Chapter 8
Print ISBN: 978-93-90516-57-5, eBook ISBN: 978-93-90516-65-0

The Limits of Mind and "The Bignetti Model"

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DOI: 10.9734/bpi/nhess/v9/7239D

ABSTRACT

Mind is so far limited that cannot give us an objective picture of the reality. Even, the sophisticated instruments invented by it, can give only a subjective perspective of the reality. An example is given by exploring "Neural Correlates to Consciousness" (NCC); by these means, we can highlight the plain route from brain to mind by exploring only the physiological, functional aspects of Consciousness, while the objective, scientific definition of it remains a groundless hope for an unsurmountable conflict of interest. This unresolved conflict mainly gives rise to three false dualisms in mind that emerge one from the other, like in a Matrioska. In each individual, the illusion of the existence of a Free-Will-possessing Self is the main outcome of this dualistic perspective of his mind. Yet, how comes that cognitive processes are so efficacious in daily life? "The Bignetti Model" is a cognitive model that explains how cognition can occur, in five compulsory steps, just on the base of these mental illusions.

Keywords: Cognition; Conscious Mind (CM); Unconscious Mind (UM); Free-Will (FW); free-will illusion; Neural Correlates to Consciousness (NCC); probabilistic-determinism in mind; 1st-Person Perspective (1PP); 3rd-Person Perspective (3PP); dual state of mind; double perspective of mind; cartesian-like dualism of mind.

1. INTRODUCTION

Since the eve of the philosophical thinking, various forms of dualism (mind-body, soul-body, man-God, God-Devil etc.) constituted argument of endless discussions. In the West, for instance, a famous conceptual contraposition of ideal versus real aspects of Nature was a central issue of Plato's school of thought. In Middle ages, for Catholics, the dual conception of God whose negative entity was considered the Devil, was not completely accepted; a trace of this ambiguity was present in the famous prayer of "*Pater Noster*" in the passage that invokes God "…*Et ne nos inducas in tentationem…*". A very recent decision of Pope Francesco and CEI modified this passage exhorting God not to abandon us to Devil's temptations. The correction of this passage, can be easily read as the realization that God is not Devil, so he cannot induce us in temptation. The difference is not so subtle since it remarks a still relevant dualism between negative and positive superhuman powers governing us.

Another famous dualism derived from Cartesian doubt whether *Res-Extensa* is underlying *Res-Cogitans* or it is a totally independent thing. Today, the baton of this unresolved doubt has passed to Cognitive Sciences with the question about brain-mind relationship. In a series of papers Bignetti [1-15] has proposed that mind emerges from brain and that consciousness (with all the functional limits of mind) is the ground of the mother's tongue language (i.e. "inner speech") by means of which the thinking process is elaborated. Then, all the discussions about mathematical, philosophic and metaphysical issues (Soft- and Hard-Sciences) are products of the human brain and not of extra-terrestrial origin. This conclusion is perfectly in line with the idea that, in Soft-sciences, every new thesis or confutation of it may each time emerge according to *pro-* or *contra-* arguments proposed by thinkers apparently more popular or more convincing than others. People's opinions may vary from time to time being conditioned by the way the wind blows; so, their changes is the clear example on how any philosophic or metaphysical message (even if apparently stringent and logic) has only a

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relative value. Conversely, logic thoughts typical of "hard" sciences (like mathematics', physics' etc) have the epistemological advantage that any assertion (i.e. any hypothesis or belief) must be experimentally demonstrated. However, even logical-mathematical way of thinking exhibits a limit, the one that in neuroscience impedes to give a scientific, absolute definition of conscious mind; a sort of conflict of interest confines consciousness not to give an answer to the famous question on "The hard question of consciousness". In this case, even Neuroscience may fall into the bulk of Soft Sciences, not seeing the light at the end of this pseudo-scientific tunnel.

Instead, Psychology ranks a peculiar epistemological position since it can be considered somehow in between hard and soft-sciences. In the one hand, Psychology by means of disciplines like "psychoanalysis" or "analytical psychology", has built up great theories without any experimental demonstration yet; on the other hand, the recent interests of Psychology towards "Cognitive Sciences" has revealed a self-consistent approach to the scientific study to functional aspects of brain that can be correlated to conscious mind, i.e. the physiological, biophysical and biochemical mechanisms of the brain that experimentally correlate to Consciousness. According to Chalmers and others [16-18], the study of "Neural correlates of consciousness" (NCC) could be the right approach to unveil the innermost nature of Consciousness, i.e. the way to give a definitive scientific definition of Consciousness. Actually, we only partially agree with Chalmers' statements. On the one hand, we also believe NCC's study should permit us to define whether there is a biunivocal "mechanical" relationship between brain and mind, thus overcoming the idea of an ontological dualism between the two. However, in contrast to Chalmers' optimistic expectations, NCC's studies will never lead us to the absolute definition of consciousness; in fact, the operative language, i.e. inner speech [19-20] that the explicit mind uses when emerging from brain, is a translation of the biophysical-biochemical activity of the brain whose interpretative code the scientists will never be able to discover. The reason of this stands on the same reasons on which a conscious mind will never be able to define itself in absolute, objective terms. It's a question of "conflict of interest" [14].

