TH.02.B1

Education and Neuron Network Based Systems[1]

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Abstract

This work approaches the education problem as a system of mechanisms which influence the function of human brain. Such mechanisms are neuron based structures which are well known as they are simulated and programmed in electronic computers usually to solve complicated problems. Therefore, education may be viewed as a neuron network programming system to develop genetic type of software in the effort to maintain a balanced human mind. Most genetic software exists by birth of a person and controls the function of all vital organs of human body including stomach, heart, kidneys, etc., and this software maintains its original structure with minimal changes. Therefore a relatively small portion of genetic software is dedicated to control human mind or human thought and human motion. This software is constantly developed as the person grows up and is influenced by the social environment. This approach is necessary to analytically explain the reasons people as individuals or as social groups behave in a specific way.

On the other hand education can be greatly facilitated if there is a clear definition of a balanced human mind model and this is also included in the investigation of present work. The conclusions of this work will help to create standards for education in its effort to develop a balanced human mind and also will help the individual to develop immune bodies against those they try to derange this balance.

Further more this approach will help social sciences to better understand and interpret the results of the analysis of samples related to the behaviour of individuals and of social groups.

Keywords: education, virtue, healthy mind, neuron networks, human error, ideals, peace

Introduction

Human sciences and particularly social sciences usually study human behavior as a separate event caused by individuals or groups by examining mostly appropriate samples or data attributed to such individuals or groups. A typical example may be considered the work published by Reinhart C. M. & Kenneth S. Rogoff**,** 2008, where economic crises events are examined as they happen to individual countries since the 14th century to conclude that major default episodes are typically spaced some years (or decades) apart, creating an illusion that "*this time is different*" among policymakers and investors, while the same economic crisis is repeated under approximately same conditions. This kind of analysis is virtually centered on

[1] Presented at the 6th National & International Conference "Systemic Approaches in Social Structures" organized by the Hellenic Society for Systemic Studies (HSSS) & University of the Aegean, Department of Sociology, 23-26 June 2010 Mytilene, Greece.

the event without examining the reasons humans behave that way. However, in this present work there will be an effort to examine the mechanisms which are neuron based structures which cause humans behave in a particular manner and which have to do with the education of people.

Neuron based structures

Human mind if examined within human dimensions is the dominant mechanism in cosmos of planning and executing actions also trying to understand the universe. In this respect, in the absence of such a mechanism like human mind, universe could have no meaning. On the other hand human mind is hosted within human brain which is a biological neuron based structure. Such structures can be trained or programmed to perform specific tasks. It is quite interesting related research performed at MIT Social Cognitive Neuroscience Laboratory (Saxe R, 2010). Neurons and neuron networks are well known because they can be simulated on electronic computers and also they can be used to solve complicated problems. A neuron network was used by Christos Vasilakos et al 2009, to estimate a fire hazard index based on 17 different variables and where the neuron network was trained using historical data for all 17 variables from past fires. There are two things to pay attention as far as neuron networks are concerned, the one has to do with their error performance and the other has to do with their training or programming capability. Neuron network structures will never be absolutely correct except by accident, therefore they can be trained so that the variance of such errors is within specific threshold limits. Although biological neurons may be different than computer simulations, they also have training or programming capabilities and they also maintain the variance of their error within certain threshold limits. Most organs on the human body such as eyes, stomach, heart, kidneys, liver, etc., are controlled by local neuron structures for routine tasks and by brain neuron structures to maintain local and global balance. Programming or training of neurons is related to corresponding software which in the case of biological structures or DNA technology structures the term *genetic software* may be used. It must be noted that most neuron structures on the human body curry genetic software which is developed by nature during pregnancy. Only a small portion of genetic software is developed after birth and during the living period of a person to control most mind activities and motion. Mind itself curries also genetic software by birth which may add some specific talents to a person. Consequently, mind in its effort to be developed builds up its own genetic software influenced by the natural and cultural environment. A simple example to illustrate how mind is developed and functions as a neuron based structure is given in Figure 1.

