

## FROM INFORMATION TO THEORY. A LOGICAL APPROACH

**Professor PhD Emil DINGA, Senior Researcher**  
„Victor Slăvescu” Financial and Monetary Research Center,  
Romanian Academy, Romania  
Email: emildinga2004@yahoo.com; blog: http://emildinga.ro

**Abstract:** The paper focuses on the logical path from information acquiring to theory elaborating. To this end, the entire chain from signal – sign – information – knowledge – theory is examined and clarified from a logical point of view. Mainly, the passing from one to another of the chain components is analyzed in order to get the general mechanisms of theories emerging. The paper has a strong general and abstract character, so its results can be applied both to natural sciences and to social sciences like economics.

**Keywords:** sign, information, knowledge, theory.

**JEL Classification:** B40, B50, O10, Z10.

### 1. Information – cognition unit – knowledge

Knowledge does not represent a simple accumulation of information, because non-cultural subjects accumulate information, and about them, at least in this moment, we cannot say that they reach knowledge. So far we have treated knowledge as a process, but it is necessary to treat it as a result as well. So, what is knowledge as a result of the process of knowledge? In order to clarify this issue, we will examine the logical (and psychological) chain for obtaining knowledge: signal, sign, data, information, cognition unit, knowledge, that is what we call the *pentagon of knowledge* (Figure no. 1).

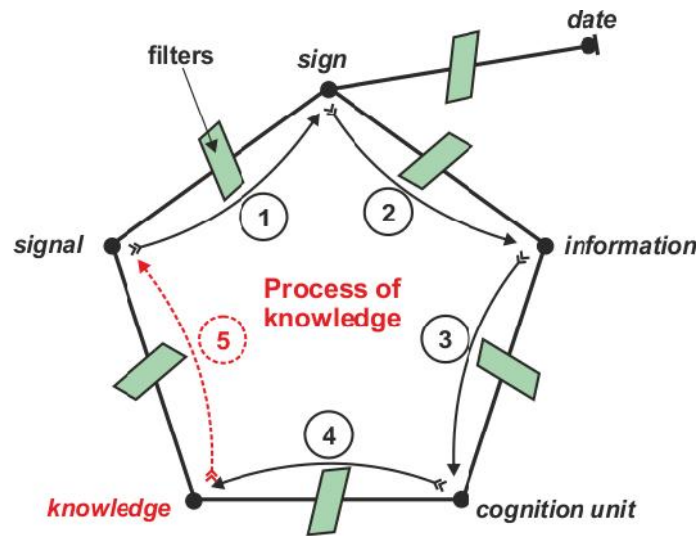


Figure no. 1. Logical flow for obtaining knowledge

#### 1.1. Signal

Any physical phenomenon which impresses one or more of the natural senses<sup>1</sup> of the subject is called *signal*. It is to be noted that both non-cultural and cultural subjects are impressed by signals, with the difference that they do not process<sup>2</sup> signals which impress

<sup>1</sup> Things are not changed at all if natural senses perceive the signal through technological prosthesis. What is important is these technological prosthesis be able to „translate” signal so that it is accessible to natural senses, with their physical and physiological parameters.

<sup>2</sup> To process means: to deposit, to process in any manner, to memorize, to integrate in ampler or qualitatively superior structures. Exception do not miss, nonetheless, here: for instance, the phenomenon of elasticity or phenomenon of hysteresis seem to indicate rudimentary elements of processing the signal at the level of objects.

them. A fundamental difference between the behavior of the subject and the behavior of the object in case they are impressed by signals is the following: objects do not register the signal, but only react (programmatically, so completely predictable) to its action<sup>1</sup> (for instance, metals dilate when heated, and this dilatation is completely predictable), while subjects register it<sup>2</sup>. Signal should be considered the transmitter (vehicle) of the sign. Of course, not any signal carries a sign, but any sign is carried by a signal.