To make this clear, we might compare a couple of examples leading to opposite conclusions. The first example regards the discovery of the genetic code, i.e. how genetic message of DNA is translated in cellular proteins; conversely, the second example regards "the hard question of consciousness" (i.e. the question about the scientific, conceptual definition of consciousness) whose answer will never be given. As it regards the first case, a large group of scientists of different disciplines (e.g. Watson & Crick [21]) demonstrated how two strips of genetic bases can couple by means of specific hydrogen bonds. The long series of these bonds in between the two DNA strips structurally and functionally recall a classic "zip". This "Zip" keep tighten the couple of DNA filaments thus protecting it against chemical aggressors and conferring it a sufficient stability for carrying on genetic heredity; on the other hand, the "zip" exhibits a sufficient specificity to be opened by the "enzymatic apparatus" devoted to read and translate single DNA filaments into a protein sequence. By studying these properties, the genetic code was discovered. The strips of DNA and RNA bases contain a sequence of triplets, each one of them corresponding to an amino-acid. The "enzymatic apparatus" is a complex architecture of proteins devoted to synthetize the proteins that are encoded in a DNA molecule; to this aim, it translates the information of the triplets according to the genetic code, and, then, it joins together the corresponding amino-acids to make the final protein. The molecular language of bases can be translated into the other one of amino-acids, since the chemistry of bonds and atoms is the same in either cases, though differently positioned in the two kinds of molecules. Then, the main difficulty of a chemist was to understand how the synthetic "enzymatic apparatus" operates the mechanism of matching different molecules.

A completely different situation regards the relationship between the unconscious mind (UM or implicit mind) and the conscious mind (CM or explicit mind)(note that UM and CM have nothing to share with Psychoanalytic definitions) [22-24]. While UM works by using biophysical-biochemical signals, CM can interpret and manage thoughts and affects evoked by music or pictures, only by means of the mother's tongue "inner speech". So, the communication at the hypothetical frontier between the two virtual territories implies the translation of a language into the other one and vice-versa. Differently from the relationship between the languages of DNA and proteins, respectively, the translation code between UM and CM cannot be discovered; being confined only within the thinking territory, CM is impeded to know the translation code by a "conflict of interest" [14]. In other words, CM is unable of

interpreting both languages since it cannot behave as an external witness of both; moreover, CM cannot even perceive the hidden activity carried underneath by UM.

Concluding, our CM can neither demonstrate nor exclude that the thinking process which CM presumes to handle with an almost absolute freedom of will, may deterministically raise from hidden activity of Brain. Rather than admitting a cause-effect law dependence, the emotional portion of CM (the subjective, emotional, Self-oriented 1st-person perspective (1PP) of CM) prefers to accept the idea that a mysterious part of the will might be controlled by a not-well defined Soul-inhabited Self [2,3-8]. Conversely, the rational, scientific part of CM (the objective, rational, Self-detached 3rd-Person Perspective (3PP) of CM) is convinced that the thinking activity may emerge from the complex structure of the brain, in particular, from "collective" events that are synchronized by physiological stimuli evoked by the external or internal environment [9]. Some recent "press-no press" psycho-physical experiments that were carried out with gladly-participating scholars (by the way, we absolutely disagree encouraging people by money rewards) confirm the 3PP's prediction [10,13].

2. FREE WILL AND FREE WILL ILLUSION

We have interestingly noted that the question about the existence of Free-will (FW) has raised in soft- and hard-sciences a strong debate, likewise Descartes' dualism. Most probably, both issues share a common ancestral mechanism in human mind. The Stanford Dictionary has analysed FW by many perspectives [25]; it gathered a huge amount of information about the term "Free Will" (FW), e.g. different philosophical definitions, meanings, origins and the conceptual applications to cognition and behaviour as proposed by several authors in due time. However, this lemma is analysed from many aspects except from the more comprehensive and folk definition that common people might share, i.e. from the definition of FW given by Oxford Dictionary that recites: "*the power to make your own decisions about what to do, without being controlled by God, fate or circumstances*" [26]. In other words, according to Oxford Dictionary, the lemma denies any form of determinism (including a so-called "conditional freedom of will" introduced by some authors to justify human situations in which action-decision mechanism is necessarily caused by external forces that, anyhow, are also widely accepted by the actor). Actually, this definition is more adherent to what people think about a "voluntary action" and FW than Stanford's reference to FW [27-28]. Nevertheless, up to us, neither one of two dictionaries is saying the truth. Up to several philosophers and neuroscientists, FW is a mind illusion [1,2,29]. Moreover, we might add that, since the believe in FW goes shoulder to shoulder with the idea of a Soul-inhabited Self, FW illusion and Cartesian-like dualism share the same underlying mechanism in mind [5,7,12]. By deeply investigating brain mechanism, it will become evident that brain is constituted by an intricate network of neurons whose biophysical-biochemical activity is typically characterized by generator potentials, synaptic potential, action potentials etc. Specific cellular and molecular structures exhibit all these activities according to a mechanism that could be defined: probabilistic-deterministic [2-5]. In many papers and books this concept has been described in detail. The peculiarity that underlies the mechanism is that each part of the network, singly taken (a protein protein-channel in a synapsis, a single synaptic vesicle or a single voltage-gated Na+-channel etc.) behave in a probabilistic way; however, when we observe all these parts collectively, i.e. working "together" in a functional response, they behave in a deterministic way (one of the well described mechanism in neurons that confirms the probabilistic-deterministic model is the named: "integrate-and-fire" behaviour) [30-31]. In all natural events, the probabilistic-deterministic behaviour is quite common; gas laws, osmotic forces in water or dynamics of enzyme activity according the Michaelis-Menten curves, are some striking examples. To demonstrate these natural dynamics by a comprehensible experiment, the scientist Galton invented a simple machine made of a plane with pyramidal array of skittles and a funnel above, plenty of balls (see Fig. 1).

