

# *Resolution Of Interconnections Between Will, Free Will And Consciousness*

Mustafa EROL<sup>1</sup> and Alkım EROL<sup>2</sup>

<sup>1</sup>Dokuz Eylül University, Education Faculty of Buca,  
Department of Mathematics and Science Education, Physics Education Division,  
Buca, İzmir, TURKEY. E-mail: mustafa.erol@deu.edu.tr

<sup>2</sup>Universitat Oberta de Catalunya, Computer Multimedia and Telecommunication Studies, Barcelona,  
SPAIN, E-mail: aerol@uoc.edu



**Abstract** – The present work concisely focuses on the complicated concepts of the will, the free will and also tries to resolve the interconnections with the concept of consciousness, on the scientific basis. Initially, complete human structure is modelled in terms of environment, body and brain-based consciousness. Based on the modelling, the origins of the human will and relations with the consciousness are discussed and investigated. The free will is briefly investigated in terms of existence, freedom level and influencing factors. Finally, the puzzling concept of destiny/fate is tackled under the illuminations of the modelling human structure and arguments on the will and the free will. It is concluded that the brain-based consciousness creates the human will, largely governs the freedom level of the will and moderately influences the destiny.

**Keywords** – Human Structure, Will, Free Will, Consciousness, Destiny.

## I. INTRODUCTION

Human decision mechanisms and consequently will or volition are amongst the most puzzling and challenging concepts of human nature and have been tackled by a number of means, namely philosophically, scientifically and theologically [1]. In the most general form, will can be described as the human ability of deciding or choosing out of a number of choices. The concept of will is fairly complicated in the sense that the origins and the degree of freedom ought to be examined and resolved very prudently. Free will, on the other hand, can be described as the human ability of deciding or choosing completely freely out of many possible choices and have also been tackled by a number of resources namely, philosophically [2-4] theologically [5,6] and scientifically [7-10]. The free will is likewise complicated and must be examined carefully due to being influenced by many concepts such as knowledge, culture, politics, emotions, communication, social pressure, self-confidence, responsibility, persuasion, advice, prohibition, ethic, encouragement and advertisement etc [11]. The will and free will are conventionally ancient problems of both natural sciences and social sciences and must therefore be handled by interdisciplinary approaches and are still far away from the full resolution [4]. Therefore, the present effort genuinely proposes to handle the concepts of the will, the free will, the destiny and their interactions with the concept of consciousness.

Traditionally speaking, two distinct approaches exist concerning the will and the free will, namely determinism and compatibilism [11,12]. Determinists assume that the macroscopic world and relating phenomena are deterministic and the outcome of any event is based on the history of the event and causally predictable. Hence, one of the most fundamental questions arises from the fact that, how, in such a deterministic world, possibly the free will can exist? Determinism is historically established in a number of aspects such as hard determinism, causal determinism, logical determinism, biological determinism,

and psychological determinism. They all underline the incompatibility of the determinism with the free will by basically excluding the human will factor from the deterministic natural laws [11,13]. Causality is naturally connected to the determinism and states that all events occur due to a cause and appropriate conditions and the results are totally predictable and deterministic [14,15]. Compatibles, in contrast to this view, express that the deterministic structure of the physical/natural world is in fact compatible with the free will [12,16]. Consequently, the deterministic structure of the macroscopic world ought to be including the human will or free will and cannot be excluded from the causality and deterministic structure of the nature [14,15]. However, there seems to be some incorrect considerations at this point in the sense that the free will is in fact a function of the human consciousness and consequently exists within the nanostructure of the brain and therefore is not a part of the macroscopic world. This view leads to a different approach, can be named as the nano-physicalism, which separates the deterministic macro world and the probabilistic nano world and articulates that the will or the free will exists within the nano world of the brain, that is the consciousness and is not compatible with the determinism.

