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UNIQUE LOGIC OF THOUGHT

Part I

Introduction

The present world is very different from the world of previous centuries. As never before in history, human activity today depends upon the efficient flow of information from newspapers, radio, TV, and, most importantly, from Internet access by PC users. Although people are not particularly conscious of it, thinking could not exist without information. Thinking is a process done individually, but it could not have developed without intelligent social interaction. It is compounded by the contributions of other people who create, communicate, and gather the results of perceived and cognizant reality. Thinking is impossible without socially evolved languages, numbers describing quantities, and graphs or pictures delineating qualities, all of which allows information to be distributed throughout society.

Our thesis, briefly stated, is that, by utilizing the concept of spaciousness, which may later be simulated by the computer, one will be able to imitate, replace, and extend the process of thinking. This concept of thought builds upon ideas previously discovered and described by Henri Bergson: "We express ourselves by words because of necessity but we think most often in space." Through language, the results of thinking are presented in a linear fashion, while the entire process occurs spaciously within the mind utilizing information as a medium. The premise underlying our thesis is that the construction of a spacious model of the mind on the proper level will enable a transfer of the thought process to a computer, which, in turn, would provide meaningful results.

Actual progress in the field of computer science and information technology has left the philosophical concept of information in its wake. It lacks a clear description of what is or is not information per se. On the side of

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computer science, there are mega, giga, and tera bytes, along with everything that can be done by them; on the side of the theory of knowledge, however, a conceptual apparatus that would allow for the full utilization of such potential does not yet exist.

The paramount concern of information technology is to provide speed, accuracy, and flow of the volume of data being reworked. The theory of knowledge should step down from its ivory tower and essentially provide keys to the interpretation and reinterpretation of these data. It can be assumed that closing the gap between computer science and the theory of knowledge will open up a new path to artificial thinking. Likewise, there is a strong belief that replacing language with information in the basic logical functions is the first step in this direction, since information, not language, is the medium through which thinking is realized. In order to specify the conditions under which thinking and its attributes are to be realized, our first question should be: What is information?

Information

The following definition is proposed: **"Information is a representation of reality objectified in a given code system"**. **Representation** may be described by synonyms, such as, presentation, reflection, projection, description, depiction, imitation, etc. The meaning of all of these words is similar, and it refers to the relationship between an object and its representation. With the word **reality**, one understands everything that can become the object of perception, inquiry, cognition, reasoning, investigation, experimentation, presentation, etc. Reality refers to physical objects, processes, and also to abstract ideas, notions, concepts, etc. **Objectified** means presented according to commonly accepted rules of operation and supported by a verified method and a proper technique. With the expression **given code system**, one understands a particular form of signs, symbols, and graphs selected for a presentation of the shape of information on a given carrier. An item that represents a single distinguished part of reality will be defined as an element of information (ei).

Levels of Analysis (Vertical Projection)

The acceptance of the concept that an element of information (ei) relates, on the one hand, to reality and, on the other hand, to the categories of cognition enables one to view particular information in the abstract. However, the result of representation, i.e., an element of information (ei), also has a vertical projection that can be examined on four levels, which we will call *levels of analysis*.

The level of analysis that describes an element of information (ei) within the framework of particular information is marked as 0 (zero). This represents the relationship between reality and information, as well as categories of cognition; and it also demonstrates that information, when it is free from particulars has a universal character. At this point, the structure of information is examined. The levels of analysis are presented as follows:

REALITY ↔ elements of inform.	level 0 ↔	categories of cognition ↓ [down]
words/express./figures	level 1 ↔	code of vocabulary
letters/numbers/graphs	level 2 ↔	code of signs
conf./sequen. of signals	level 3 ↔	code of signals

These three (1, 2, 3) levels represent the shape of information, i.e., something material. The zero (0) level of elements of information has a virtual character. The existence of the zero (0) level implies a necessity for an interpretation requiring the possession of pertinent knowledge.

The level dealing with lingual description, parametrical expression, or graphical presentation is accepted as the next level and labeled (1). The level of analysis that consists of letters in written form or syllables in a spoken language, as well as numbers, digital symbols, and visual representation, such as graphs, ideograms, etc., are accepted as the next level and labeled (2).

The last distinguished level of analysis is called level of signals[1] and labeled (3). Because the shape of information is transmitted by signals in the telecommunication channel, the most popular concept of information pertains to a signal as a unit of information. This leads to the conclusion that more signals equal more information.

Regarding the issue of the quantity of information, our thesis claims that this can be clarified with respect to the level of analysis. Analysis of a certain structure of information on the 0 (zero) level enables the distinguishing of a certain number of elements of information within the scope of horizontal projection.