When balls freely descend on the plane, bounce right or left on each skittle, with the same probability; so, it is not possible to foresee the final position of each single ball at the end of the run. However, if we observe the final disposition of all the balls at the end of their runs, we can see a "normal distribution". In conclusion, each single event has the same probability of bounces with a chaotic result, while a collective behaviour produce a normal distribution, i.e. a precise mathematical function with a deterministic result. In conclusion, the Galton machine is a clear model of any complex system

whose mechanism exhibits a probabilistic-deterministic mechanism of many concomitant events, like it occurs at different sub-cellular structures of CNS.

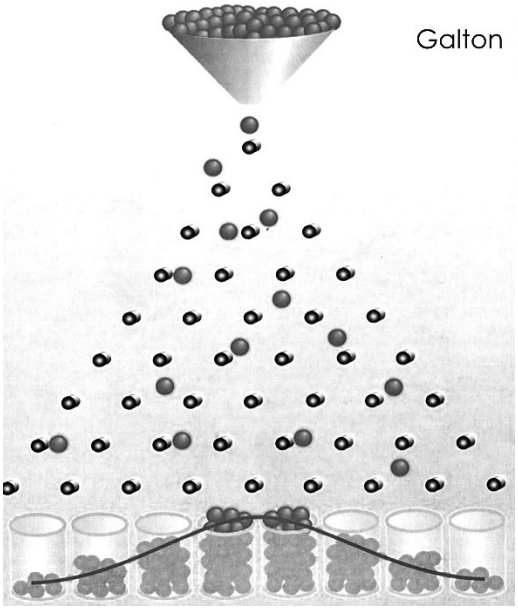

Fig. 1. Galton apparatus. We cannot predict where a single ball might fall; conversely, we can mathematically predict the final distribution of a large, collective number of balls at the end of the experiment
See: https://it.wikipedia.org/wiki/Francis_Galton

Another peculiar aspect of CNS that possibly is a consequence of the probabilistic-deterministic mechanism, is the evidence that mind is "continuous", i.e. mind exhibits a never-ending activity [32]. To make it clear, we might assume that, when a stimulus strikes on a specific receptor, its response triggers a series of probabilistic events that lead to a primary, deterministic thought; that thought, interacting with other nervous structures, will determine not only the expected behavioural reaction (for instance, the stimulus of thirst will trigger a drinking reaction) but also a secondary thought and then a tertiary, etc. etc.. thoughts involving cognitive areas and always respecting the probabilistic-deterministic mechanism of transmission. Actually, our nervous system is so complex that we cannot easily foresee which areas of the brain will be involved at a time, and to which extent those areas will contribute to the reaction; in a certain way, a thought follows a so complex pathway that could be compared according to a ball in a pinball machine [12]. The initial pull (stimulus) draws a ball in play (initiates a thought in mind) before it will be naturally drown into the hole by the force of gravity (the pathway will find the correct response like a chemical reaction will be drown to a state of minimal free Energy). However, if the player is skill, the ball will take a long time before falling down (this time will be taken by cognitive processes to better understand the nature of the stimulus and the consequences of a reaction to it). So, the bounces against the skittles return the ball many times in play (a thought interacting with different brain areas, are thus modified by exchanging information). Obviously, the energetic pathway of the ball will go down towards a loss of Gibbs free energy; so, sooner or later the ball will have the chance to get into the hole. Conversely, in mind we observe a fundamental difference: while the play will end with the fall of ball into the hole, a thought not only produces a reaction to the stimulus but, by interacting with brain areas, generates also a cognitive process (learn and memory processes); the interactions with brain areas have recharged thoughts with fresh energy (i.e. the metabolic process underlying a thinking process is revitalized by energetic molecules), so that, the interactions of the circuiting thoughts within brain areas will permit new analogies, syllogisms serendipities etc., thus giving them a continuity, at least from a cognitive point of you. By this means, the thinking process may continue towards unexpected targets; as we have elsewhere predicted by analysing the metabolic characteristics of CNS, neurons "need" to think [1]. If

we are not able to aliment mind by this constant exchange of information, that would mean the death of our mind [12].