Complete resolution of human structure is surely linked in many ways to the concepts of the will, the free will, the consciousness and indeed the destiny, hence ought to be considered all together. The first ground breaking effort to resolve the complete human structure is historically performed by famous philosopher Descartes, articulating that the body and the mind or soul are two distinct aspects of the human structure [17]. Human actions are mainly driven by the thoughts, feelings and indeed beliefs and realised in the form of interactions with the surrounding environment. The control and decision mechanism of the actions, based on thoughts, feelings and beliefs, which are undoubtedly associated with the concept of volition or will, must be handled carefully. In order to resolve the human decision mechanisms and will, it seems compulsory to resolve the complete human structure. Complete resolution of the human structure has been the scorching topic of a number of disciplines, namely psychology, psychiatry, neurosciences, cognitive sciences, biology, physics, chemistry, sociology, philosophy and so on [18]. In spite of some pronounced efforts, pure scientific resolution of the human structure is not allocated enough until recently and left behind the scope of the scientific activities. Hence, modelling the human structure could be considered to be one of the most important highways to fully resolve the will/volition and free will.

Destiny or fate has conventionally been the topic of theology and philosophy, hence left out of the scientific considerations, however recent developments on especially natural sciences specifically on quantum mechanics open new routes to tackle the problem in an enhanced way. Fate or destiny puzzles theologians, philosophers and scientists in many ways and the complete resolution appears to be far away. The concepts of will, the free will, the consciousness and the human structure surely and relentlessly interact with each other, and determine route of the complicated concept of destiny and these all have briefly been within the scope of the present work [7,19].

There have recently been some great scientific efforts focusing on the origins, existence, functioning and resolution of the will and the free will. In order to mention some neuro scientific approaches, Libet placed some efforts on answering the question of whether human beings do have free will or not? Libet has taken an experimental approach to the problem and concluded that the will or volitional process is initiated unconsciously, nevertheless the conscious function could still control the outcome. Libet also expressed that free will would not initiate a voluntary action nevertheless it could control performance of the action.<sup>7</sup> In another effort, testability of free will hypothesis is studied neuro scientifically and concluded that the free will is neither verifiable nor falsifiable by empirical evidence. It is also stated that the relevant arguments are not a priori but rather are based on a posteriori consideration of the relevant neuroscientific investigations [20]. The neurocognitive bases of human volition or will is reinvigorated by Haggard via proposing a range of different features that constitute a new neuro cognitively realistic working definition of volition. It is concluded that volition is a neurocognitive process of enormous common importance and subject to scientific investigation [21].

The will and free will problem is also handled by physicists both classically and quantum mechanically and the efforts lead to some great progresses. The free will theorem is stimulatingly developed based on purely experimental physics and proved that if the choice of a particular type of experiment is not a function of the information accessible to the experimenters, then its outcome is equally not a function of the information accessible to the experiment. It, in more common sense, states that if the selection of a human being does not depend on the past experiences then the outcome equally does not depend on the previous experiences [22]. Philosophy of mind and the problem of free will, in the light of quantum mechanics, is also tackled by physicist Stapp. He essentially expresses that to cope with the conflict between the macroscopic indefiniteness and the definiteness of the conscious experiences, quantum mechanics introduces the argument of agent-generated probing actions, each of which identifies

a definite set of alternative possible experientially distinct outcomes. Quantum theory offers the mathematical concept of randomness to describe the probabilities of the various alternative possible outcomes of the chosen probing action. Nevertheless, the agent-generated select of which probing action to perform is not governed by any known law or rule, statistical or otherwise. This causal gap offers a logical need, for the entry into the dynamical structure of nature of a process that goes beyond the currently understood quantum mechanical statistical generalization of the deterministic laws of classical physics [23]. Lloyd has likewise recently tackled on the roles of quantum mechanics and computation in free will. It is expressed that quantum mechanics suggests that events are intrinsically unpredictable, the stochasticity of quantum mechanics adds randomness only to decision-making processes, not to free will. By contrast, the theory of computation indicates that, even when our decisions arise from a completely deterministic decision-making process, the outcomes of that process can be intrinsically unpredictable. It is also argued that the intrinsic computational unpredictability of the decision-making process is what gives rise to our impression that we possess free will [24].

