Preface and Prologue

The linguistic term information is loaded with confusion which is enhanced by different inconsistent associated concepts such that its phenomenon has become amorphous without a head or tail. Information has been made into a strange thing, where the head is the tail and the tail is the heard. Unlike the phenomena such as matter and energy, information seems to be undefined. In this strange situation, information is taken to be anything such as data, fact, evidence, knowledge, and many others where there are some who maintain that information is information in circularity of definitional reasoning. In this confused epistemic framework, theories of data, evidence, fact, and knowledge are claimed to be the theory of information. This epistemic confusion is amplified by a number of scientists who equate communication theory with information theory. There are some who claim that information theory is a branch of applied mathematics, electrical engineering, and computer science involving information quantification. The defining claims that information is not different from the mathematical definition of a variable \( x \), where \( x \) is \( x \) by definition in a content-free analytical environment. In this way, the variable \( x \) can be made to represent anything in any system of thought. This mathematical definition of variables constrains the development of language where classifications into categories, groups, and sets are useful in a non-content-free environment. Categories, groups, and sets impose contents on mathematical and logical variables by their definition. Within this epistemic confusion, there are claims of analytical sub-fields called the sub-fields of information theory such as coding theory, algorithmic complexity theory, algorithmic information theory, information-theoretic security, and the theory of information measurement.

The result of this epistemic confusion is the general claim that the objective of information theory is the study of the transmission, processing, utilization, and extraction of information and the resolution of uncertainties. In this respect, information theory is intimately connected, as it should be, to the theories of knowledge, decision-choice behavior, and command-control management. A problem arises when the mathematical theory of communication as advanced by Claude Shannon is taken to represent the essential component of information theory. Claude Shannon objective is to solve some specific computational problems, where information is
viewed in terms of a set of messages in the possibility space, where such messages in the transmission process must pass through the probability space due to the existence of a noisy channel, and where the message sizes are to be quantitatively related to the channel capacity. In other words, what is the relationship between the message size and channel capacity in the information delivering process? This is the source-destination information delivering problem which is part of the general source-destination delivering problem of all objects and processes, where capacity must be related to size. The solution to the size-capacity problem requires the assumption of the given contents. It further requires that the contents be packaged in a manner that is consistent with an optimal capacity. The problem simply fits into maximization of capacity subject to size or minimization of size subject to capacity. In this way, there are size conditions and capacity conditions that must be considered in the source-destination delivery process. The conditions of the size, the capacity, or the channels cannot be used to define the contents contained in the message. This seems to be the situation in dealing with the mathematical theory of communication or information as abstracted from the tradition.

In the case of information communication, the packaging of the information contents takes the form of representation of the messaging in the form of codes and the development of optimal coding. Alternatively, the code representation of the contents contained in the message sizes that is the packaging may be taken as given constraints on the development of optimal capacities. The coding system includes the use of existing language forms or the development of new language forms that must satisfy the source-destination familiarity. Whatever may be the case of source-destination delivery optimality, the process is about controlled communication over the epistemological space. In other words, the source-destination delivery process is about communications among ontological elements in the epistemological space where cognitive agents have to work within necessity–freedom duality, and where necessity constrains freedom to generate sufficient conditions in the management of the command-control process of decision-choice systems.

In all the approaches to the theory of information, one thing that is clear is that the concept and phenomenon of information remain undefined and illusive. Information cannot be defined within the analytical system of mathematical theory or any other theory of communication, where the conditions of the probability space are of epistemic essentiality. It also cannot be defined in the analytical system of the semantic theory of information where the conditions of data space are of epistemic essentiality in the theory. It is the case that, just as the source-destination size-capacity delivery conditions cannot be used to define the contents and the phenomenon of things to be delivered, so also the size-capacity delivery conditions of communication cannot be used to define information. In all analytically conceivable space, information cannot be defined by the concepts of data, facts, evidence, and context-free representationally structural instrument such as a mathematical calculus or any element of/in the family of abstract languages. Information is an input into the communication process to deal with control-state production. In terms of the relationship between information and communication, communication is a process of action for carrying messages of information under
energy while information is the essence of that which is communicated within states and over states where within states is static in nature and over states is dynamic in nature. Information, just as matter and energy, is something, and the search for this something is the preoccupation of this monograph.