[1] SIGNAL, electrical impulse, light electromagnetic wave. Attention! Because a signal is a specific physical phenomenon that: 1) is generated by a certain system or transmitter for the purpose of conveying information; 2) is generated spontaneously by physical objects/processes from the surrounding world. It should be mentioned that the object of our interest in this work is the signal that is generated intentionally.

The fact that many different codes exist in relation to the three (1, 2, 3) distinguished levels gives rise to situations in which a given number of words/expressions/figures or a quantity of letters/numbers/graphs or a number of sequence of signals will be different, although the number of elements of information will remain the same.

The basic software utilized in each personal computer manifests a state close to the operational perfection of conversion between the third (3), second (2), and first (1) levels, i.e., from signals into signs, and signs into expression. Herein arises the problem that is still awaiting a solution – namely, the interpretation and reinterpretation of this meaning during the passage from the first (1) to the zero (0), and from the zero (0) to the first (1), levels of analysis.

Basic concepts

When issues of information in the most general sense are considered, the following situation thus occurs: There may or may not be information about a given event (x). This can be described as follows:

$I\ (x) \rightarrow e\ (x)$

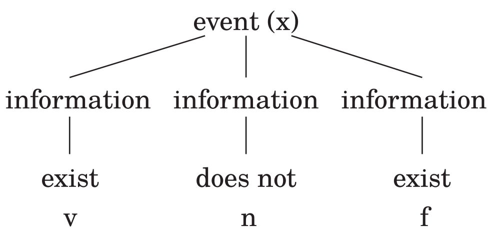
$n \rightarrow e\ (x)$ n (nullus)

In an instance in which some information about an event x does exist, it could be true or false information. This would be expressed as follows:

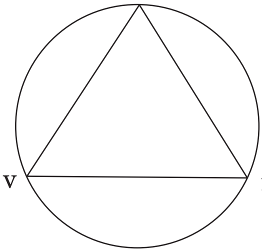
$I\ (x) \rightarrow e\ (x)$ than $I\ (x)$ could be true (verum)

or $I\ (x)$ could be false (falsum)

Existence of information is superior, with regard to either truthfulness or falsity; thus, nonexistence is the negation of either true or false information.



It is assumed that truthfulness (v), nonexistence (n), and falsity (f) are states that make up a universal base (foundation) for analyzing information from the valued point of view. By analogy, in physics one has voltage (+), lack of voltage (o), or negative voltage (–). Similarly, in mathematics there are positive numbers (+), zero (o), and negative numbers (–). The Wankel engine would represent a similar mechanical analogy. The above relation could be presented by utilizing an equilateral triangle inscribed in a circle.



The above analysis provides a basis for replacing a proposition (sentence) with a segment of information in logical matrices, and likewise extending these for three values instead of two.

Truth-Functional Connective

The truth-functional connective for the three values (v, n, f)[2] – could be presented as follows. If there is one argument (p), then the matrix of negation will contain the following possibilities:

p	np^1	np^2
v	f	n
n	v	f
f	n	v

If p is v, then its negation is f and n; if p is n, then its negation is v and f; if p is f, then its negation is n and v. In other words, as this illustration makes clear, the assumption of one value excludes the other two.

If there are two arguments (p, q), then the combined matrix for <u>alternative</u> "∨",[3] <u>disjunction</u> "/", <u>conjunction</u> "∧", <u>equivalence</u> "≡", and <u>implication</u> "→" could be presented as follows:

[2] For a presentation of other concepts of multi-valued logic, see: [6] and [4] There, the author presents the concept and matrix of Lukasiewicz's 3-valued logic.

[3] The functions of alternative and disjunction are presented here separately, see [8] and [3].

p	q	p∨q	p/q	p∧q	p≡q	p→q
v	v	v	f	v	v	v
v	f	v	v	f	f	f
v	n	v	f	n	n	v
n	v	v	f	n	n	v
n	n	n	n	n	v	v
n	f	f	v	n	n	v
f	n	f	v	n	n	v
f	v	v	v	f	f	v
f	f	f	v	f	v	v

During the realization of a certain task, if **choice**, **elimination**, **coordination**, **estimation**, and **inference** were applied, then the above dependencies indicate what the value of these functions would be for a certain combination of two arguments. From this premise, logic in the most general manner provides guidance concerning what would be expected as a result of thought, i.e., the dynamics of the process of thinking.

