

# The Rosetta Stone and the Codes of Central Nervous System

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## Abstract

The Rosetta Stone, is used as a metaphor about the Central Nervous System functioning. In CNS, messages are simultaneously expressed in a linguistic form, in commands for behaviours, and in neurophysiologic processes and decisions. The meaning and intention of states expressed in a linguistic form engage anticipatory and consummatory references, intentional declarative processes and neurophysiologic decisions. From a systemic viewpoint, the meaning and intention of a concept can be formulated taking into account respectively state transition matrices which, given a certain state and an input specify respectively the next state of a system and its output. The meaning and intention of a concept are specified by a set of decision rules which allow its inclusion in the class of equivalence that specifies the concept in extension.

**Keywords:** Neural codes, linguistics, meaning, intention.

## 1 Introduction

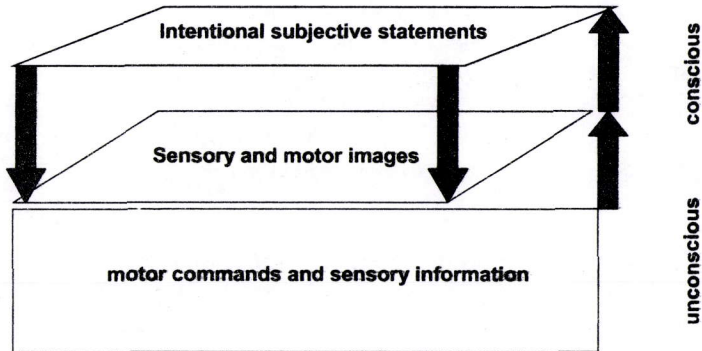
The problem of meaning and intention of expressions of the linguistic declarative system remains an unsolved problem.

Certainly language is a system that serves simultaneously many proposes but we will examine only their functions concerning representation of the meaning of reality and of decisions which aim to attain an adaptation to the environment.

The choice of a particularly simple phrase will allow the establishment of relationships between a verbal statement that expresses an intention, a sequence of behaviours directed to a certain goal and a complex structure of neurophysiologic processes and decisions – three levels: verbal, behavioural and neurophysiologic (figure 1).

On the other hand, some experimental results point to the relevance of relationships between apparently distinct phenomena like verbal expressions, body images and motor representation, acoustic and other modality images and imagination of movement which produces an evident change in skill and quality of performance.

We will show that phenomena that attain a conscious reflexive level of representation result from unconscious processes. The neurophysiologic processes are generated by cognitive intentions and decisions. The riddle disappears but an explanation is not attainable.



**Figure 1:** Illustration of relationships between intentional subjective statements, a sequence of behaviours directed to a certain goal and a complex structure of neurophysiologic processes and decisions.

## 2 The Nature of the Problem.

We recognize that the problem we formulate has an extreme difficulty. We know, from Austin, that the pragmatic meaning of a linguistic expression is given by the change of behaviour that results from the reception of that message. This fact is immediately observable and belongs to a publicly observable environment as would happen with any other public observable state of an object although we must recognize that it belongs to the domain of significant symbolic expressions and expresses necessarily some aspect of cognition as it is conveyed by language.

On the other hand, anticipatory and consummatory types of behaviour don't raise particularly difficult epistemic problems.

The same may be said about the neurophysiologic processes on which the performance of behaviour will depend.

At the present it is well known the neurophysiologic machinery which performs motor actions including their programming in Premotor cortical areas of the brain,



subcortical-cortical contributions involving circuits that connect the Putamen, Globus Pallidus and Dorsal Lateral Nuclei of the Thalamus and the Motor Area of the brain.

It is well known that the control and timing of action exerted by Cerebellum as well as the role of the Reticular System of the Brain Stem and Spinal Cord and the static postural and the dynamic kinetic contributions of the different parts of the body. Although, their complexity does not allow an analysis in extreme detail of both anatomical microcircuits and neurophysiologic microscopic decision making which are not the adequate conceptual level to describe and explain macroscopic phenomena – the same way that most of the times a quantum physics explanation does not contribute to an understanding of an engineering problem.