The functionality of Galton's machine is quite simple and easily interpretable; instead, the aspect and the pathway of a brain electrochemical response to a stimulus is much more complex. Famous electrophysiological experiments carried out by Libet demonstrated that an "intentional act" (i.e. an act leading to a conscious muscular movement or thought) is always anticipated by an unconscious trace in brain by several milliseconds or seconds, the so called "readiness potential"; the evidence of an unknown elaboration of brain preceding the intentional act brought into a serious question about FW existence [33-35]. The labyrinth where a thought hides and emerges, here and there in brain, is so intricate to people's sight that leads them believing in a Soul-inhabited Self, e.g. the idea of possessing a FW. In other words, it seems that "complexity" in people's mind would *per-se* mean the opposite, obscure and spiritual face of matter. One might ask how our CM may offer this interpretation? Evidently, a rational explanation of mind's complexity is not affordable by the rational function of CM; conversely, the emotional, irrational part of CM might intervene by introducing the Cartesian-like dualism that we have initially introduced. This idea might emerge within the hidden folds of CM bifurcation, as a creeping sense of the presence of a metaphysical non-human alterity. The thinking pathway underneath the process, however, is totally invented by our mind; this will be discussed in detail below.

In summary, we have understood that our thoughts continuously circulate in mind so that they are always ready to interact with sensory inputs. Apparently, our mind seems to elaborate the behaviour on the basis of motivations, deductions, inductions, expectations, conclusions etc according to a free will; however, thoughts are necessarily determined by biophysical-biochemical mechanisms underlying the neuronal processes. The false believe of people in the existence of FW is the consequence of the complexity of our brain like a gigantic pinball in which an enormous number of bounces makes impossible to foresee the pathway towards the end of play. To this aim, it is interesting to note that people believe in FW when discussing about the reasons that moved them to their "so-called voluntary action"; while, their view is more deterministic when they evaluate others' action, as if the interdependence between stimuli (causes) and reactions (effects) were much more evident when judged by an external witness [27-28].

A further conclusion, we have drown is that two states of mind (the first one is implicit or unconscious mind (UM) while the other one is explicit or conscious mind (CM)) coexist and collaborate although using different languages, in many functions [24]. The content of the information that is translated from one functional language to the other one, when exchanged among the two states of the mind, is probably highly preserved. Just to make an example, when we feel thirsty, a series of sensory signals send the information as action potentials to brain specific areas; this causes the triggering of water search as a correlated effect. Apparently at the same time, this stimulus is recognized by CM and named as "thirst", so that, the need to drink water emerges in CM as a a conscious effect.

Since, a rational, conscious reaction of an individual is always motivated by the need either to remove or to adapt to the perturbing stimulus, the "Cause-effect" law seems to characterize human so-called voluntary behaviour. In order to carry out the right reaction, the impinging stimulus must be at first "interpreted" by the individual; at second, by knowing the nature of the stimulus, the individual will be motivated either to remove the stimulus or to adapt to it. However, we should remember that FW does not exist; so: "On which basis will the reaction paradigm be chosen"? Actually, either we can imitate examples we have found in our Long-Term Memory stores, or we adopt the classic trial-and-error mechanism. The main task in cognitive processes is to learn and memorize experience, trial after trial, in order to improve the action paradigm every time. thus progressively ameliorating the outcome. So repetitive experiences will make the action that at the beginning was aleatory, deterministically automatic. For example, let's take a look at a professional tennis player, e.g. how he will learn not to miss a shot after a long exercise. In other words, a behaviour will become automatic when the stimulus is well known and the correct reaction paradigm has been learnt and memorized by means of repetitive experience [10-11,13].

As we have anticipated, we consider the definition of FW given by Oxford Dictionary a folk definition more adherent than other to what people thinks about their own FW. However, this definition clearly

excludes the control that might be exerted by "the intrinsic nature of a stimulus", i.e. by the "causes" that might condition a specific response". In this case, the decision would not be dictated by FW but it would be the expression of the deterministic control of the premises inherent in causes. In early teaching, Buddha's response on the possible existence of FW was evasive. Even to-day, many Buddhist monks are a bit confused on this question. To this regard there is a famous video of a dialogue on FW existence between Krishnamurti and some Buddhist scholars [36-39]. In a certain way, it seems that Samsara might be overcome by a conscious effort of the will; in other circumstances, instead, the same monks discuss about the possibility that insight meditation on mindfulness (and not a voluntary action) might automatically drive an individual out of suffering of Samsara. To this regard, recent assertions of Zen monk Tetsugen Serra [40] are interesting; in synthesis, he concludes that meditation will not necessarily develop foresight, rather it will sharpen your wits, thus you'll become aware of the cause-effect law. By deeply understanding the cause (situation), you will anticipate the future effect and the trajectory of your life will be more clear.