The scientific works, summarised above, clearly indicate that human decision mechanism or will surely realise within the brain-based consciousness [25,26]. Hence the resolution of consciousness seems to be the key factor to understand and resolve the will. Recently there has been some great advancement on understanding the mechanisms within the brain and consequently consciousness, therefore we are in a much better position to understand the will, the free will, the complete human structure and indeed the destiny. The present work specifically focuses on resolving the interconnections between the concepts of the will, the free will, the complete human structure and consequently the consciousness and the destiny. Specifically, following fundamental problem statements are tried to be answered. 1-How can we model the complete human structure? 2-What is the origin of the concept of will and how does it operate? 3-Do we have free will and to what extend decisions are really free? 4-What is the relation between the free will and fate/destiny?

## **II. MODELLING COMPLETE HUMAN STRUCTURE**

The human structure, in general, can be considered as one of the most complicated entities of the nature due to principally having the physical body and also functioning very complicated activities such as thoughts, emotions, beliefs, decisions and actions and so on [18, 27, 28]. In order to resolve the will and the free will and also to answer the first problem statement of the work, complete modelling of the human structure is currently proposed.

The Human Structure Model (HSM) is assumed to be comprised of three main components, namely the environment, the physical body and the mind/consciousness. The environment is the source of any information and the interactions of the environment and the body results to the transfer of the environmental data to the physical body and vice versa. Therefore, any instantaneous event or environmental information adds up to the actual database of the HSM. The environment inclusively contains all other human beings, all other living creatures and also non-living matter or energy. The second component of the HSM is the physical body which indisputably accommodates all the organs, tissues, vessels, muscles, bones and of course the sensory organs and entire nervous system which definitely embraces the physical brain. The environmental information can be transferred to the sensory organs in the forms of visual, auditory, gustatory, olfactory and somatic data. Each sensory organ has some special sensory cells that receive the environmental information/energy in different forms and convert that information to unique electrical action potentials and transfer the information to the nervous system, specifically either to the brain or to the spinal cord. The information/energy arriving at the spinal cord is transferred to the motor neurons and finally to the autonomic nervous system and generate the reflex activities. The reflex activities are finally realised by the sympathetic or parasympathic systems and can be considered as non-conscious actions. The reflex actions need no decision making or thinking processes such as driving, cycling, swimming. Therefore, the reflex activities can be excluded from the volition or will in the sense that they are unconsciously realised. The consciousness is the evaluating, processing and governing part of the HSM. The sensory information/energy, transmitted directly to the brain, creates the vital conscious activities [29]. The brain in fact transforms that energy/information to the unique action potentials and later to the quantised electromagnetic fields and transmits that information to the ultimate control and processing centre that is the consciousness/mind.<sup>26</sup> The brain, in this sense, performs as an interface between the rest of the body and the mind/consciousness. The consciousness/mind is presumed as the ultimate control centre of the human beings and processes any information, initiates responses, produces thoughts, emotions and decisions and also creates the memory and stores the information. The response of the consciousness/mind is initially transferred to the brain and sequentially to the spinal cord, to the motor neurons and finally to the somatic nervous system and conscious actions are maintained [30]. Suggested Human Structure Model (HSM) is given in the figure 1.