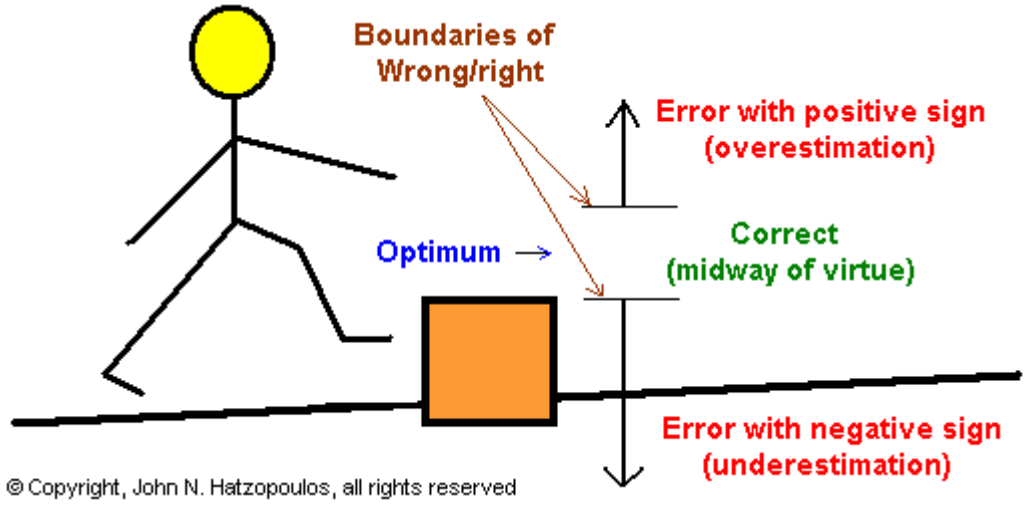


Figure 1. The functioning of a neural network and the error variance (Hatzopoulos 2009).

As shown in Figure1, if someone wishes to walk over an obstacle during walking in a flat terrain, it is necessary to raise the foot. There is an "*optimum"* or *perfect* height to raise the

foot, i.e., with minimum energy and minimum risk. However, raising the foot a little higher or a little lower from the optimum height, the action is considered as being correct because in this range there is no false step. If the height of the foot is lower than the correct height then there is a false step and the action may be considered error with negative sign. If the height of the foot is higher than the correct height then there is a false step and the action may be considered error with positive sign. The magnitude of the error varies from a temporary loss of balance and return to the right position, to a serious injury. However, if human error is to be quantified it will take values from zero to minus infinity and from zero to plus infinity (see also Figure 4). The midway (mid-space) which is defined as "*correct*", is actually the error variance of the neuron structure and it is quite similar to the "*midway of virtue*" as defined by Aristotle and is going to be studied bellow.

Therefore, one may observe the following:

(a) The boundaries of wrong and right are quite clear and can be precisely defined.
(b) The function of a neuron network structure has the following characteristics:
    a. A non trained neuron structure (for example, a little kid) the first time that will try to pass the obstacle it is likely to have a false step.
    b. The next time that will try to pass the obstacle it is going to have a better performance which means that the neuron based structure can be trained to improve its performance at any desirable level as approaching the optimum.
(c) In the same action, wrong and right (error and correct) coexist and their boundaries are located at a point where the error value is bellow a threshold limit.
(d) Correct and error are quantities inverse proportional to each other which means that in an action with high error value the correct value is low and in an action with low error value the correct value is high.
(e) Let X be the error value and Y the correct value of a specific action, then the function which relates these two quantities is as follows:

$$Y = 1/X \qquad (1)$$

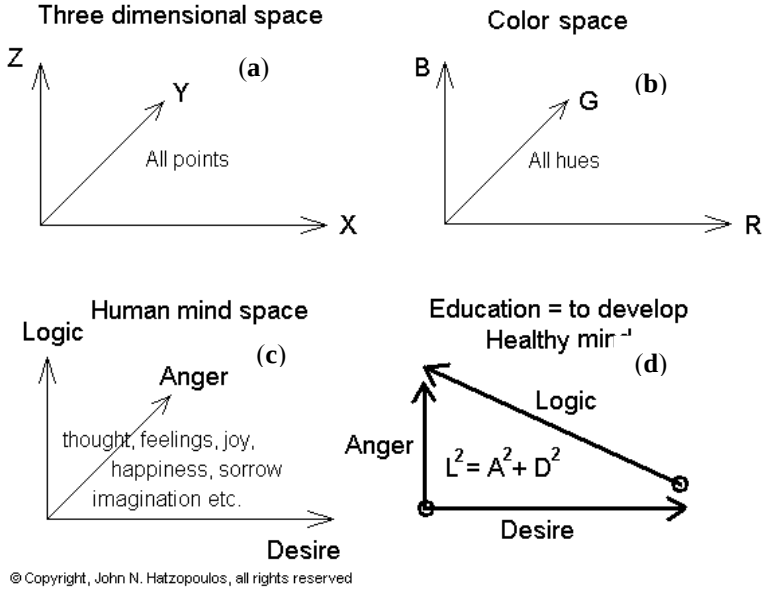
(f) The mid-space of correct (midway of virtue) shown in Figure 1, contains a diversity of correct actions which define the degrees of freedom or the options a person has for this specific action to pass over the obstacle. Although this mid-space looks being small, it provides options of unlimited diversity and freedom.
(g) Options outside the error variance or mid-space of correct (see Figure 1) cannot be considered as diversity options or freedom options because they do not help to solve the problem which is to pass over the obstacle and on the contrary they introduce difficulties because they may cause a serious injury.
(h) Options outside the error variance or mid-space of correct (see Figure 1) are damaging options and they denote uneducated neuron structure, or bias, or, deception in the effort to pass over the obstacle.