Nevertheless, even at that level, the paradigms are well known. A paradox lies in the fact that all those phenomena are unconscious sources for cognition.

In the other extreme point of analysis what seems more obvious for our analysis of phenomena, namely the simple ostensive statement of a verbal expression like “today I will go to Tropic Hotel to have a luncheon there” is not explainable in neurophysiologic terms without the help of intermediate concepts.

It is not easy to understand how such a simple phrase is read, encoded and its intention executed as a sequence of directed structure of motor behaviours. Here, we must discuss how reflexively conscious phenomena are translated into procedural non declarative types of decision making.

The question is ultimately to know how a conscious subjective state generates command and control mechanisms which regulate a stepwise control of commands and executions of those acts.

On the other hand, what is the relationship between highly differentiated kind of behaviour either if they are speech acts or non verbal symbolic acts and how we are able to cope with loss of information as well as lack of specification about the way such verbal expressions must be translated into complex sequences of motor decision making.

Furthermore, we should know how physiological mechanisms are translated into verbal statements or in conscious states.

Consider that although motor acts may constitute complex sequences, they result from short and completely non-specified statements and it is not easy to explain how such complex and many times adaptive kinds of behaviour are regulated by states created by summary and incomplete statements.

When a verbal statement is made, it does not even mention the executive actions which will lead to a consummatory execution of action.

### **3 Mental Training**

Mental training considered as a process of improving behavioural skills on the basis of purposefully produced sensory and motor images which reproduce those interactions the individual is intending to ameliorate concerning their efficiency – for instance a high competition sport activity helps to understand about the interaction between mental activity and neurophysiologic mastering of behaviour.

In mental training, mental imagery as well as motor decisions are recalled and kept present as the centre of attention while the individual may occupy himself with other tasks.

He may remember the sounds and the noises of a stadium, the call for an exercise, the position of his body awaiting the start sound, the initial departure coordination movements and running amidst competitors and final movement at the arrival when the course is ending.

The subjects combine verbal statements together with sensory and motor images and a coordinated sequence of events without performing any overt activity.

Symbolic cognitive representations never lack their motor or sensory characteristics and are joined together by linguistic statements.

An important feature of these symbolic subjective experiences is that they are immediately connected to neurophysiologic and decisions, excepting in what concerns linguistic statements.

Although many of the details of both motor and sensory encoding have not been satisfactorily clarified much is known about neurophysiologic representations of motor commands and sensory stimuli.

Mental and motor images may be seen as an envelop directed to its proper decoding device which contains inside many of the neurophysiologic commands and information directly related to sensory representations and motor decisions. These contents are there because they provoke the desired subjective experiences although their symbolic characteristics remain at present unknown. We only know they are efficient as commands and representations and that they stay at the neurophysiologic level of processing because they produce those states without losing their symbolic subjective accessibility, what is completely different from linguistic representations.

The symbolic status of those images is that they may be translatable both into motor commands and behaviour on one hand and into mental sensory images that may be represented by verbal statements.

Such neurophysiologic processes must ultimately be considered as the meaning of those verbal statements because they represent their sense although not rigorously their constituent parts – due to the fact that verbal representation uses an autonomous grammar code.

It should not be forgotten that linguistic manipulation is a cognitive act on its right. Consequently we have thoughts that generate action mechanisms and unconscious mechanisms of motor planning and command which we may know through their translation into motor images and linguistic representations. The same reasoning applies to sensory imagery.

This example shows how a high level processes may be converted into basic sensory and motor command processes.

Returning to the verbal system, we may immediately identify verbal forms which denote actions as well as relevant sensory characteristics inside an autonomous grammar encoding. We refer to verbs that predicate action, like to go, to come, to jump, to climb, to dive, to run, to walk, to send, to catch, etc. It is obvious that these



predications must be integrated in a context that specifies who does it, what he does, why he does it and the circumstances of space and time in which it occurs.