Communication constituting a process of action of a carrier cannot form an input into decision-choice and transformation actions on alternatives where such alternatives must be seen as varieties with defined identities. It is that which is communicated that constitutes the essential in knowing that affects the management of decision-choice systems and that which is communicated cannot be defined by the communication process. The contents and the phenomenon of things which are being delivered cannot be defined by the means of modal conditions of delivery. Shannon’s initial approach to the development of the mathematical theory of communication was intended to solve particular technical problems in relation to size-capacity conditions in the source-destination duality over the epistemological space under the command-control activities by decision-choice agents. His mathematical construct is about communication viewed as a mode of delivery of messages in a manner that produces optimal mathematical size-capacity relation. The problem over the epistemological space may be defined for person–person intercommunication, person–machine intercommunication, and machine–machine intercommunication, where social decision-choice activities are defined for transformations of socio-natural varieties. In this respect, the focus of the mathematical theory of communication was, and is, on the conditions of the efficient transmission of information when it is known through the reproduction of messages from one defined point to another specified point through noisy channels of uncertainty, where the event of the correct message being sent is measured by probability distribution over the epistemological space. This probability is part of the delivery conditions and may not be used to define the concept of information and then fix the phenomenon of information in probabilistic boundaries.

The task of the mathematical theory of communication is not on the work of the general information that contains the contents and the signals. The task seems to concentrate on how best to transmit and interpret the signal disposition given the content disposition. The theory of communication involves the delivery conditions of content disposition through signaling and optimal coding. It is part of the general theory of information and not the entire general theory of information itself. Unfortunately, the mathematical theory of communication as advanced by Shannon has helped in understanding and creating solutions to specific size-capacity problems in messaging in engineering conditions. However, the directions that have been taken by many information theorists and scientists have made the mathematical communication approach into a theory of information, where the emphasis is on the theory of quantitative measure of signal transmission and channel capacity. This mathematical approach developed on different probabilities and probability distributions has become an important constraint as well as an epistemic limitation on the development of the general theory of information.

The general theory of information must lead to the recognition of differences and similarities that form the development of the concepts of cluster, group, category,
and set in mathematics and non-mathematical discourse to establish varieties, differentiations, and categorial varieties for comparative analysis and the understanding of conditions of static and dynamic behaviors of elements. The idea of variety is the epicenter of the development of the general theory of information and the development of forms of representation. The theory of communication deals with a small but essential part of the general theory of information, just like the theory of languages or representation deals with an essential part of communication. The general theory of information must deal with contents and transmission of the contents for which identities and categorial identities can be known in time and over time, in such a way as to provide direct inputs into knowledge production and indirect inputs into decision-choice activities which have no material relevance without varieties that may establish comparison of alternatives.

The ideas of in time and over time relate to the ideas of static and dynamic behaviors of varieties as revealed by the concept and phenomenon of information. The implication, here, is that the general theory of information must be seen in terms of the theory of info-statics and the theory of info-dynamics where communication is an essential part at each point of time. The epistemic frame where information is related to the concept of variety cannot be handled in any theory of communication whether mathematical or non-mathematical. The quantity of information and its measurements have nothing to do with the essential factors of information as establishing differences and commonness that are associated with varieties and categorial varieties on the basis of which socio-natural changes and transformations of socio-natural objects acquire cognitive meanings over the epistemological space. The relevance of quantity of information and its measurement, constrained by qualitative disposition, is found in the decision-choice systems for the command-control process of change and transformation of varieties as well as the assessments of true-false propositions and messages over the epistemological space.