This example explains the way human mind functions as a neuron based structure.

Ideals and definition of education

The importance of education is best expressed by Jaeger W 1945, Gross R. E. & Zeleny L. D., Editors, 1958, and Manolas E 2006. Education in its effort to respond to its destination as a vocation system, has to provide such ideals to the educated person so that this person will try consistently to achieve the correct and minimize the error. Therefore, to define precisely education it is necessary to know how human mind works as a system. Human mind as a system has many functions such as: thought, joy, sorrow, anger, control over the actions, desire, imagination, feelings, etc. All these functions take place within the *mind space* which must be well defined. Mind space can be approached in a quite similar way to the three dimensional geometrical space (see Figure 2a), or, to the trichromatic color space which

represents all color hues (see Figure 2b). However, the question is: are there three basic functions of human mind which can describe all other functions within the mind space?



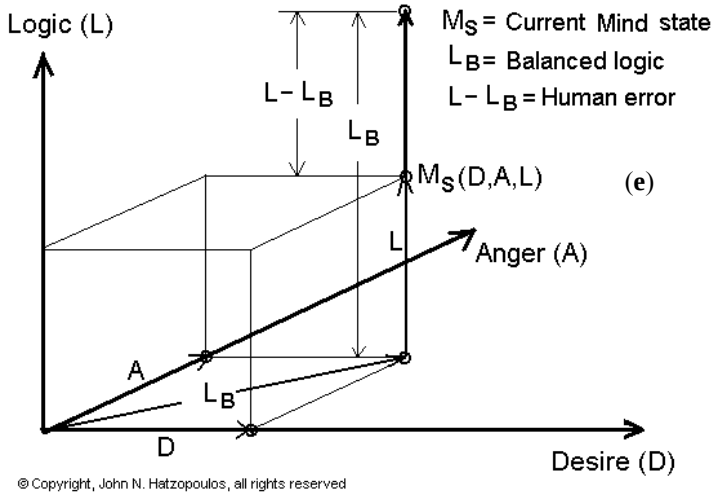
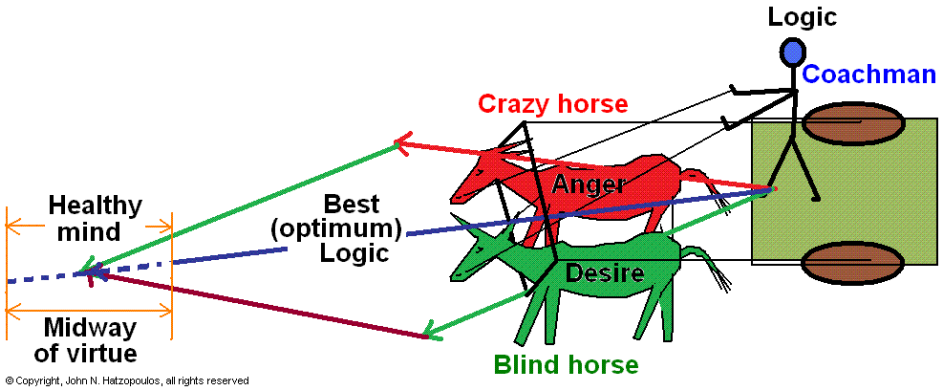


Figure 2. (a) Three dimensional space, (b) Color space, (c), (e) Mind Space (Hatzopoulos 2008a).

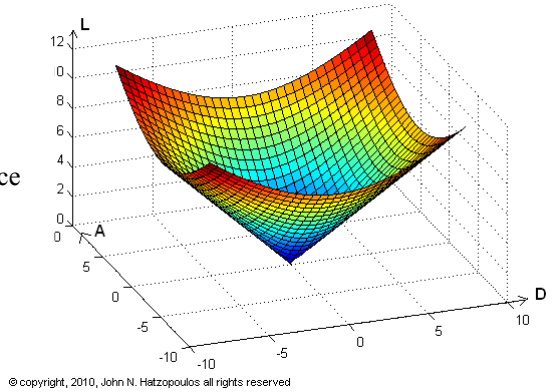
The answer comes from Plato in his work *The Republic (441a-443a)* where human mind is described with three basic functions which are: *logic* (L), *desire* (D) and *anger* (A) as shown in Figures 2c, 2e. In Figure 2a is shown a three dimensional space system where the geometric position of any point is represented by three values (X, Y, Z) called coordinates. In Figure 2b is shown a color space where any color hue is represented by three values (R, G, B) called color coordinates and correspond to the three primary colors *red*, *green, blue*. Similarly, In Figures 2c and 2e is shown the mind space where any mind state is represented by three values (L, D, A) called mind coordinates and correspond to the three primary mind functions *Logic*, *Desire, Anger*. Plato's structure (L, D, A) is adopted in this work because on the one hand describes with three coordinates all mind states, on the other hand describes the *healthy state of mind* which is going to be used as ideal for the education of people.