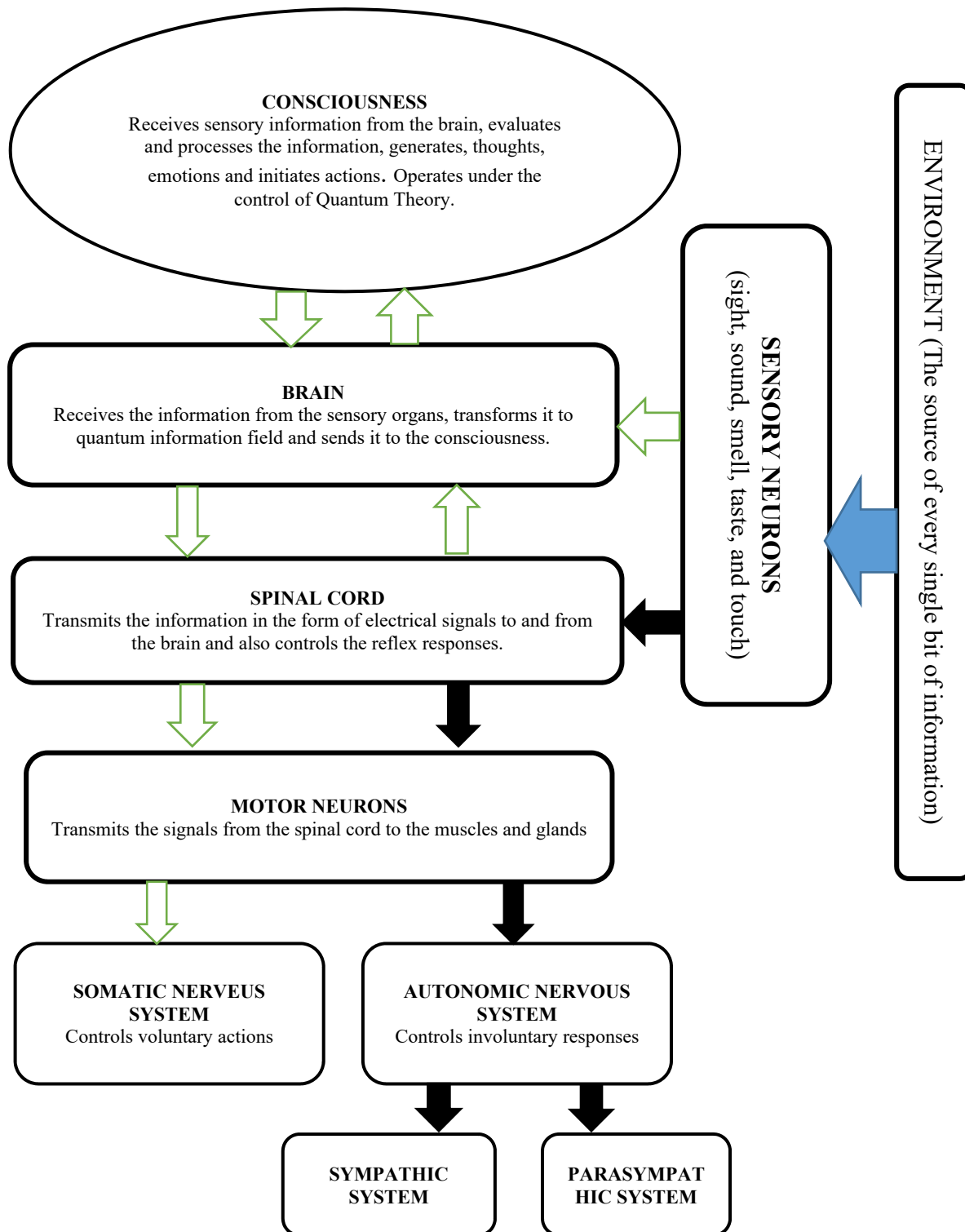


Figure 1. Schematic illustration of The Human Structure Model (HSM), consisting of three main components namely, 1. The Consciousness/mind, 2. The Physical Body and 3. The Environment. Unfilled arrows show the route for the conscious acts and filled arrows show the route for the involuntary reflex acts.

Concerning the will or the free will, the proposed HSM is comprised of two main routes, namely conscious actions and unconscious or reflex actions. Unconscious reflex actions are controlled by purely the spinal cord and realised through the autonomic nervous system, specifically, through the sympathetic or parasympathic nervous systems. Obviously reflex actions are not interconnected to the brain and consequently consciousness, therefore they can be extracted from the concept of volition or will. According to the proposed HSM, conscious voluntary actions are created by the consciousness and realised through the somatic nervous system directly connected to the brain and consequently to the mind/consciousness. Hence, volition or will is generated by the mind/consciousness and functions in accordance with the principles and laws of the quantum field theory of quantum mechanics. The volition or will is created by the consciousness in the following manner. The sensory information/energy received by the brain is transferred to the relating cortical neurons and finally causes to the creation of the quantum information field [26]. The quantum information field can be assumed to be the equivalence of the consciousness/mind and is the ultimate management centre of the human structure. The mind/consciousness, once receives the information, immediately processes it in accordance with the quantum mechanical laws and decides what to do and whatever the final decision is, it is conducted to the brain and the brain fulfils the order.