Information communication is an important part of person-person relational complexity while information storage and retrieval is person-specific in terms of memory. Communication, storage and retrieval must be related to information content to separate relevance from irrelevance in relation to specific decision-choice action about varieties specified as alternatives. All decision-choice activities are meaningful only in the space of varieties that must be established from information stock-flow conditions. The concept and phenomenon of information must be developed to allow for variety identifications in time and over time as well as information stock-flow conditions of varieties and categorial varieties. There is no decision and there is no choice without varieties. Even in a single element case a variety is created in decision-choice action by dualizing the element in terms of with and without to create two varieties for decision-choice action. The central concerns of the general theory of information are the development of solutions to the variety-identification problem, the transmission-process problem and the stock-flow problem in time and over time.

The theory of info-statics is about the solution to the variety-identification problem in terms of definitional conditions of content, behavioral conditions of stocks and transmission relative to varieties and categorial varieties in time and in
terms of the past-present existence. It is thus about an explanation of the nature of varieties and categorial varieties. The theory of info-dynamics is about the explanation of growth in information stocks of individual varieties and categorial varieties as time proceeds into the infinite future in terms of present-future existence. The epistemic force in the theory of info-statics lies in the creation of definitional conditions for defining varieties and the levels of information stocks of varieties and how this information is transmitted within the source-destination structure. The epistemic force in the theory of info-dynamics lies in the creation of logical and analytical systems to understand transformations of varieties and categorial varieties, and how new information is created as information flows to increase the information stocks of varieties and categorial varieties without the destruction of existing stocks of information.

At the level of dynamics, these are forces that bring about socio-natural transformations of socio-natural varieties and categorial varieties with the actual-potential polarities under the general principle of destruction-creation processes with the substitution-transformation dynamics, where the real cost-benefit rationality is the guide to every change. The net cost-benefit conditions register as either negative, positive, or zero-sum game for the poles in polarities through the behavior of the internal dualities. The dynamic process is such that old socio-natural varieties are faded away or destroyed losing their net benefits but retaining the information that shows their previous existence. From these destroyed varieties and loss of net benefit, new socio-natural varieties emerge with new real net benefit in replacement of the old with new information to add to the existing information. The system is such that the real old benefits are traded for new real benefits in such a way that the real net benefits of the previous variety become the real costs of the real net benefits by some socio-natural decision-choice processes with their information added to the stocks.

In this cognitive frame of forces of matter, energy, and information that create change and transformation, there is none as powerful as information. The universal system of existence is made up of nothing else but matter, energy, and information that become inputs into continual transformation destroying old forms and creating new forms in never-ending processes. Given information as establishing identities of varieties and categorial varieties, one can construct the past-present dynamics to understand aspects of the process of the history of categorial conversions of varieties from the beginnings. Similarly, one can construct present-future dynamics through decision-choice activities that can bring about continual transformation of varieties and categorial varieties of existence through the interactions of matter, energy, and information itself. The nature of universal existence is always seen in terms changing varieties through the collective interactions of matter, energy, and information and the work of energy.

In developing a general theory of information, a number of questions that must be answered come to the practical and epistemic surface. How does one know the past gone elements, present existing elements, and the future emerging elements as input-output structures of creative-destructive works of universal actual-potential polarities? In other words, how does one know the elements in the actual space and
the potential space in universal existence? Do these elements exist in differences or commonness, and how do they reveal their presences, similarities, and differences? Do their natural differences and similarities change overtime and how does one know whether they change or not? In other words, how do they reveal the history of their behavior in time and overtime in terms of the past, present, and future as creatively represented by the *Sankofa-anoma* in relation to the time trinity? What are the possible relationships of the structure of these questions and possible solutions to information in time and overtime? The answers to these questions involve two organic solutions with sub-solutions that may be required for sub-problems that may arise within the organic problems.

The first solution involves the identification problem of elements leading to the establishment of conditions of identities and categorial identities with corresponding varieties and categorial varieties in time and their transforming behavior overtime. The solution to the identification problem demands the development of definitional foundations of information that will relate to identities and varieties of elements and how the information is transmitted through points of time. This is the focus of the development of the *theory of info-statics*. The epistemic epicenter of the theory of info-statics is variety that is made possible by information at a time point and helps to establish the info-stock in terms of the nature of the identities of varieties and categorial varieties at a point of time. Cognitively, the universe in relation to matter and energy has no existence without information. Language has no meaning without variety; vocabulary is devoiced of cognitive existence without differentiation and commonness; naming makes no sense without variety, and identity and rules of combination in language, as well as meaning of words and sentences, lose their communicational essence without identity that fixes variety.