ALTERNATIVE

If there are two arguments (p, q), then the matrix for the alternative would be presented as follows:

	p	q	p ∨ q	comments
1	v	v	v	suffices → for a choice of true argument
2	v	f	v	does not exclude → a choice of true argument
3	v	n	v	does not exclude → a choice of true argument
4	n	v	v	does not exclude → a choice of true argument
5	n	n	n	excludes → a choice
6	n	f	f	excludes → a choice of true argument
7	f	n	f	excludes → a choice of true argument
8	f	v	v	does not exclude → a choice of true argument
9	f	f	f	excludes → a choice of true argument

If **choice** is applied during the realization of a certain task, then the above dependencies show what the value of the alternative would be for a certain combination of two arguments.

Alternative presents a situation dealing with choice, and it exists when the choice is between two arguments. The alternative is true when at least one argument is true, although both could be true. The first variant v/v fulfills the alternative and represents a sufficient condition. Which argument is chosen is inconsequential, whereas the result will be a choice between true arguments. Four variants, namely, v/f, v/n, n/v, and f/v, also lead to a true alternative, with each representing a possible condition. One variant – n/n – leads to a lack of alternative and represents a necessary condition. Three variants – n/f, f/n, and f/f – lead to a false alternative, with each representing a necessary condition.

DISJUNCTION

If there are two arguments (p, q), then the matrix for disjunction would be presented as follows:

	p	q	p/q	comments
1	v	v	f	excludes → elimination of false argument
2	v	f	v	does not exclude → elimination of false argument
3	v	n	f	excludes → elimination of false argument
4	n	v	f	excludes → elimination of false argument
5	n	n	n	excludes → elimination
6	n	f	v	does not exclude → elimination of false argument
7	f	n	v	does not exclude → elimination of false argument
8	f	v	v	does not exclude → elimination of false argument
9	f	f	v	suffices → for elimination of false argument

If **elimination** is needed during the realization of a certain task, then the above dependencies indicate what the value of disjunction would be for a certain combination of two arguments.

Disjunction presents a situation related to elimination, and it exists when one of two arguments must be eliminated. Disjunction is true when at least one argument is false, although both could be false. Three variants – v/v, v/n, and n/v – lead to a false disjunction, with each representing a necessary condition. One variant – n/n – excludes an elimination, which also represents a necessary condition. Four variants – v/f, n/f, f/n, and f/v – lead to a true disjunction in which each represents a possible condition.

Variant f/f also leads to a true disjunction, and it represents a sufficient condition. Moreover, it is immaterial which argument would be eliminated, as the false argument would be excluded in any case.

CONJUNCTION

If there are two arguments (p, q), then the matrix for conjunction would be presented as follows:

	p	q	p∧q	comments
1	v	v	v	suffices → for true coordination
2	v	f	f	excludes → true coordination
3	v	n	n	excludes → coordination
4	n	v	n	excludes → coordination
5	n	n	n	excludes → coordination
6	n	f	n	excludes → coordination
7	f	n	n	excludes → coordination
8	f	v	f	excludes → true coordination
9	f	f	f	excludes → true coordination

If **coordination** must be applied during the realization of a certain task, then the above dependencies represent the value of conjunction for a certain combination of two arguments.

Conjunction represents a situation involving coordination, and it exists for the coordination of two arguments. Conjunction is true only when both arguments are true. The first variant – v/v – fulfills conjunction and represents a sufficient condition. Five variants – v/n, n/v, n/n, n/f, and f/n – lead to a lack of conjunction, representing in each instance a necessary condition. Here, something – which could be either true or false – could not be coordinated with nothing. Three variants – v/f, f/v, and f/f – lead to a false conjunction, and in each case they represent a necessary condition.

EQUIVALENCE

If there are two arguments (p, q), then the matrix for equivalence would be presented as follows:

	p	q	p≡q	comments
1	v	v	v	suffices → for true estimation
2	v	f	f	excludes → true estimation
3	v	n	n	excludes → estimation
4	n	v	n	excludes → estimation
5	n	n	v	suffices → for true estimation
6	n	f	n	excludes → estimation
7	f	n	n	excludes → estimation
8	f	v	f	excludes → true estimation
9	f	f	v	suffices → for true estimation

If **estimation** needs to be applied during the realization of a certain task, then the above dependencies illustrate what the value of equivalence would be for a certain combination of two arguments.

Equivalence represents the situation involving estimation. It exists when the value of the first argument is estimated by that of the second. Estimation is true whenever both arguments have the same value. Three variants – v/v, n/n, and f/f – lead to true equivalence, with each representing a sufficient condition. Two variants – v/f and f/v – lead to a false equivalence, and these represent a necessary condition. Four variants – v/n, n/v, n/f, and f/n – lead to a lack of equivalence, and these also represent a necessary condition.

