

# The General Theory of Information as a Unifying Factor for Information Studies: The noble eight-fold path

Mark Burgin

**Abstract:** We analyze advantages and new opportunities, which the general theory of information (GTI) provides as a unifying factor for information studies.

**First**, the general theory of information gives a flexible, efficient and all-encompassing definition of information. In contrast to other definitions and descriptions used before, this definition is parametric allowing specification of information in general, as well as information in any domain of nature, society and technology.

Even more, the new definition taken in broad context make it possible to unite the conceptions of information, physical energy and psychic energy in one comprehensive concept. Being extremely wide-ranging, this definition supplies meaning and explanation to the conjecture of von Weizsäcker that *energy might in the end turn out to be information* as well as to the aphorism of Wheeler *It from Bit*.

This shows that the general theory of information provides means for a synthesis of physics, psychology and information science playing the role of a metatheory for these scientific areas.

At the same time, the new definition characterizes proper information when the general concept is specified by additional principles. The construction of an infological system allows researchers to exactly delineate information in the area of their studies.

**Second**, the general theory of information explains and makes available constructive tools for discerning information, measures of information, information representations and carriers of information. For instance, taking a letter written on a piece of paper, we see that the paper is the carrier of information, the text on it is the representation of the information contained in this text

and it is possible to measure the quantity of this information using Shannon entropy or algorithmic complexity.

**Third**, the general theory of information provides efficient mathematical models. There are models of three types: information algebras, operator models based on functional analysis and operator models based on category theory. Functional representations of information dynamics preserve internal structures of information spaces associated with infological systems as their state or phase spaces. Categorical representations of information dynamics display external structures of information spaces associated with infological systems. Algebraic representations of information dynamics maintain intermediate structures of information spaces. These models allow researchers to discover intrinsic properties of information.

**Fourth**, the general theory of information supplies methodological and theoretical tools for the development of measurement and evaluation technologies in information studies and information technology. Moreover, any science needs theoretical and practical means for making grounded observations and measurements. Different researchers in information theory have developed many methods and measures. The most popular of them are Shannon's entropy and algorithmic complexity. The general theory of information unifies all these approaches opening new possibilities for building efficient methods and measures in areas where the currently used methods and measures are not applicable.

**Fifth**, the general theory of information offers organization and structuration of the system of all existing information theories.

However, it is important to understand that this unifying feature and all advantages of the general theory of information do not exclude necessity in special theories of information, which being more specific, can go deeper in their investigation of properties of information and information processes in various areas. For instance, syntactic information theories, such as Shannon's theory, are very useful in the area of communication. Algorithmic

information theories, such as the theory of Kolmogorov complexity, are very useful in the area of automata, computation and algorithms. There are also semantic, pragmatic, economic, semiotic and other special information theories, each of which is directed at investigation of specific properties of information, information processes and systems.

**Sixth**, the general theory of information explicates the relevant relations between information, knowledge and data demonstrating that while knowledge and data are objects of the same type with knowledge being more advanced than data, information has a different type. These relations are expressed by the Knowledge-Information-Matter-Energy Square:

*Information is related to knowledge (data) as energy is related to matter*

In particular, it is possible to transform knowledge or data into information as we can transform matter into energy.

**Seventh**, the general theory of information rigorously represents static, dynamic and functional aspects and features of information. These features are modeled and explored by algebraic, topological and analytical structures of operators in functional spaces and functors in the categorical setting forming information algebras, calculi and topological spaces.

**Eighth**, the general theory of information explicates and elucidates the role of information in nature, cognition, society and technology clarifying important ontological, epistemological and sociological issues. For instance, this theory explains why popular but not exact and sometimes incorrect publications contain more information for people in general than advanced scientific works with outstanding results.