

# Chapter 17

## Towards a General Theory of Information

**Laura L. Pană**

*Polytechnic University of Bucharest, Romania*

### ABSTRACT

*Contemporary society is an information society based on information sciences and information technology. Technical information is therefore the most accessed and further promoted. This chapter aims to push toward completeness the study of information by analyzing the variety of information types and by presenting the hierarchy of information levels of existence. Specific features of natural, social, and human information are highlighted. The internal information structure of distinct domains and levels of natural and social existence is explored. Information types such as structural information, systemic information, functional information, or free information are characterized and defined from various perspectives. An interdisciplinary study of information is thus accomplished by using findings from several scientific and philosophical disciplines from information epistemology or information aesthetics to neuroinformatics and neurorobotics. New research topics such as information values, information efficiency, and information responsibility are proposed at the end of the chapter.*

### INTRODUCTION

Today's society and our entire epoch are often characterized as the information society, respectively the information epoch, which is the current stage of the technical era. The technology developed on information bases – Information Technology – is now exhaustively studied and further rapidly developed. Consequently, technical information is nowadays the most accessed. This article attempts to bring nearer to completeness the theory of information by analyzing social and human information, existing in various, humanlike and human-made structures, processes and activities. The complex status of information is based on its double quality, namely that of an essential component of existence at all its structural levels, and that of a founding concept for many scientific, technical and philosophical disciplines. An interdisciplinary study of information is thus accomplished, by using findings from several scientific and philosophical disciplines, from Information Epistemology or Information Aesthetics to Neuroin-

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formatics and Neurorobotics. Various information types, specific for different existential levels, such as structural information, functional information or free information will be characterized and defined, as well integrated in a general overview of the world of information. New research themes such as information values, information efficiency and information responsibility are proposed at the end of article.

## **BACKGROUND**

Intellectual life is dominated today by information-related activities such as information generation, information processing, evaluating, managing and using. Under these conditions, even society, as well as the whole existence could appear as a hierarchical succession of informational structures, processes and activities. This information-centered vision is supported by a series of scientific representations and philosophical outlooks. Some outstanding findings of these cognition area show, respectively argue that information is present, active and has a decisive importance at each layer and in every field of existence: in nature, society and technology. In the field of physics, various structural layers of existence are often associated with certain informational features. Sometimes the hypothesis of generation of distinct existence forms by various information contents is formulated. At other times, even a distinct kind of matter is postulated – the so named *informatter* –, characterized by some deep constitutive information sorts, such as electric charge, lepton or baryon number, charm and strangeness (Drăgănescu, pp. 52, 228, 219).

The synthetic concept of *informational energy* was coined and elaborated by means of mathematical statistics (Onicescu, pp. 4-5). The formula associated with this concept makes possible an overall characterization of the organization state of a system: when the system is completely disorganized, its informational energy is minimal, and when the states of the system tend to be reduced to a single state, its organization is total and the informational energy to maximum.

Energy, organization and information are correlated and within different technical approaches. Norbert Wiener was the first who explicitly stated that information is that what counteracts the degradation of energy as the increasing of disorder in systems, and who defined information as negative entropy or *negentropy*. In other, kindred, but more nuanced approaches, as that of J. Guillaumaud, who accept only an analogy between negentropy and information, this latter is understood as *potential anti-entropy*, with the same role: that of a measure of the degree of organization of a system. Recently, datastore technologies were enriched with *active anti-entropy* applications, by which can be developed faster-growing Web-based, mobile and social networking activities, as well as cloud services, used to solve conflicts between information object replicas stored on different nodes or between concurrent client updates, and devoted to avoid physical data loss and corruption, and other events that distributed systems are built to handle. A *passive anti-entropy* system heals information object conflicts only when a read request reaches the web service from a client: any conflicts between objects that are not read by clients will go undetected. In an active anti-entropy technology, conflict resolution runs as a continuous background process, by which databases are updated in real time as new writes come in, which reduces the time that it takes to detect and repair missing or divergent replicas.

Some authors studied *information entropy* and more, its role in *social entropy*. They demonstrated that the quantity of information in a social system depends only on its complexity and dynamics (Șilețchi & Lascu, p. 19), but also that important in social entropy reducing are not only order and disorder, but also orientation or disorientation of social processes (p. 37-53); a well oriented social development can stabilize the variation of social entropy and thus can decrease the probability of crises in the society - nature

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