IMPLICATION

If there are two arguments (p, q), then the matrix for implication would be presented as follows:

	p	q	p→q	comments
1	v	v	v	suffices → for true implication
2	v	f	f	excludes → true implication
3	v	n	v	does not exclude → true implication
4	n	v	v	does not exclude → true implication
5	n	n	v	suffices → for true implication
6	n	f	v	does not exclude → true implication
7	f	n	v	does not exclude → true implication
8	f	v	v	does not exclude → true implication
9	f	f	v	suffices → for true implication

If **inference** is applied during the realization of a certain task, then the above dependencies represent what the value of implication would be for a certain combination of two arguments.

Implication represents a situation dealing with inference, and it exists when the first argument represents a premise and the second, a conclusion. Implication is true in all cases, with the exception of variant 2 v/f, since it is not possible for a false conclusion to be inferred from a true premise. In other words, variant v/f represents a necessary condition because this excludes a true implication. However, the same combination of two arguments – v/f – would be false for equivalence and conjunction, yet true for alternative and disjunction. Three variants, namely, v/v, n/n, and f/f, assert inference, since a true premise leads to a true conclusion, the lack of a premise leads to the lack of a conclusion, and a false premise leads to a false conclusion, representing in each instance a sufficient condition (see Equivalence). Five variants – v/n, n/v, n/f, f/v and f/n – also fulfill an implication because they do not exclude true inference, representing in each instance a possible condition (see Alternative, Conjunction, Disjunction).

Truth-Functional Connective (Comments)

When one analyzes the issue of **lack** and its meaning in an abstract manner, two different situations arise: first, when such information does not exist **at all**; and, second, when a certain subject **does not have** the necessary information at a particular time and place, but nevertheless has to make a decision and move forward. Truth-functional matrices apply to both situations. This involves a different approach than the one provided by traditional logic. Two-valued logic is based on each one actual or universal relation between a subject and the object of examination, whereas 3-valued logic refers to the information about this examination. In such a situation, an examination is realized **by proxy**, as the subject deals exclusively with information.

The simplicity and beauty of dichotomous division has enabled it to maintain a prominent position in logic since the time of Aristotle. As a guide to thought, however, such a division appears to be insufficient in situations in which steps are undertaken that are partially based upon a lack of information or even upon obvious ignorance. Examples that come to mind are the construction of airplanes or electronic computing machines. What could have been predicted over 60 years ago about computer applications? The point to which technological progress in the field of electronics has advanced humankind was not only improbable at that time, but was even beyond one's wildest imagination. As never before in history, the actual virtual reality of information confronts a subject with a situation in which one has either true information, false information, or no information. Moreover, it is irrelevant if such information does not exist or if it is merely inaccessible.

Part II

Amount of Information

In the previous section, matrices of 3-valued logic were presented that depict an abstract situation in which, in addition to true and false information, the realization of a certain task takes into account a lack of information as a necessary component of logical relation. Now it would be constructive to return to one of the key questions related to the **quantity** or **amount** of information. Here we will refrain from discussing **Shannon's** concept of **quantity** of information, which is based upon transferring signals by wire, because this concept is commonly known[4]. We do wish to state, however, that, with the exception of the area of telecommunications, his concept has caused more confusion than enlightenment.

There is another aspect of the value of information that should be considered. Whenever an event x occurs, it is named an element of reality (er) that could be presented by one element of information (ei), and then the following possibilities occur: First (p^1), that the representation is true (v); second (p^2), that the representation has not been achieved (n); and, third (p^3), that the representation is false (f).

	p^1	p^2	p^3
er	v	n	f

How many possibilities can be found if the object of description contains more than one element? If there are two (er^1, er^2) elements of reality, then the number of possibilities (p) is nine.

	p_1	p_2	p_3	p_4	p_5	p_6	p_7	p_8	p_9
er^1	v	v	v	n	n	n	f	f	f
er^2	v	f	n	v	n	f	n	v	f

[4] See [11].