## 1.2. Sign

We call *sign* that signal which has, for the receptor of the signal, a signification. In other words, if a signal seems to stay, for the receptor of the signal, for anything else than for itself, then the respective signal becomes a sign for that receptor. Here appears the important problem of signification. In the most common sense, signification expresses the referent (entity, thing, phenomenon, relation, state, propriety, etc.) for which the sign stays, that is the referent which it replaces in front of the receptor of the signal. Of course, not recognizing the signal as a sign is a complicated thing (which we will not develop here), which reclaims the existence of symbolization codes, based on which one can recognize the fact the signal stays for anything else than for itself, and precisely for a specific referent (denotate). Codes can be both individual (generated by individual experience or reflection) and social (generated by social experience or reflection) and they represent, essentially, correspondence tables between signals and the referents associated through those codes.<sup>3</sup> About the competence<sup>4</sup>, respectively the performance<sup>5</sup> of recognizing the signs conveyed by signals we will not discuss in this paragraph, although these are interesting issues, both from semiotic perspective, and especially, from cognitive and actional perspective. For instance, the sight of the smoke signifies, for the person who saw the smoke, the existence of fire (here the signal is the smoke, and the referent is the fire; the identification of the referent transforms the signal into sign).

## 1.3. Data

We call *data* the signal which, by sending to the referent, does not influence any uncertainty or any incompleteness of the person who perceives the sign. Data has a simple role of confirmation or consolidation of the referents (denotates) which the subject already associated with the respective sign. So, data doesn't bring anything new, unknown for the subject who interprets<sup>6</sup> the respective sign. If, for instance, I am in the Northern Station from Bucharest and I wait the arrival of a train at a certain hour, if at the station one

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<sup>1</sup> Although, in philosophical sense, only subjects (and precisely only cultural subjects) exert actions, through a certain verbal license inherited from Newtonian mechanics, we use the term of action for objects as well.

<sup>2</sup> Non-cultural subjects continue the registration with memorization and, possibly, with the formation of certain associative connections based on the theory of conditioned reflex (**Pavlov**), while cultural subjects go, of course, with the processing of signal registered, up to knowledge.

<sup>3</sup> In the pre-cultural history of mankind, such codes were rather of a natural type (that is they had in themselves a justification or a signification) while during modern history codes are discretionary formed, sometimes even arbitrarily, which does not prevent the recognition of signals, but implies a previous preparation for acquiring the codes in question, which was not necessary in case of natural codes. An example can be, here, the approach of proper nouns: once they were used to express a trait of character or of behavior of the individual to which that name was associated, today such rigors do not function anymore (the name, including the proper name, either written or told, must be considered a signal).

<sup>4</sup> Competence means the knowledge of the symbolic code signal – sign. Competence has, therefore, absolute degrees.

<sup>5</sup> Performance means the efficacy with which competence is used. Performance has, therefore, relative degrees to competence.

<sup>6</sup> We warn the attentive reader that the term of *interpretation* used in this paragraph has no relation to the concept of interpretation from semiotics (see, here, **Peirce** or **Eco**) but has a purely hermeneutical meaning.

announces the arrival of the respective train at that hour, although the signal represents a sign for me (I suppose the announcement is made in a language which I understand), it does not influence (modify, eliminate, reduce) no incompleteness or incertitude, but confirms/consolidates what I already knew.

#### 1.4. Information

By *information* we will understand the sign which, by sending to the referent (denotate) modifies, eliminates or reduces either an incertitude or an incompleteness. In other words, the sign can have two alternative „destinies” disjunctively for the subject: either it remains at the quality of data, as we mentioned above, or it gets the quality of information. If, to repeat the empirical example used in the previous paragraph, the announcement about the train which I wait in the Northern Station says that the respective train will arrive with a delay of 10 minutes, then this sign will transform into information, because it will change what we knew before.