### **III. ORIGIN OF THE WILL AND THE CONSCIOUSNESS**

The will/volition can alternatively be assumed as the human ability of consciously choosing or deciding out of a number of existing choices and acting accordingly. The HSM offered previously assumes that the ultimate control centre of the conscious activities is the consciousness/mind which is produced by the cortical neurons of the brain. Consequently, the origin of the will/volition can scientifically be attributed to primarily the brain and epiphenomenally to the consciousness [31, 32]. Therefore, the existence and the resolution of the concept of will depend on the resolution of the consciousness. Many disciplines have, up to date, given some great efforts to describe and resolve the consciousness/mind by focusing on different and intangible properties of the concept [29, 33, 34]. The scientific research focusing on the resolution of the brain and consciousness by using the quantum physics achieved incredible progress on both the brain and mind/consciousness [18, 35]. The assumption of the consciousness as a physical concept, which means comprised of either energy or matter, has made a great breakthrough on this problematic issue. This is the vital and critical step to consider the consciousness as a physical and measurable entity. Considering the scientific approaches and assuming the consciousness as a pure physical energy lead to the following scientific definition. Consciousness is the dynamic self-awareness concept, constructed by the brain's cortical neurons as a quantum information field that continuously receives information/energy from the brain, evaluates and processes the information and initiates the responses. The consciousness is, by definition, a dynamic entity which can instantaneously be influenced by both long-term and instant conditions such as, needs, knowledge, education, freedom, culture, social pressure, self-confidence, responsibility, persuasion, advice, prohibition, ethic, encouragement, advertisement, politics and many more [36]. Hence, the full resolution of the will/volition is highly complicated in the sense that it is almost impossible to determine the weight of any specific parameter on a specific choice or decision. The presence of the choices can obviously be considered as the precondition of the human selection or decision mechanisms. Assuming that the choices are all on the table, then the mechanisms of conscious selection or processing is the fundamental issue of human consciousness and consequently the will/volition. The HSM divides the human activities into two distinct parts, namely conscious actions and unconscious actions [37]. However, the issue is in fact more complicated in the sense that most actions involve both conscious and unconscious involvements. Walking or swimming, for instance, can be considered to be involving both conscious and unconscious activities. The human actions that are completely unconscious are purely controlled by the spinal cord and autonomic nervous system. All sort of reflex actions is automatically governed by the spinal cord through the sympathetic and parasympathic systems [37,38]. The actions that are consciously realised are, on the other hand, governed by the cortical neurons of the brain and therefore by purely the brain-based consciousness.

Consciousness works fundamentally in two distinct ways, namely instantaneous data based processing and memory based processing. Instantaneous data based processing is realised at the moment of any case of which sensory information is being reached to the brain. Solving a physics problem is, for instance, such an activity. Memory based processing is, on the other hand, is realised by purely considering and evaluating the data already present within the memory. Deciding to enter a specific exam or deciding to get married with a specific person are such activities. Both data based and memory based conscious activities are performed based on the data or information already existing within the memory. Therefore, the will/volition can be assumed to be performing based on the memory of the person. [39]. This basically means from the moment of birth to the present moment all the environmental sensory information builds up the database for the consciousness and also for the memory. Consciousness mainly

creates thoughts, emotions and beliefs, based on the data in the memory, past experiences, and instant information stream internally from the whole nervous system and externally from the sensory organs [27, 40]. As a result, the will or volition is assumed to be created and fully controlled by the brain-based consciousness and is a pure function of the brain-based consciousness [21, 39, 41].

#### **IV. PARAMETERS INFLUENCING THE FREEDOM LEVEL OF THE WILL**

It is expressed that the human will or volition, from the scientific point of view, is purely created and performed by the consciousness [42]. The free will is, on the other hand, the ability of choosing or deciding on any issue completely freely. In this sense, the freedom level of the will, in other words the free will, is a fundamental puzzling issue and needs to be resolved clearly. The freedom level of the will/volition is assumed to be depending on three main factors, namely, memory, existing choices and processing mechanisms.