This means that the result of one representation must be equal to one of nine possible results, which, however, does not mean that the one completely truthful result is necessarily found among the nine representations. The reader should **recognize this table as a horizontal layout of the matrix of conjunction**. If there are three (er^1, er^2, er^3) elements of reality, then the number of possibilities is twenty–seven; if there are four elements, then the possibilities are eighty–one. Because of the possible increases in relation to the number of elements of reality, as described above, which has a power nature, the following formula is utilized instead of matrices:

Number of possible results of a process (in this case cognition) for reality with x elements N = 3x

Process of Cognition

The assumption is being made that the cognition of reality is realized by means of **identification** or **measurement**[5]. Identification refers to quality, whereas measurement has to do with the characteristic of quantity. The realization of identification and measurement discloses the existing relationship between the quality and quantity of a certain object. In the instance of identification, quantity is disregarded; in the case of quantity, identification is disregarded. The relationship between quality and quantity represents the structure of information. This can be described as follows:

measurement	me	(numerator)	quantity	ei^1
relation	re	(connector)		ei^2
identification	id	(denominator)	quality	ei^3

The value of information is a function of method (Me)[6], technique (Te), and goal (Go). If, within the scope of the tasks of identification or measurement, method (Me), technique (Te), and goal (Go) are in agreement regarding the object (Ob) of examination, adequate information (equal within assumed scope) is obtained. Such information is then accepted as true information:

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[5] The most general categories utilized in the field of philosophy are substance, quality, and relation. See [7]. However, for a more detailed presentation of this concept better serving our purpose, the categories of quantity, quality, and relation must be considered.

[6] The actual level of development in a given field of knowledge, which is based upon a confirmed theory, is represented by a method. For this reason, the value of information is changing over time, which, in turn, means that truth depends not only upon correct logical procedure, but also upon progress in a given field of knowledge.

if er = ei then ei is true (v)

The principal issues within the scope of tasks of identification or measurement are a lack of, or an inconsistency of, method (Me), technique (Te), and goal (Go) in relation to the object (Ob) of examination. What would then transpire is either a lack of or an improper result. In other words, the result would be a lack of information or inadequate information. Inadequate representation would be considered false information:

if er = 0 then is null (n)

if er ≠ ei then if false (f)

When considering these components (Me, Te, Go) during the process of cognition, the following values are applied: (+), meaning proper; (o), meaning lack; (–), meaning improper.

These symbols are deemed suitable for describing the situation when the said components (Me, Te, Go) must act together. It seems more desirable to use the word **proper** than the word **true** when one is engaged in applying a method (Me), using a technique (Te), or pursuing a goal (Go). Thus, a slightly modified **matrix of conjunction** is utilized for the three arguments. The next table shows possible variants of cognition focused on an object (Ob) as related to method (Me), technique (Te), and goal (Go).

	Me	Te	Go	Result
1	+	+	+	+
2	+	+	–	–
3	+	+	o	o
4	+	–	+	–
5	+	o	+	o
6	+	o	o	o
7	+	–	o	o
8	+	o	–	o
9	+	–	–	–
10	o	+	+	o
11	o	+	–	o
12	o	+	o	o
13	o	o	+	o
14	o	o	o	o

	Me	Te	Go	Result
15	o	o	–	o
16	o	–	o	o
17	o	–	+	o
18	o	–	–	o
19	–	o	+	o
20	–	+	+	–
21	–	+	o	o
22	–	o	o	o
23	–	–	+	–
24	–	+	–	–
25	–	o	–	o
26	–	–	o	o
27	–	–	–	–

Possibilities 1–27 can be classified as follows: The first possibility represents a proper result. This can be interpreted as the **true** cognition of identification or measurement. A lack of result is represented by 19 possibilities, namely, 3, 5–8, 10–19, 21–22, and 25–26. An improper result is represented by 7 possibilities, i.e., 2, 4, 9, 20, 23–24, and 27. Even the lack of one factor causes a lack of result for the entire cognition. An improper result occurs when certain combinations of (+) and (–) arise for all factors. The following three possibilities indicate that the second (++–) method (Me) and technique (Te) were in order, but the goal (Go) was inconsistent (**teleological error**); the fourth (+–+) method (Me) and goal (Go) were in order, but the technique (Te) was inconsistent (**technical error**); the twentieth (–++) method (Me) was inconsistent, whereas the technique (Te) and goal (Go) were in order (**methodical error**). In the aforementioned three instances, cognition resulted in **false** information because one of the three necessary components was improper.

With regard to both identification and measurement, the obtained truth has relative character. In addition to the function of method (Me), technique (Te), and goal (Go), other components include time (Ti) and place (Pl). During the time of Ptolemy, the widely held view of the Solar Planetary System was different from the one following the time of Copernicus. The same can be said of the measurement of the distance between the moon and the earth. What was believed a hundred years ago is different than what is believed today.