The second solution involves the stock-flow problem of elements leading to the explanation and prescriptive dynamics of destruction and creation of varieties and identities, where the history of their time-point natures establishes stock-flow and its behavior overtime through the process of info-flows. The solution to this information stock-flow problem demands the construct of developmental foundations of information that will relate to the transformation of identities and varieties of elements and how their information changes and accumulates overtime. This is the theory of info-dynamics which is concerned with transformations of varieties and categorial varieties that make possible info-flows to update info-stocks in every time point. It is useful to keep in mind that a change of identity and corresponding variety is a production of new information.

This monograph is about the development of the theory of info-statics to solve the problems associated with definitional conditions of identities in relation to existences of varieties and categorial varieties. This theory follows the epistemic tradition of a number of my works on the theory of knowledge, rationality, decision-choice system, possibility–probability spaces, and uncertainty-risk phenomena, where information is taken as input into their constructs without specific definition of the concept of information that fixes the applicable range of the information phenomenon. This monograph is an initial attempt to discuss and fill the omission on the definitional aspect of information and the relevant properties
of the phenomenon not in terms of communication but in terms of requirement to
the understanding of the general theory of knowledge systems, rationality, and
socio-natural decision-choice actions. The combined theories of info-statics and
info-dynamics will show an approach to understand the claims of unified theories of
physical sciences, engineering sciences, and social sciences, and how these theories
constitute a unified theory of knowledge production in time and overtime. The
general theory of information is also an attempt to demonstrate the existence of
unified logic and mathematics that will allow a consistent development of a unified
knowledge system over the epistemological space. Given the goals and objectives
of the theory of info-statics, the monograph is organized in six chapters.

Chapter 1 initializes the conditions of the theory of info-statics by dealing with
the relational structure between information and knowing of reality over the
ontological and epistemological spaces. In this chapter, there are general epistemic
reflections on the definitional problem of approaches to the concept and phe-
nomenon of information and the lack of an explicit definition of the concept of
information. The reflections lead to a number of important questions which must be
answered by any theory of information. These questions relate to subjective-
objective dispositions in the quantity–quality duality and how these questions relate
to the universal existence in terms of matter and energy. The chapter provides a
framework for points of departure from the tradition and a point of entry into the
development of a general conceptual system of information theory with definition
and properties.

Chapter 2 takes up the discussions on the analytical frame for the points of
departure and entry and relates them to the BIT-IT problem in relation to the
mind-matter problem. The conceptual foundation on the relationship of IT to BIT
and vice versa is discussed leading to a search for the factors required for defining
the concept of information, and then linguistically constrain its phenomenon and its
uses in all areas of knowledge production as well as all areas of communication. It
is in this chapter that the concept of variety, categorial varieties, and the factors of
characteristic and signal dispositions are introduced and then related as a property
of matter leading to the discussion of important concepts of primary category and
derived category with the universal existence, and how they relate to information
under conditions of acquaintance, knowing, learning, and teaching.

Chapter 3 presents the theory of info-statics, where information is argued to be a
property of matter and a property of energy by categorial derivatives contrary to
those who think the contrary. There is natural connectivity among matter, energy,
and information, where each has a specific role to play in the static and dynamic
states in the universal existence over the ontological space. This natural connec-
tivity is made explicit with logic and exposition over the epistemological space.
Matter is considered as the primary category of existence with many forms of
appearance that must be recognized. This observation of different forms of matter
and energy and further observations of different languages, naming, and vocabulary
lead to the introduction of the definitional concepts of variety, identity, character-
istic disposition, and signal disposition on the basis of which the theory of
info-statics is developed with definitional foundation and extensions which must
apply to all activities over the epistemological space under the conditions of cognitive actions. There is an implied theory of transmission and communication with and without noisy channels. The theory of transmission is general which is applicable over both the ontological and epistemological spaces and between them. The theory of communication is confined to the epistemological space in which the mathematical theory of communication is applicable; it is irrelevant to the ontological space. A set-theoretic framework is used to develop the definitional foundations over both the ontological and epistemological spaces. The objective of the general theory of information is stated leading to the establishment of the general information definition (GID) over the ontological space in order to obtain the concept of ontological information and its definition. The concepts of characteristic and signal dispositions are then embedded in the quantity–quality duality in a manner that allows the specification of interqualitative categorial differences and similarities as well as intra-quantitative categorial differences and similarities.