1-Memory: The memory denotes the database that has been built up depending on the past experiences and recorded through the sensory information. Any information, exists within the memory, is based on the sensory information which builds up instantaneously and continuously right from the beginning, that is the birth or even before the birth and creates the space for the consciousness to be able to function. Hence, any instantaneous environmental information in the past effectively determines the effective database and outcomes of the consciousness. In this sense, the will/volition functionally depends strongly on the database of the consciousness.<sup>43</sup> The database is the actual source of information, which is in fact the memory, to evaluate, compare and process in the case of a decision or selection moment. The processing mechanism is more complicated and difficult to resolve in the sense that the process can be influenced by a number of social concepts such as culture, social pressure, self-confidence, responsibility, persuasion, advice, prohibition, ethic, encouragement and advertisement etc [36].

2-Choices: The present conditions and of course the choices on the table are the other important parameter that influence the actual outcome of the human consciousness. In this sense, instant and long term conditions such as, needs, knowledge, education, freedom, culture, social pressure, self-confidence, responsibility, persuasion, advice, prohibition, ethic, encouragement, advertisement, politics and many more are predominantly influences the free will [36].

3-Processing: The processing and evaluation mechanisms of the consciousness primarily effect the freedom level and consequently the outcome of the consciousness or will. Therefore, the actual problem actually reduces to tackle and discuss the concepts and mechanisms that govern the human consciousness [28]. Recent great scientific progress on the resolution of the consciousness, summarised above, indicates that the consciousness operates under the full control of the quantum mechanical laws based on the physical information reaches to the brain and eventually creates the consciousness database [28]. However, processing that information, in any case of any selection or choice, seems very complicated. Quantum field theory is assumed to be principally governing the information processing mechanisms of consciousness in accordance with the laws of quantum mechanics. According to the quantum theory, every single bit of visual, auditory, gustatory, olfactory and somatic data is represented by a unique energy quanta and stored within the memory. In the case of any selection, decision or evaluation process, the instantaneous data is compared and physically interacted with the existing energy/data and the outcome is determined. Therefore, the probabilistic structure of the quantum theory obviously plays a fundamental role within the processing mechanism of the consciousness. It is also clear, according the human structure model, that there are no any supernatural intervention or mechanism to govern or pre determine the route of the actual decisions and selections. Consequently, it is genuinely proposed that the past experiences strongly influence the will. The will is not fully free, however is limited to the past experiences, present choices and the ability of the consciousness to processing capacity of that information.

#### **V. THE DESTINY AND THE WILL CONNECTION**

Destiny/fate is an exceptionally complicated concept and has historically puzzled some fundamental disciplines such as theology, philosophy and lately indeed the natural sciences [19]. A person's life line and therefore destiny/fate is tried to be resolved concerning a number of aspects, some of which are the origin, supernaturally, predetermination and responsibility [5]. The debate is surely not terminated by any means, however recent great achievements of especially the natural sciences illuminates some powerful lights on this specific problem. Explicitly, great interdisciplinary scientific progresses relating the human brain and brain-based consciousness, the extend of quantum mechanics to various disciplines and recent further comprehension of the natural sciences lead to some alternative approaches to resolve the fate/destiny. Recent progresses especially on the resolution of the human consciousness shows that consciousness is directly connected to the will or free will.



Therefore, the problem of destiny is scientifically assumed to be influenced by three main mechanisms, namely the natural laws, personal conscious actions and finally others' conscious actions.

1.Natural laws: There is no doubt that the natural laws, causal deterministic at macro scales and probabilistic at atomic scales, govern the whole matter or energy at any spatial and temporal scale [44]. Additionally, the natural/physical laws are invariant with respect to time and space, meaning no change occurs by any means. Probably, the most important feature of the natural/physical laws, is that no external or supernatural interception exists. This feature in fact eliminates the theological and some philosophical arguments expressing that the fate or destiny is controlled by the supernatural power. Hence, scientifically approaching the fate/destiny is primarily influenced by the natural laws which are time, intervention and space free.

2.Personal conscious actions: Conscious actions are governed by the brain-based consciousness which operates under the full control of probabilistic quantum information field theory based on the environmental information. Accordingly, the conscious actions are managed by the motor neurons and muscles in accordance with the conscious decisions. Therefore, it is quite obvious that any personal fate or destiny is strongly influenced by the personal decisions and actions [21].

3.Excluding actions: The final mechanism that influences anybody's personal fate or destiny is the interactions between one's personal actions and actions of other living creatures, humans or animals [45]. Any intervention at space-time can decisively change the route of the destiny and therefore this process can continuously alter anybody's life line.