Conclusion Regarding Fundamentals

The previous three sections of this paper disclosed **three different aspects** of understanding the concept of true (v), a lack of (n), and false (f) information. The first was the logical aspect, depicted in the form of matrices, which indicated in a most abstract manner what the result of our thinking would be for two arguments (p, q) if we considered three values (v, n, and f). The second was the probabilistic aspect, presented in the form of tables and formulas, which illustrated what could have occurred during the time when information originated, i.e., what the result could have been (v, n, f). This section also considered a different concept of quantity or amount of information by modeling how a number of cognizable elements translated into a number of possible results.

The third was the corresponding aspect. The name here being borrowed from the **correspondence theory of truth.**[7] This aspect consists of three

[7] See: [1] and [12]

categories – quality, quantity, relation – and, in a general way, depicts with participation of what components: method (Me), technique (Te), goal (Go), the value of information (v, n, f) originate.

Before proceeding with the presentation of the structure of information and the spaciousness of thought, the author requests that the reader stops for a moment and tries to imagine these three aspects of comprehending value (v, n, f) as a certain three-dimensional, geometrical figure assembled from three equilateral triangles, of different colored sides, inserted into a transparent sphere, connected by a common point and adjusted for 120 degrees. Such an illustration is proposed because it appears to represent the nature of analyzed values.

Part III

Structure of Information

The structure of information, in **horizontal projection**, on the zero (0) level of analysis can be presented in the following manner. There is a relationship between an element of information and reality, on the one hand, and an element of information and corresponding categories of information, on the other hand. This is a general matrix consisting of object (Ob), method (Me), technique (Te), goal (Go), subject (Su), time (Ti), and place (Pl). These categories would need to be utilized for any type of examination. Here, social connections are introduced to these categories because of their common character. This also means that they become the **vectors of the virtual space of information**. With the exception of covering the totality of representation, the structure of this space assumes an efficiency for the servicing of information. Here, individual thinking encounters its social foundation, allowing an objectivization of its result. The category of subject (Su), which personifies the usage of method (Me), technique (Te), and goal (Go), is necessary for processing. An equivalent to the subject could be a computer functioning as an autonomous causative system. The last two categories refer to and describe time (Ti) and place (Pl), **when** and **where**, particular information originated.

Ob(v1)	Me(v2)	Te(v3)	Go(v4)	Su(v5)	Ti(v6)	Pl(v7)
object	method	technique	goal	subject	time	place
what	how	what with	why	who	when	where
ei^1	ei^2	ei^3	ei^4	ei^5	ei^6	ei^7

According to our thesis, **these categories are necessary components of thinking**. And regardless which process of thought is being examined, it will always be constructed in a dynamic mode based upon these components.

Spaciousness of Thought

In the opening section of this paper, the **vertical structure** of information was described along with the concept of **levels of analysis**. This concept served to examine what is manifested in the shape of information. Now, by delving deeper into the virtual realm of thinking, we next focus upon the well-known concept of **hierarchical levels**. Thus, when adjacent levels are involved, the level above represents the location of something general (term, information), whereas the level below stands for the location of something particular (term, information). In addition to the relations between two levels during the thinking process, we also encounter the relation of something (term, information) with something else on the same level, between two sides that are named **coordinal** sides. Because something could represent inference, we therefore introduce the additional concept of consequential states, which applies to **diagonal** relations.

The analysis of truth-functional connectives for alternative, disjunction, conjunction, equivalence and implication has lead to the distinction of **possible**, **necessary**, and **sufficient** conditions within each function. Our present focus has to do with an examination of how **possible**, **necessary** and **sufficient** connections appear with regard to the **hierarchical levels**.

The logical frame of thinking appears in a spacious manner on hierarchical levels:

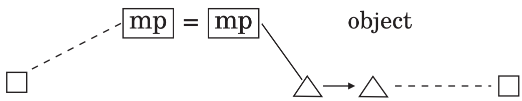
between two hierarchical levels,	–	vertical	$\uparrow$
between two coordinal sides,	–	horizontal	$\rightarrow$
between two consequential states,	–	diagonal	$\nearrow$

Connections such as potential (possible), essential (necessary), actual (existing), and reciprocal (sufficient) are realized within this framework.

Possible **vertical** connections will apply, for instance, in the case of language, to the term representing a class that has names of its members.; and, in the case of information, to the parameters of a class that has parameters of its members. Omitted here are descriptions of horizontal / possible and diagonal / possible for language, as well as for information.

Essential **horizontal** connections will apply, for instance, in the case of language, to the name of the characteristic of a class that has a term representing the class; in case of information, for the parameter of a member's feature that has parameters of its member. Again, we are omitting here the vertical / necessary and diagonal / necessary for language, as well as for information.