Chapter 4 is utilized to extend the ontological information to the conditions of the epistemological space, where cognitive agents operate, in order to provide a definition of epistemological information. There are discussions to show the differences and similarities between the epistemological information and ontological information. The chapter is used to introduce the conceptual comparison of the ontological and epistemological characteristic–signal dispositions and their relationship to the phenomenon of information. The concepts of epistemological variety, category, characteristic disposition, signal disposition and their relationship to theories of representation, language, and coding under methodological nominalism are discussed in relation to the definitional foundations of information. On the basis of these concepts, the epistemological information is defined as a derivative from the ontological general information definition in relation to matter and energy in terms of the concept of characteristic–signal disposition. The defined general information is then related to the conditions of acquaintance through the concept of signal disposition. It is within this epistemic structure that the concepts of exactness and inexactness are introduced and related to possibility and probability spaces to give a framework to define channel noises and their relation to defective-deceptive information structures, risks and size-capacity conditions of messages and channels over the epistemological space. These concepts are not available to us in the space of ontological actions. The chapter is concluded with a set-theoretic summary of, and reflections on, the general information definition.

Chapter 5 presents the relational structure of information, variety, category, ordering, and socio-natural transformations over both the ontological and epistemological spaces. The objective is to relate variety to alternatives in ranking and decision-choice activities over the epistemological space. The conceptual framework of conditions of informing, knowing, learning, and teaching is presented in order to answer a set of questions in the sender–receiver process over the epistemological space. The concept of variety holds in both the ontological and epistemological space. The relational concept of variety to alternative and ranking holds only over the epistemological space and not the ontological space. The set of questions requiring answers are fundamental such as who is informing? Who is
informed? What is learned? What is known? How does the knower know that he or she knows? There are many other fundamental questions relating to the source-destination process. The value of information is discussed relative to the source and destination conditions in terms of symmetry and asymmetry leading to the relative measurements of symmetric and asymmetric values of information. The chapter links the concept and phenomenon of information to the existence and nature of possibility and probability spaces and sets. This linkage leads to the discussion of the relational structures of information, expectation, anticipation, surprise, and decision. The discussions are extended to the past-present-future structures of information flows, where the concepts of discount, forecasting, prediction, and prescription are defined and discussed to conclude the chapter.

Chapter 6 builds on Chap. 5 and examines some important concepts such as data, fact, evidence, evidential things, and knowledge in relation to the concept and phenomenon of information. This chapter is used to present an idea that data derivatived from the signal disposition component of characteristic–signal disposition; fact is derived from data; evidence is derived from fact, evidential things are derived from evidence while knowledge is a composite derivative from information. Some aspects of the semantic theory of information containing the standard definition of information (SDI) plus declarative, objective, and semantic (DOS) with enhancement are examined with criticism. Some questions are raised about the concept of epistemic modalities with some discussion. Algebraic definitional structures of data, fact, and evidence are presented to enhance the verbal definitions leading to the discussion on the similarities and differences among them.

The monograph of the theory of info-statics as definitional foundations begins with a preface and prologue on the nature of the set of problems of the general theory of information which is divided into the theory of info-statics and the theory of info-dynamics. It ends with reflections on theories of information, knowledge, and decision to provide an entry point into the development of the theory of info-dynamics. The conditions of the theory of info-statics initialize the dynamics of the information process.

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