As we have said, CM is the terrain of thoughts generated and maintained according a probabilistic-deterministic mechanism, i.e. in the absence of FW. Since, these thoughts cannot freely manage our so-called "voluntary" actions, the main question is: "how and where does action-decision making come from?". To answer this question, first of all, we should imagine for a while to be confined (not in CM but) in UM, i.e. in the terrain of the biophysical-biochemical language and, secondly, we should assume that the cause-effect law might hold here too; then, we might represent a stimulus and the reaction to it with a "specific pattern" of electrochemical signals that are elaborated again according the probabilistic-deterministic mechanism. When we have learnt and memorized the nature of a stimulus as well as the correct paradigm to react to it, UM can every time elaborate a perfect action-decision mechanism against that stimulus; instead, against a new stimulus and an unknown paradigm, then UM can only apply a "trial-and-error" procedure by searching within the electrochemical reactions memorized in LTM, those paradigms that may fit at best the new situation. As one can see, in any case, UM intervenes first, i.e. in advance with respect to CM. So what's the role of CM in cognition? The author, since many years ago has developed "The Bignetti Model", a human cognitive model that first explains how UM may intervene in action elaboration, and how CM may intervene few milliseconds later in order to acquire a valuable experience from the action outcomes. Interestingly, CM is totally unaware of the preceding events, so it is convinced that the action might be decided and carried out by means of its FW [2,4-8].

3. "THE BIGNETTI MODEL"

The pathway of a full cognitive processes might be Ideally represented by a feed-back circuit made of two main steps (see Fig. 2): ACTION, i.e. the so-called "voluntary" action in response to a stimulus, and COGNITION, i.e. learning and memory of the acquired experience that will be useful for facilitating future action-decision making. However, the question is: "Who might decide whether an ACTION gave positive or negative outcomes? Who might decide whether LTM should be upgraded on the basis of the experience acquired by means of that ACTION?". As a matter of fact, in a full cognitive process, an individual who has reacted to a stimulus is then expected to analyse and memorize the experience acquired during that action, by using critical sense; however, UM may act according to a cause-effect mechanism that stands on a probabilistic-deterministic mechanism, but that mechanism is not enough to introduce further critical evaluations of the action outcomes. So, the lack of critical sense of UM might obstacle COGNITION.

Fig. 2. Cognition is a circular process that includes two steps: 1) ACTION that is determined by subject's response to a stimulus ("cause"); 2) COGNITION that is a two-step compulsory process made of learn and memory of the experience gained by the action outcome ("effect"). COGNITION has a feed-back effect since the experience of an ACTION will be useful for the next one

The question now posed is "who is carrying out COGNITION?". This is similar to the famous Dennett's question who asked "Who is the driver of the car"? [41] In general, a Soul-inhabited Self is considered "the driver of the car". As a matter of fact, people consider it as a gift of God who indulges in positioning them between Heaven and Earth. In the West, people are first convinced that Soul-inhabited Self, possessing FW, was a reward of God in order to decide a truly-voluntary ACTION; secondly, they are convinced to have the ability for COGNITION, in either cases independent on physical-chemical restraints. However, we have thoroughly discussed this issue and concluded that Soul, God, religion, sacred texts etc. are CM's metaphysical ideas that affectively justify inexplicable events of mind, in the absence of a convincing, rational alternative of CM. Incidentally, the sacred text listed in the web are about 1700 [42]; so, how may we decide which is the holiest? [15]. Then, we must turn our investigation towards a different direction, i.e. by abandoning metaphysical hypotheses and looking for a concrete brain mechanism that may correlate to conscious functions (i.e. towards NCC). To this aim, we elaborated "The Bignetti Model" (TBM) [2,8], a new cognitive model that took inspiration mainly from two evidences: the first one is behavioural, the second one is neuroscientific. The first evidence regards the paradigm of conditional learning in animals in which reward and punishment, either physical or psychological, are incentives necessary to learn from experience and predict/prevent effects from causes. The second aspect of the model is the evidence that mind exhibits a dual-state: one is Unconscious (UM) (also known as implicit mind), the other one is Conscious (CM) (also known as explicit mind). The two states have different logics and languages but interact and cooperate each-other when necessary (for instance, the control of neurohormones is exclusively UM.