Sufficient **diagonal** connections, for instance, apply to a pair in which the first (essential) is represented by law (constant) and the second, by the given object of investigation:



Gold (□) has a melting point (mp) of 1064.43°C; object (△) melts at a temperature (mp) of 1064.43°C; therefore, object (△) is (made of) gold (□).

The above instances do not pretend to fully describe the logical frame of thinking; they merely aim to demonstrate its spaciousness. In conclusion, we can say that spaciousness of thought manifests itself virtually in the following dimensions: vertically, between the levels; horizontally, between the sides; and, diagonally, between the states.

Levels of Synthesis

In order to make a general analysis of the contents of thought in vertical projection, it is necessary to introduce another category of levels that we call **levels of synthesis**.

These levels ascend from the zero (0) level of elements of information to parts, numbers, and relations at the first (1) level. And, from here to configuration and sequence, set on the second (2) level. Finally, from the second level (2), one moves to the structure of the model on the third (3) level.

	structure of model	level 3	↔ HYPOTHESIS
	config./sequence/set	level 2	
	parts/numbers/relations	level 1	
REALITY ↔	elements of information	level 0	↑ [up]

Please note that the numbers of the **levels of analysis** are delineated by **overlining**, while the numbers of the **levels of synthesis** are delineated by **underlining**.

Planes of Realization

Leaving aside the presentation of elements of information in vertical and horizontal projection, we next focus on the planes of realization. The thought that goes through the mind – whatever it may be – has a particular meaning and is therefore connected to the proper word. It also has specific parameters that allow connections among the various elements of information. Similarly, the mind must take the value of the involved factors into consideration. Nevertheless, if any measurement is involved, computation is assumed.

- The **lingual** plane contains term, relation, and definition, and it serves to communicate results.
- The **informational** plane contains object, method, and goal, and it serves to achieve transformation.
- The **logical** plane contains alternative/disjunction, conjunction/equivalence, and implication/negation, and it serves to supervise evaluation.
- The **functional** plane contains addition/subtraction, multiplication/division, and equation/inequation, and it serves to control computation.

The above relationships can be presented in the form of a table:

Lingual	Informational	Logical	Functional
term	object (Ob)	alternative/disjunction	$+/-$
relation	method (Me)	conjunction/equivalence	$\times/\div$
definition	goal (Go)	implication/negation	$=/\neq$

Paradigm of Thinking

The sequence of possible thought activities is determined by the order of its component parts. To initiate thought activated by technique (Te), the starting point would be a single component. It could be the object (Ob), the method (Me) or the goal (Go). We assume that the reader remembers the function of these components which is involved in the **process of cognition**. Thus, technique (Te) is marked in the center, and object (Ob), method (Me), and goal (Go) on the circumference of a circle that represents a certain unity (whole). The following situation arises: Originating from any of the components, the directional options would be left or right. This movement discloses the **surprising simplicity of the paradigm of thinking**. At each beginning, there is a choice of either left or right. When one is dealing with two component parts, rather than merely one, a person has only one direction, i.e. does not have a choice. Any action is determined by this fact.

This paradigm of thinking can be synchronized with all three types of reasoning. An initial point might be the goal (Go). Then, if there is a certain problem to be resolved, the follow-up would consist of the path of **reductive** reasoning. If the initial point is the object (Ob) and if there are certain data to be processed, then the follow-up would consist of the path of **inductive** reasoning.

Suppose the primary point were method (Me), then, by applying a certain rule, the follow-up would be the path of **deductive** reasoning. The many forms in which these three kinds of reasoning are being utilized by the millions of human minds all over the world are irrelevant, for it appears that no additional types of reasoning could be discovered/invented. On the other hand, this paradigm represents a solid, evolving base that serves to circumvent initial problems by creating an autonomous causative system that can exceed the ability of the human mind.

This treatise has departed from the popular dichotomous division of reasoning into **induction – deduction**, or the rare division of reasoning into **deduction – reduction** (Czezowski[8]). Thus, the assumption is maintained that ***correspondence theories of truth*** establish the foundation for inductive reasoning, that ***coherence theories of truth*** establish the foundation for deductive reasoning, and that ***pragmatic theories of truth*** establish the foundation for reductive reasoning. In the first case, synthetic truth is dealt with by formulating a generalization/law; in the second case, analytic truth is dealt with by employing a law; and, in the third case, pragmatic truth will be dealt with by constructing a hypothesis.