#### 1.5. Cognition unit

By *cognition unit* we understand that information which, once receptioned as such, finds in the pre-existent cognitive „deposit” of the receptor subject an informational basis (and of cognition as well) which allows its integration in a structural manner. If, for instance, I receive the information that the black holes evaporate<sup>1</sup>, this information becomes cognition unit in case I have already a certain cognitive luggage regarding the physical concept of black hole. If, nonetheless, I am let’s say a poet and I have no previous knowledge about the concept of black hole, although I receipt the information in question, it will not become a cognition unit for me. The question will arise: how can I access, at the cognitive level (that is, how can I know) a new field, if no information received about that field does not become a cognition unit? Indeed, it seems we have here a vicious circle: never the first information regarding a new field cannot become cognition unit in accordance with the mechanism described before. We say that there is a solution and that it is offered by psychological characteristics, specifically from the memory of the subjects: information, although it does not become cognition unit, stays a certain period (short term) in memory. We can call this period with the term of *interval of free remanence*. The interval of free remanence plays the role of cognitive „deposit” but without having a permanent character (or, at least without long-term subsistence, as it is the case with the actual cognitive „deposit”). So, if new information is receipted within the period of free remanence of at least one previous information, then the new information becomes a cognition unit. More than that, the previous information, situated in the interval of free remanence, is also „converted”, with this occasion, into cognition unit, forming the actual cognitive „deposit”, with an existence on long term (related remanence)<sup>2</sup>.

We can also ask: the cognitive pre-existent „deposit” of the subject receptor of the information must have a certain dimension in order to have the capacity of integrating the new information which, thus, to become cognition unit? Otherwise said, is there a threshold under which the new information is not possible to integrate in the preexistent cognitive „deposit”? An answer to this question cannot have a logical nature, it must be decided empirically. Obviously, we do not have an answer here. A graphical exemplification of the above proposals can be represented as in Figure no. 2.

<sup>1</sup> Evaporation of black holes (which has as result their disappearance) is a discovery made by the famous theoretician physician **Stephen Hawking** (evaporation Hawking, or radiation Hawking).

<sup>2</sup> Of course, this solution is one of logical nature: psychologists, especially those specialized in cognitive psychology, must decide if this logical mechanism superposes or interferes with any real physiological – psychological mechanism.

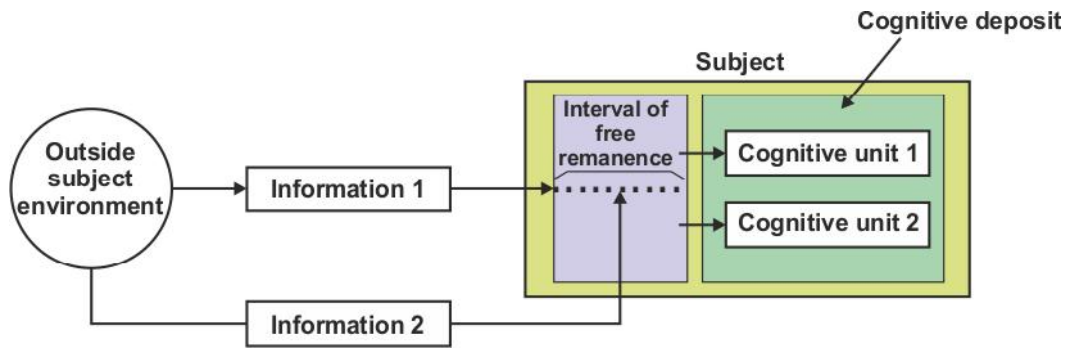


Figure no. 2. Logic of forming cognitive deposit at the subject receptor of information

### 1.6. Knowledge

By knowledge we understand the assembly of cognitive fields which have cognitive deposits formed in a subject. When we say assembly, we understand both the logical sum between cognitive deposits taken individually, and the synergy generated by the interactions from these cognitive deposits. As we said above, we will not develop here the concepts of cognitive competence, respectively cognitive performance, our purpose being exclusively that of clarifying the concept of knowledge, both as process and result.

### 2. Theory<sup>1</sup>

As a rule, knowledge is condensed, systematized in theories. Theory represents a set of propositional enouncements, with descriptive character<sup>2</sup>, regarding a certain field of knowledge<sup>3</sup> (Figure no. 3).

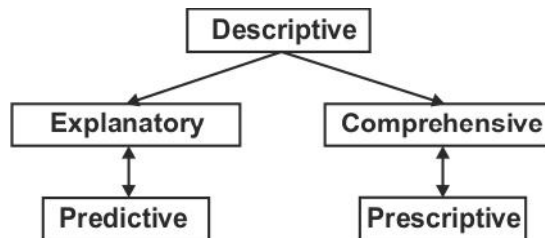


Figure no. 3. The two „fields” of the theory

<sup>1</sup> This paragraph is taken, for the most part, from our study, *Political Economy between normative and positive economics*, prepared within the **Romanian Academy** – Center for Financial and Monetary Research „Victor Săvescu”, in 2015.