TBM represents the pattern of a "so-called" voluntary action in response to a perturbing stimulus (see Fig. 1). It is articulated in 5 compulsory steps divided in two phases: ACTION (pertinent to Unconscious Mind (UM)) and COGNITION (pertinent to the 1st-person perspective (1PP) of Conscious Mind (CM). In ACTION, the paradigm adopted by UM to react to the perturbing stimulus is picked up from memory-encoded paradigms pertaining to a similar or analogous experience. In COGNITION, CM focus the attention on how the action evolves with few msecs of delay than UM's activity. So, not knowing the preceding UM's work, CM deludes to have freely and autonomously decided that action (free-will illusion). Moreover, CM feels the sense of responsibility of that action, thus self-attributing a reward or a blame, depending on action outcomes. Then, memory archives are updated of this new experience; the updating will be useful to UM for future actions. Here below the scheme of TBM, slightly evolved in these last years from the original scheme [8]:

Action:

(1) The so-called "voluntary" action is decided and performed by the agent's Unconscious Mind (UM) in response to a stimulus. To this aim, the reaction paradigm that might have the best probability of success is retrieved by UM among those that are encoded in long-term memory store.
(2) After a slight delay, the agent becomes aware of the ongoing action through feedback signals (somatosensory, etc.) that are conveyed to the brain as a consequence of action performance. Thus, the agent's Conscious Mind (CM) (more precisely: the 1st-person perspective (1PP) of CM) always lags behind UM's activity.

Cognition:

(3) Owing to this delay, CM (i.e. 1PP) cannot know UM's work that precedes awareness; thus, erroneously believes it has freely decided the action. Though objectively false, this belief is subjectively perceived as true, due to Free-Will (FW) illusion. It is so persistent and deep-rooted in the mind that CM (i.e. 1PP) is unwilling to abandon it.
(4) The FW illusion satisfies a psychological need to secure the arousal of the Sense of Agency (SoA) and of Responsibility (SoR) of the action. Both SoA and SoR inevitably lead CM (i.e. 1PP) to self-attribute reward or blame depending on action performance and outcome.
(5) Both reward and blame are motivational incentives that foster learning and memory in the CM (i.e. 1PP); the updating of Knowledge will provide new information and the skill required for further action (restart from point 1).

In synthesis, if the stimulus initially is completely unknown, mind will behave as a *Tabula Rasa*; so, the first reaction will be aleatory. However, if the stimulus is repeated, one must restart from the step one; so, if that occurs many times, the learning curve will assume a hyperbolic aspect.

As an example we can show what might occur when writing a letter in response to a friend (see Fig. 3).

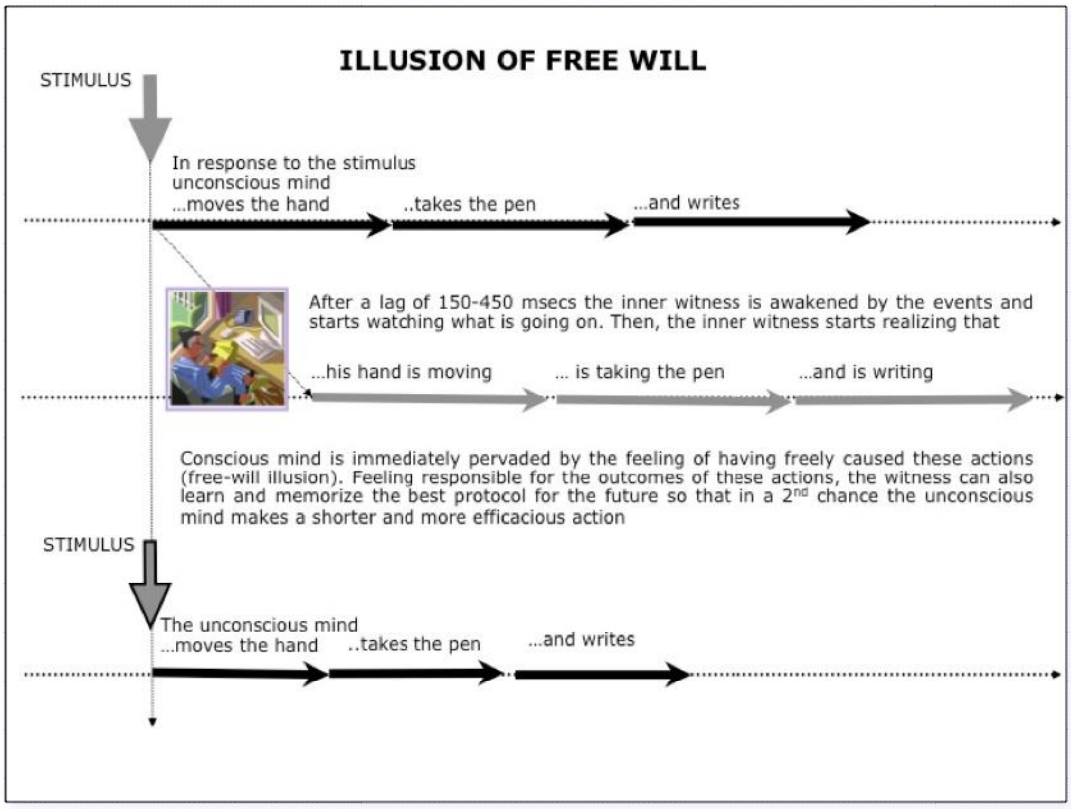

Fig. 3. Recently, we have proposed that CM can dialogue with other minds since it is a domain of thoughts formatted and then translated into a language comprehensible to other people. Dialoguing is one of so-called "voluntary" actions that TBM can therefore describe: 1) ACTION, voice or written messages are controlled by various mechanical actions of vocal cords, breath modulation, finger coordination etc.; 2) COGNITION, the interpretation of voices, written languages or specific gestures may subsequently occur thanks to a mysterious translation of UM's biophysical/biochemical language into the mother's tongue language of inner speech that is comprehensible to CM