#### **4 The Complex Relationships Between Meaning, Cognition and Declarative Intentional Linguistic Expressions.**

It remains as a problem the understanding, given a sentence like "Today I will go to Hotel Tropico to have luncheon" involves an immense number of intermediate acts, (which remain not denoted, together with their intermediate final steps) as necessary constituent of the conceptual and motor walk that will be necessarily performed to render effectively possible to lunch in Hotel Trópico:

1. To stand up and walk out the room.
2. To walk to the entrance door
3. To wait for the car that will transport to the Hotel Tropico
4. To direct the walk to the car.
5. Enter the car, seat and keep an adequate posture during the displacement of the vehicle.
6. To get out when it stops.
7. To enter the door of the Hotel
8. To descend the steps that give access to the dinning room.
9. To walk through the door.
10. To ask for a free table
11. To seat ... receive the menu and make the choice ...

All these in a single phrase very limited in its denotations "Today I will go to Hotel Tropico to have luncheon".

We can argue, as we did before, that the meaning of the phrase may be reduced to the neurophysiologic decisions that will allow the execution of an intention which is expressed.

Nevertheless, it is necessary to keep performing the intention and that all those sequences of behaviour remain adapted to the initial purpose even when they are not denoted and require adaptations which are also not foreseen.

Tolman's proposal when he explains learning processes by means of a chaining of successive of classical and operant conditioned reflexes all coordinated by an anticipation of the successive goals, intermediate and final goals to be attained. Those acts are the anticipatory and the consummatory referents, respectively, of the intentional behaviour.

Tolman explains these complex behaviours by telescoping, shortening and simplification of conditioned acts, both classical and operant, secondary conditioning, generalization and differentiation, attribution of positive and negative valence to stimuli and results of acts, motivation, gestalt integration of constituent acts, cognition and expectancies which he integrates in an internal model of the interaction the subject is having with external environment.

This representation in an internal model leads to a process of mobilization of means to attain aims and the consideration of spaces of locomotion in which the action is occurring. We will have, this way, an instance which commands and controls the intentional act might, during all the phases of this trajectory, formulate questions about what is happening and join together predictions with corrections of the deviation of the preceding trajectory.

The problem is formulated in a way that allows the supposition of complex decision networks which are partitioned into ensembles of elementary decisions which will have immediate neurophysiological correlates.

Apparently those are simple concepts but there appear immediately questions which are close to being unsolvable as for instance:

1. How these correlates have been established?
2. How can the linguistic declarative statement specify complex neurophysiologic processes which have not been yet translated into executive routines and simultaneously produce cognitions which concern intermediate stages which are not completely foreseen?
3. How can the nature of neurophysiologic processes be recognized by means of an almost void linguistic statement?
4. Which are the criteria to attribute neurophysiologic processes to course cognitive processes and plans?

Another difficulty results from the fact that neurophysiologic decisions occur as nondeclarative procedural events completely independent from conscious declarative verbal expressions. We would have then non declarative procedural events generating conscious declarative linguistic expressions. Conscious processes would result from a deliberate but not conscious planning.

In a certain sense, a necessary explanation might be equivalent to attain the synthetic a priori concepts of Kant and, as an alternative, persons might behave concerning these processes in a zombie like manner.

Still, Tolman's theory remains as an orienting concept in our efforts to hypothesise how the required structures of behaviour were established during development which will latter on be integrated in conscious intentionality.

It is obvious that the reverse process, the generation of conscious declarative processes would result from non-declarative procedural events poses problems with a similar difficulty. To solve this kind of difficulty in an interactionist Karl Popper and John Eccles have proposed the concept of liaison brain in which consciousness, considered as an autonomous entity, would read backward and forward with an eigen time non declarative processes which are occurring in the brain and rendering the subject aware of them.

As we are touching the problem of psychophysical relationships the alternative explanation would be found in the parallelistic concept of Descartes or else in hileomorphic or double simultaneous reading in physical and psychic terms as it was proposed by Aristotle.



## 5 Conclusion

1. To analyse the meaning and intention of a verbal declarative expression we used a paradigm which implies anticipatory and consummatory references, the process of neurophysiologic decision making and those processing of messages which are needed.
2. We have shown that the real meaning of declarative verbal statements which expresses, at a cognitive level, both meaning and intentionality is basically carried by neurophysiologic mechanisms considered in their significant dimension and not only as commands and controls of body events.
3. This approach results in an attribution of psychological dimensions to what preceding was considered as purely neurophysiologic.

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