The proposed destiny approach underlines that the organic connection between the destiny and the will is realized through the personal actions mechanism. Other mechanisms, namely the natural laws and excluding actions or other living creatures' actions cannot externally be influenced or controlled by the subjects. Hence, the destiny or fate of a person can only be determined and controlled to some extent by only personal conscious actions which are obviously the function of the will and consequently the free will. However, the weight of the personal will on the overall personal destiny is too complicated to determine based on today's science and technology. It is strongly believed that the issue is very motivating and can surely be resolved in the future.

## VI. CONCLUSIONS

This work is a concise effort to resolve and answer the following fundamental problems; firstly, how can we model complete human structure? secondly, what is the origin of the concept of will and how does it operate? thirdly, do we have free will and to what extent decisions are really free? and finally, what is the relation between the free will and Fate/Destiny? The first problem statement is answered by suggesting a complete human structure model based on three main factors, namely the environment, physical body and the consciousness. The second problem statement is answered by connecting the origin of the will to the brain-based consciousness and consequently the actual operation of the will is connected to the quantum information field approach. The freedom level of will is tackled by basically proposing the fundamental factors of the memory, the choices and the data processing mechanism of the consciousness. Conclusively it is expressed that the will is in fact limited to the sensory information, the existing choices and also to the processing power of the consciousness. In order to answer the last problem statement, the destiny is basically resolved and the physical link is set between the destiny and the natural laws, personal conscious actions and also other's actions.

## REFERENCES

- [1] R. C. Bishop, Chaos, indeterminism, and free will. In *The Oxford handbook of free will*, 2002.
- [2] H. Bergson & F.L. Pogson, *Time and free will: An essay on the immediate data of consciousness*. Courier Corporation 2001.
- [3] D. Pereboom, *Living without free will*. Cambridge University Press 2006.
- [4] R. Kane, *Rethinking free will: New perspectives on an ancient problem*. In *The Oxford handbook of free will* 2011.
- [5] C.J. Nederman, *Amazing grace: Fortune, God, and free will in Machiavelli's thought*. *Journal of the History of Ideas*, 60(4), 617-638, 1999.
- [6] R.W. Jenson, *Systematic theology: The works of God (Vol. 2)*. Systematic Theology, 2001.
- [7] B. Libet, *Do we have free will ?*. *Journal of consciousness studies*, 6(8-9), 47-57, 1999.