4. DUALISMS IN MIND

4.1 "Dual State"

The coexistence of the cooperative but distinct activities of mind, the first one conscious (CM), while the other unconscious (UM) has been already reported in literature as a "Dual State of mind" [15]. Recently, we have made some examples of UM and CM activities by which mind physically and psychically can communicate with the rest of the word. The phylogenetic origin of this "Dual state" in mind seems to be very ancient, i.e. a sort of a-priori dualism whose evidence is particularly efficient and distinctive in men; as if it were genetically selected to facilitate intraindividual communication thus laying the foundations for social life.

4.2 "Double Perspective"

Moreover, we have observed that CM undergoes a maturation process that starts with birth and ends few months later in a bifurcation that gives rise to a second dualism, namely: "Double-Perspective" [15]. The first branch of the bifurcation amplifies the ability of analysing and elaborating thoughts under a rational and objective perspective; while the second one installs the Ego-sense that is suitable to analyse and elaborate thoughts under an emotive, Self-oriented and subjective perspective. These two ways of thinking gives rise to a psychological contraposition between the 3rd-person perspective (3PP, i.e. rational, objective, Self-detached, etc.) and the 1st-person perspective (1PP, i.e. subjective, emotional, Self-oriented, etc), respectively. During individual growth of CM, the Ego-sense grows with the conviction of possessing FW and dominates 1PP; conversely, 3PP confutes 1PP's convictions on scientific bases that binomial Ego-FW might be real. As a matter of fact, this dualism emerges from the "dual-state of mind" as a compulsory product of this dualism. CM, conditioned by 1PP, deludes to possess FW and believes to be the "driver of the car". Paradoxically, this 1PP's strategy shows an enormous success in everyday life cognition, so that it is comprehensible why it underwent a natural selection. Conversely, 3PP knows well that the binomial Ego-FW is an illusion but cannot intervene in TBM; The only possibility of 3PP is to deny the existence of both Ego and FW under a scientific perspective. Therefore, when CM is influenced by 3PP, it may criticize the role that 1PP plays in a voluntary action but only a-posteriori, i.e. only when a so-called voluntary action (i.e. ACTION and COGNITION) have come to an end. As a matter of fact, CM can alternatively utilize either 1PP or 3PP; while 1PP brings COGNITION to a successful Self-oriented (egoistic) end, 3PP is useful to explain all the physiological aspects of mind, i.e. those aspects that are usually considered in the scientific investigations of NCCs. As an example we can compare what is said about FW in Oxford and Stanford dictionaries, mentioned above: FW definition in Oxford Dictionary is a folk definition that meets the subjective, emotional daily-life needs of most people (1PP), while the one in Stanford Dictionary is a highly cultured, objective and self-detached essay that better meets a scientist (3PP).

4.3 "Cartesian-like Dualism"

To this respect, we should notice that 3PP exhibits a witnessing ability, rational and far from any personal interest; so, 3PP can unveil the false 1PP's point of view about the existence of the binomial Ego-FW. Nevertheless, 3PP cannot oppose any concrete, alternative hypothesis about human existence, Self and others hidden aspects of life and consciousness; so, CM begins to feel a creeping suspicion that the "Truth" is an unreachable matter, distinct from mind. So we came to discover the origin of "Cartesian-like Dualism" (CLD) in mind [15]. CLD we are going to talk about, may put in difficult position many readers, since it refers to classic duality, counter-posing two separated realties like mind and body, the observer and the observed, body and Soul, God and Evil, etc.. However, it should be noted that we are not claiming that CLD is real; we are only highlighting that this is the third of a series of dualisms emerging from the others in mind, with no proofs of truthfulness.

5. CONCLUSIONS

In summary, the 1st dualism ("Dual State") is a-priori physiological, the 2nd one ("Double Perspective") appears typically psychological, while the 3rd one ("Cartesian-like Dualism") produces metaphysical unsolvable problems that condition our daily life in all respect: cultural, social, political, religious etc.. Interestingly, all these forms of dualisms seem to emerge one from the other like in a Matrioska, i.e. a special fractal made of expanding envelopes (see Fig. 4).