<sup>2</sup> It is obvious that, between descriptive and explicative, the first is the genus and the second is the species: any explicative is also descriptive (otherwise, it is also prescriptive, from which it is not different from the logical point of view), but not any descriptive is explicative. Except for the species of explicative, descriptive can contain also the species of comprehensive.

<sup>3</sup> In many cases, the field of knowledge coincides with the field of action: for instance, the field of economic knowledge coincides with the field of economic action (we have, thus, a coincidence between cognitive and praxiological). There are also cases where the field of knowledge does not „require” a field of action as well: the fields so-called of socio-human knowledge (esthetics, literary critic etc.). We specify that for the moment we cannot speak about scientific knowledge, but about knowledge in general. We accept, therefore, that there are species of non-scientific knowledge that are species of knowledge which do not require the verification of scientificity conditions (for example, hermeneutics or theologies offer knowledge, but not scientific knowledge).

The question arises if between predictive and prescriptive there can be a relation and which would be the type of this relation. In our opinion, predictive and prescriptive will replicate, between them, the relation which, eventually, could be identified between explanation and understanding. We consider that the relation between explanation and understanding could be characterized as such:

- Explanation implies understanding, representing an objectification (that is an interpersonal communication) of understanding; of course, understanding is self-sufficient, as long as it is not the case (that is, it is not necessary, from the social point of view) for an affirmation of this understanding to other subjects from which it is expected to take a position related to it);
- Explanation is deliberative, while understanding is intuitive;
- Explanation needs a discursive form<sup>1</sup>, while understanding needs a non-discursive, self-persuading form;
- Both explanation and understanding depend on the language; in principle, the language in which understanding is intuited is not different from the language in which explanation is communicated.

We state that the sufficiency predicates of a theory are:

- It is a linguistic construction<sup>2</sup> of discursive type;
- It has a cognitive purpose, declared<sup>3</sup>;
- Is interpersonally communicable.

For the moment we are not interested if this theory is or not of scientific type. In order for a theory, as it was defined through the above sufficiency predicates, to be scientific, we must add another sufficiency predicate, precisely:

- Factual falsifiability<sup>4</sup> of predictions made based on the theory or based on the logical consequences of the theory.

By structure of a theory we understand the list of basic components of the theory so that they fulfill the declared cognitive function. We consider that the structure of a theory contains the following components:

- Hard components (relatively invariant): component A
  - a principle of cognitive foundation;
  - a set of hypothesis within which theoretical knowledge is possible;
  - a set of protocol propositions which describe the knowledge mechanisms;
- Soft components (variables): component B
  - a set of conjectures regarding cognitive results;
  - a set of results (conclusions, assertions) cognitive tested;

We will give an exemplification, extremely simplified (almost to the didactic level), on the case of orthodox economic theory<sup>5</sup>. On this example, the structure of a theory

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<sup>1</sup> Discursiveness is necessary in order that the explanation could be verified by other cognitive subjects.

<sup>2</sup> The language used can be a natural language or an artificial language, but it must have the characteristics of an intelligible language. Intelligibility of a language supposes the existence of a vocabulary, respectively the existence of a system of rules of correctly forming enunciations based on vocabulary elements.

<sup>3</sup> In this sense, philosophy (either positive, or metaphysical), theology, religion as such, mythology etc. must be considered also theories, next to the theories accepted „naturally”, because each of the ones enumerated verifies the sufficiency predicates mentioned.

<sup>4</sup> The term of falsifiability has the meaning introduced by **Karl Popper**, that is corroboration or, on the contrary, factual negation.

<sup>5</sup> Through orthodox economic theory we understand the neoclassical model of economic theory (including with small „adjustments” brought by the so-called *behavioral economics*, starting from the concept of limited rationality of **Herbert Simon**, and even from the considerations of psychology of economic behavior introduced by **Keynes**).

