagues in other disciplines at our university. First and foremost, Dr. Stefan Hottinger, lecturer in the Institute of Philosophy, must be named, whose support, granted over a long period of time, contributed substantially to the philosophical nucleus and to matters further afield. The professionalism of the mathematics was assured by Dr. Jürg Schmid from the Institute of Mathematics and that of the bioneuronal section was assured by the Director of the Institute of Physiology, Dr. Hans-Peter Lüscher. All of you deserve the most heartfelt thanks of the signatory,

Hansjurg Mey