The classical ontogenetic-phylogenetic triune brain development in man (from the inner brain, cortex has developed into reptilian or instinctive, limbic or emotional and neocortical or rational) was proposed by Paul MacLean [43] as the result of millions of years of evolution; to this respect, according to Munoz [44], it is possible to consider also a spiritual evolution emerging from the biological one: Homo sapiens (transitory physical body), Homo moralis (*Transitory Inferior Conscience*) and Homo spiritualis (*Eternal Superior Conscience*). This study postulates the development of improved neocortex II or "intuitional brain" in next millennia. So, human noble qualities and subtle essential unity among beings will prevail. Again, for the yogis the "experimental meditation-

tool" is the way to demonstrate the perennial divine existence that points from intellect to wisdom intuitions. Munoz says: "*there are some gifted people who raise their consciousness to superior levels through intuition for immediate learning and wisdom attaining direct perception of Divine Truth…*". Then, according to Vedic teachings, he concludes that: "*When a human being elevates the mind to higher planes, he promotes the virtuous qualities of man. Experts from different areas including philosophers and biologists propose that if we teach Yoga to children, the world violence would be eliminated in a single generation*".

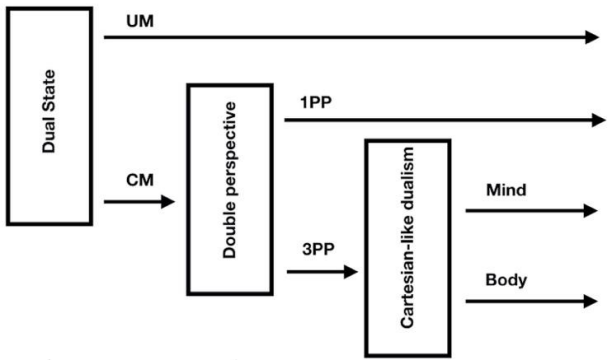

Fig. 4. Ontogenetic pathway of dualisms in mind. At birth, mind progressively splits into 2 cooperative states: Unconscious and Conscious Minds (UM & CM), the first one working with biophysical-biochemical functions while the other one working with a mother's tongue inner-speech, respectively. This dual-state arrangement of mind has phylogenetic origins. Then, in a couple of years, a double-perspective of the inner and outer experience of the Self arises in CM: 1st-person perspective (1PP) and 3rd-person perspective. 1PP evaluates things under a Self-oriented, affective and irrational basis, while 3PP develops a rational, objective and Self-detached perspective. The arousal of Ego and Free-Will (FW) develops with the arousal of 1PP; the binomial Ego-FW will rise as an illusion, nevertheless it will determine the success of Cognitive processes in man. 3PP will try to deny the existence of Ego-FW for the all life, without a convincing argumentation; so, the sense of uncertainty of mind about its identity will finally open the door to metaphysical issues, thus introducing a third dualism: Cartesian-like dualism between *Res-Cogitans* and *Res-Extensa*

As one can understand, this Munoz's hope is an optimistic view of human destiny, anchored to a typical Cartesian-like dualism, i.e. to 1PP's metaphysical conviction [15]. As a matter of fact, this is not really what one should attain by Yoga meditation. In Patanjali's sutra (196 threads written by the sage around 400 C.E.) [43], the maximal target of Yoga meditation is "*citta vritti nirodha*"; this atheistic approach will help us to remove all the fluctuations of the mind that confuse our thoughts: nothing else!

COMPETING INTERESTS

Author has declared that no competing interests exist.

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Enrico Bignetti
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Research and Academic Experience: 1949: born in Brescia, Italy. 1974: graduated Doctor in Veterinary Medicine at the University of Parma, Italy. 1977: Professor of Physiology at the University of Parma. 1985: Professor of Clinical Biochemistry and Molecular Biology at the University of Parma. 1987-1998: Director of Veterinary Biochemistry Institute. 2017: retired. Foreign Scientific Institutions attended: 2 semesters c/o Polytechnic of Zurich. 1 stage at the University of Oregon, 1 stage at Yale University and 2 semester at Florida State University at Tallahassee, USA. International congresses: participated to several congresses as invited speaker (Brescia, Italy; Palermo, Italy; Jerusalem, Israel; Agra, India) (Rome, Italy, and New York, USA, will be postponed for Covid19).

Research Area: 1) The molecular mechanism of vision: for the 1st time it was demonstrated that Guanosine-triphosphate is directly involved in light-excitation of photoreceptors. 2) The molecular mechanism of olfaction: for the 1st time it was purified and characterized an Odorant-binding protein from nasal mucosa. 3) The molecular mechanism of taste: the psycho-active effect of Glutamate (Umami taste) was investigated. 4) Neuronal cells in culture for biosensor productions were used to investigate the psycho-active effects of food. 5) The study of cognitive processes in Cognitive Sciences: for the 1st time a new human cognitive model based on free-will illusion was proposed.(The Bignetti Model).

Number of Published papers: About 200 papers on national and international journals and several books.

Special Award: "Premio S. Martino 2011": a special award given by the Mayor of Noceto town to illustrious citizens. Several other appreciations by academic and editorial institutions for professor's life and work.

Any other remarkable point(s): Extra Academic activities: Conceptual Artist (Art exhibitions of installations and assemblages). Teacher of Hatha Yoga and expert of oriental philosophies since many decades ago.