(without exhausting, of course, the description of the structure in cause, but presenting only an exemplificative schema) can be described as such:

(1) component A:

- *principle of cognitive foundation*: economic behavior is generated by rarity of economic resources in relation with economic needs
- *hypothesis*:
  - economic behavior is rational or at least of limited rationality;
  - economic actor processes completely information;
  - economic actor is selfish;
- *protocol propositions*:
  - individual preference is at the foundation of economic decision;
  - macroeconomic behavior represents the „enfoldment” of microeconomic behaviors (methodological individualism);

(2) component B:

- *conjectures*:
  - economic decision is taken based on marginal bases;
- *results*:
  - economic process takes place cyclically;
  - the route of any economic phenomenon can be approximated, in dimensional plan, depending on the variable time, with a logistical trajectory.

A very general classification of theories can be the following :

- *explicative* theories: they furnish veridical (causal) protocols of cognitive interest fields
- *comprehensive* theories: they offer plausible (acceptable) protocols of cognitive interest fields.

The problematic of normative theory is very interesting (for the part of the chapter which will treat about the foundations of economic knowledge). Normative theory is, by definition, a theory of prescriptive type, that is a theory whose propositions correctly formulated represent norms. As it is understood, norms are generated by comprehension, therefore only theories from the second category from those mentioned above (specifically comprehensive theories) can be named, properly, normative theories. It is good to avoid confusion, otherwise quite frequent, through which the issuance of predictions based on explanations has the significance of norms: predictions say only what we anticipate that will happen, while norms say what we want (or expect) to happen.<sup>1</sup>. Norms can be considered both in their standard signification (protocols of cognitive behavior – let’s call these norms as norms of type  $\alpha$  ), and also, often, in the sense they represent cognitive targets to be reached (let’s call these norms as being norms of type  $\beta$  ). It is very interesting to be noted that between the two types of norms (both of cognitive type, of course) there is a relation which could be described as such:

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<sup>1</sup> It is good to specify here something: anticipations are always established through calculus, they do not represent desirabilities, but possibilities with a high degree of confidence in their actualization (some call them probabilities, which is again confusion between the extrapolation of an archive and the result of a calculus), while expectations are „established” through „subjective deliberations”. Anticipations are species of predictions (based on explanations), while norms are species of self-imposed desirabilities (based on comprehensions).

- any norm  $\alpha$  is issued taking into account a norm  $\beta$  : this relation is obvious, because a cognitive protocol must have a purpose<sup>1</sup>; of course, a norm  $\alpha$  can aim several norms  $\beta$  , but also in the opposite way, a norm  $\beta$  can be verified through several norms  $\alpha$  (condition of compatibility between the two types of norms is an aspect implicated);

$$\beta_i \leftarrow (\alpha_i^1, \alpha_i^2, \dots, \alpha_i^{n_i})$$

$$\alpha_j \rightarrow (\beta_j^1, \beta_j^2, \dots, \beta_j^{n_j})$$

- norms of type  $\beta$  must be in the universe of possibilities of norms type  $\alpha$  ; this means that the norm  $\beta$  must be accessible, from cognitive perspective, as a result of the operationalization of the norm (or of the norms, after the case) of type  $\alpha$ :

$$\beta_i \in \mathcal{U}_i^{\alpha_0}$$

where with  $\mathcal{U}_i^{\alpha}$  we noted the universe of  $\alpha$  which is compatible with the realization of  $\beta_i$ . In case of several norms of type  $\alpha$  which ensure „protocol fund” of realization of norm type  $\beta$  , compatibility must be judged at the level of intersection of the universes corresponding to norms  $\alpha$  involved:

$$\mathcal{U}_i^{\alpha} = \bigcap_{k=1}^{n_k} \mathcal{U}_i^{\alpha_k}$$

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<sup>1</sup> We avoid the term of finality in favor of the term of purpose, because finality is the genus, while purpose is the species: purpose is that finality which is not necessary. For instance, you cannot propose to die (except for the case of suicide; case of death for an ideal is, from motivational perspective, also a suicide); because death is necessary, so it is a finality independent from the person subject to death.