In more comprehensive language, we could then say the following: If series of observations have led to a single conclusion, then the tool utilized was

[8] See [2].

inductive reasoning. If series of conclusions have been obtained on the basis of one law, then the necessary tool was deductive reasoning. On the other hand we utilize reductive[9] reasoning when we construct series of hypothesis regarding resolution of a certain task. Or in the opposite case, when constructing a single hypothesis to determine causality of series of events.

Conclusion

The dominance of computer science over the interpretation of many crucial problems related to the working of the **brain**, in addition to discoveries of important physiological characteristics of gray matter, has, in the author's opinion, created a perspective for understanding the thought process that is both limited and too general. The author believes that the philosophical sciences must provide a healthy counterbalance by focusing attention on specific rational activities of the **mind**, i.e., on thinking and reasoning. Alfred Whitehead wrote, "Philosophy is not one among the sciences with its own little scheme of abstractions which it works away at perfecting and improving. It is the survey of sciences, with the special objects of their harmony, and of their completion."[10]

The limited scope of computer science may be attributed to its perception of objects of investigation via the category of quantity, thus implying that any resolution should be available via computation. At this point, it is instructive to quote Ray Kurzweil, who is a prominent figure in the field of artificial intelligence: "Our human intelligence is based on the **computational process** that we are learning to understand. We will ultimately multiply our intellectual powers by applying and extending the method of human intelligence using the vastly greater capacity of **nonbiological computation**."[11] It is obvious that, to a certain extent, computers have the ability, via their **computational process**, to imitate or replace the process of thinking. However, it must be maintained that the proper description of the nature of these processes requires a more diversified approach.

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[9] In American terminology, the term **abductive** is used; see [10]. .. (2) For C. S. Peirce (g.v.8), abduction is one of three basic forms of inference, along with induction and deduction. Abduction is the means whereby hypotheses are generated, moving from a particular case to a possible explanation of the case." We are convinced that inductive and deductive reasoning originated as a result of resolving a problem, that is, by employing reductive reasoning. See [5].

[10] See [13].

[11] See [9].

Given the current advanced level of computer and information technology, in order to better understand the issues involved in the modeling of **human intelligence**, we should replace the word **computation** with the term **transformation**, since, among other things, this term denotes **dynamism** and **spaciousness**. It is the author's opinion that issues presented in this paper could assist in the development of a new and fruitful alliance between philosophy and information technology in the field of thought modeling.

Bibliography

[1] Angeles Peter Adam, *Dictionary of Philosophy*, Barnes & Noble Books, New York 1981, p. 298.

[2] Czeżowski Tadeusz, *Główne Zasady Nauk Filozoficznych*, Zakład Narodowy Imienia Ossolińskich – Wydawnictwo, Wrocław 1959, ch. III, part 1, *O rozumowaniach*, pp. 136–141.

[3] Czeżowski Tadeusz, *Główne Zasady Nauk Filozoficznych*, Zakład Narodowy Imienia Ossolińskich – Wydawnictwo, Wrocław 1959, ch. I, pp. 68–69.

[4] Czeżowski Tadeusz, *Logika. Podręcznik dla studiujących nauki filozoficzne*, PZWS, Warszawa 1949, ch. 3, pp. 193–204.

[5] Goldstein Martin, *How We Know*, Plenum press, New York and London, New York 1978, ch. 2, p. 19.

[6] Haack Susan, *Philosophy of Logics*, Cambridge University Press, 1978, ch. 11, pp. 205–220.

[7] Harre Rom, *The Philosophies of Science*, Oxford University Press, London 1972, ch. 4, pp. 100–101.

[8] Johnson William Ernest, *Logic*, Dover Publications, Inc. 1964, part 1, ch. 3, p. 32–33.

[9] Kurzweil Ray, *The Singularity Is Near*, Viking, New York, 2005, pp. 652, Chapter: *The Limits of Computation*, p. 128.

[10] Reese William Lewis, *Dictionary of Philosophy and Religion*, Eastern and Western Thought. New Jersey: Humanities Press. Sussex: Harvester Press. 1980. p. 644. "ABDUCTION. From the Latin ab ("away") and ducere ("to lead").

[11] Shannon Claude Elwood, *A mathematical theory of communication*, Bell System Technical Journal, July and October, 1948, vol. 27, pp. 379–423 and 623–656,

[12] *The Correspondence Theory of Truth*, Stanford Encyclopedia of Philosophy (Internet).

[13] Whitehead Alfred, *North, Science and the Modern World*, The Press, New York 1953, Chapter V, p. 87.

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