- [8] P. Haggard, Human volition: towards a neuroscience of will. *Nature Reviews Neuroscience*, 9(12), 934-946, 2008.
- [9] T.T. Hills, Neurocognitive free will. *Proceedings of the Royal Society B*, 286(1908), 20190510, 2009.
- [10] C. Janew, The Reality of Free Will. *Journal of Consciousness Exploration & Research*, 11(1), 1-16, 2000.
- [11] N. Pleasants, Free will, determinism and the “problem” of structure and agency in the social sciences. *Philosophy of the Social Sciences*, 49(1), 3-30, 2019.
- [12] T.J. McKay & D. Johnson, A reconsideration of an argument against compatibilism. *Philosophical Topics*, 24(2), 113-122, 1996.
- [13] R. Groff, Sublating the free will problematic: powers, agency and causal determination. *Synthese*, 196(1), 179-200, 2019.
- [14] M. Bunge, *Causality and modern science*. Routledge, 2017.
- [15] T. O'Connor, Causality, mind, and free will. *Philosophical Perspectives*, 14, 105-117, 2000.
- [16] H. Beebe & A. Mele, Human compatibilism. *Mind*, 111(442), 201-224, 2002.
- [17] R. Descartes & A. Kenny, *The philosophical writings of Descartes: Volume 3, The correspondence (Vol. 3)*. Cambridge University Press, 1984.
- [18] A. Parent & M.B. Carpenter, Ch. 1, *Carpenter's Human Neuroanatomy*, Williams & Wilkins, 1995.
- [19] R. May, *Freedom and destiny*. WW Norton & Company, 1999.
- [20] R. Northcott, Free will is not a testable hypothesis. *Erkenntnis*, 84(3), 617-631, 2019.
- [21] P. Haggard, The neurocognitive bases of human volition. *Annual review of psychology*, 70, 9-28, 2019.
- [22] J. Conway & S. Kochen, The free will theorem. *Foundations of Physics*, 36(10), 1441-1473, 2006.
- [23] H.P. Stapp, *Philosophy of mind and the problem of free will in the light of quantum mechanics*, 2008. arXiv preprint arXiv:0805.0116.
- [24] S. Lloyd, A Turing test for free will. *Philosophical Transactions of the Royal Society A: Mathematical, Physical and Engineering Sciences*, 370(1971), 3597-3610, 2012.
- [25] D. Hodgson, Quantum physics, consciousness, and free will. In *The Oxford handbook of free will*, 2002.
- [26] M. Jibu & M. Yasue, *Quantum brain dynamics and consciousness: an introduction*. advances in consciousness studies, J.B. Publishers, Amsterdam, 1995.
- [27] M.E. Ford, *Motivating humans: Goals, emotions, and personal agency beliefs*. Sage Publications, 1992.
- [28] J.R. Busemeyer Z. Wang & J.T. Townsend, Quantum dynamics of human decision making, *Journal of Mathematical Psychology*, 50, 220–241, 2006.
- [29] J.M. Schwartz, H.P. Stapp & M. Beauregard, Quantum physics in neuroscience and psychology: A neuro physical model of mind-brain interaction, *Philosophical Transactions of the Royal Society of London B*, 360, 1458, 1309-1327, 2005. DOI 10.1098/rstb.2004.1598.
- [30] T.A. Poehlman T.K. Jantz & E. Morsella, Adaptive skeletal muscle action requires anticipation and “conscious broadcasting”, *Frontiers in Psychology*, 2012. doi: 10.3389/fpsyg.2012.00369.
- [31] J. Shepherd, Free will and consciousness: Experimental studies. *Consciousness and Cognition*, 21(2), 915-927, 2012.
- [32] P. Adams & A. Suarez, *Exploring Free Will and Consciousness in the Light of Quantum Physics and Neuroscience*. In *Is Science Compatible with Free Will?*, Springer, New York, NY., pp. 273-290, 2013.
- [33] -E.H. Walker, The Nature of Consciousness, *Mathematical Biosciences*, 7, 131-178, 1970.
- [34] K.H. Pribram, *Brain and Perception*, New Jersey: Lawrence Erlbaum, 1991.



- [35] L.M. Ricciardi & H. Umezawa, Brain and physics of many-body problems, *Kybernetik*, **4**, 44–48, 1967.
- [36] R.F. Baumeister & E.J. Masicampo, Conscious thought is for facilitating social and cultural interactions: How mental simulations serve the animal–culture interface. *Psychological review*, 117(3), 945, 2010.
- [37] B. Libet, Unconscious cerebral initiative and the role of conscious will in voluntary action. *Behavioral and brain sciences*, 8(4), 529-539, 1985.
- [38] P. Sumner & M. Husain, At the edge of consciousness: automatic motor activation and voluntary control. *The Neuroscientist*, 14(5), 474-486, 2008.
- [39] R.F. Baumeister, E.J. Masicampo, &K.D. Vohs, Do conscious thoughts cause behaviour? *Annual review of psychology*, 62, 331-361, 2011.
- [40] A. Ellis, The revised ABC's of rational-emotive therapy (RET). *Journal of Rational-Emotive and Cognitive-Behaviour Therapy*, 9(3), 139-172, 1991.
- [41] E.R. John, A field theory of consciousness. *Consciousness and cognition*, 10(2), 184-213, 2001.
- [42] T. Thagard, Mind, Consciousness, and Free Will. *Frontiers of Philosophy in China*, 13(3), 377-393, 2018.
- [43] M. F. Mascolo & E. Kallio, Beyond free will: The embodied emergence of conscious agency. *Philosophical Psychology*, 32(4), 437-462, 2019.
- [44] R.C. Bishop & H. Atmanspacher, The causal closure of physics and free will. In *The Oxford Handbook of Free Will*, 2011.
- [45] J. H. Conway & S. Kochen, The strong free will theorem. *Notices of the AMS*, 56(2), 226-232, 2009.