Let us assume a state of the mind M_S with coordinates in the mind space $M_S(L, D, A)$, (See Figure 2e). According to Plato, a healthy mind state is defined when "*The logic balances the desire and anger*". Plato gives an example to illustrate the healthy mind as shown in Figure 3a, where the desire is represented by a *blind horse*, the anger is represented by a *crazy horse*

and the logic is represented by the *coachman* who tries to move the car in the correct direction.



(**a**)



(**b**)

Figure 3. (a) A healthy mind as defined by Plato where the logic balances desire and anger.
(b) The absolute healthy mind space according to Pythagoras theorem:

$$L = \sqrt{D^2 + A^2}$$

This example illustrates the equilibrium of three forces and perfect equilibrium is obtained when the Pythagoras theorem is used (see Figures 2d, 2e, 3b) as follows:

$$L_B^2 = D^2 + A^2 \qquad (2)$$

Where L_B is the balancing logic while L is the current logic corresponding to the current mind state $M_S(L, D, A)$. This means that the effort of any mind action must be guided by the ideal that: "*Current logic L must approach as much as possible the balancing logic* L_B". In this way according to Plato, Education is defined as: "*the effort to develop a healthy mind*". Plato is also supporting this argument by telling that: "*when the body is sick needs medical attention and treatment, when the mind is sick needs education*". However, it is evident that human mind is sick when the current logic is quite different than the balancing logic and this difference may be called *human error* and is given by the relation:

$$\textit{Human error} = L - L_B \qquad (3)$$

A careful look at Figures 1 and 3 reveals that there is a perfect logic (*optimum* – see Figure 1, *best logic* – see Figure 3) which is expressed by Equation (2) and also there is a correct logic which corresponds to a human error which is smaller than a threshold or error variance limit (see Figure 3). Notice that this threshold limit defines the boundaries of wrong and right (see Figures 1, 3, 4) and limits the area where the mind energy is correct (constructive) and this area is also defined by Aristotle as "*the midway of virtue*", or the energy of a healthy mind.

Ideals and definition of virtue

Virtue as a philosophical structure is analyzed and clearly defined by Aristotle in his work "*The Nikomachean Ethics*" (Tasios, 2003). According to Aristotle, virtue is a "*mesotita = midway*" (*mean + variance*) which means it is found in midway between two extreme actions, or, badness. Aristotle gives the following example to support his argument: "*If bravery is a virtue then the brave person is to be found in midway, between the provocative and the coward person, …and when one is brave, then the coward will call her/ him provocative because she/he is beyond coward's capacity, while the provocative will call her/him coward because she/he is beneath provocative's capacity…* ". Accordingly, one could characterize thrifty as a virtue that is to be found in midway between stinginess and overspending and the stingy will call the thrift as overspender while the overspender will call the thrift as stingy.
Aristotle also defines the person of virtue "*as the one who is trying to be a person of virtue"* which means that virtue is the effort to maintain actions within the midway and which allows anybody at any moment to be a person of virtue (*never is late*). According to Aristotle the person of virtue is not the one who commits no errors but is the one who is trying to minimize human errors. This definition of virtue is completely fitted within human dimensions and under certain conditions it may allow extreme actions to take place, as is for example, self defence. Aristotle also accepts that justice is the top virtue and contains all virtues.
The Aristotelian midway of virtue includes *the mean and the error variance* and has a universal validity, for example, taking into consideration the orbit of the earth around the sun, one may observe that the earth will never follow exactly the same path and there is a midway where orbits of the earth must occur in order to have equilibrium. If the earth gets off such bounds towards the inside, then the earth may collide with the sun, if the earth gets off such bounds towards the outside, then the earth may get lost in space. This example defines also precisely the boundaries of wrong and right where wrong occurs when the earth tends to collide with the sun (negative error) or tends to get lost in space (positive error) while right occurs within the midway of orbit error variance which follows until now.
Virtue as defined by Aristotle is in agreement with the neuron based structure of human brain and consequently with the function of human mind (see Figure 1), as well as, with the definition of education given by Plato (see Figures 2, 3) which now can be integrated to: "*Education is the effort to develop a healthy mind to the person of virtue*". It is again emphasized that the term used by Aristotle "*mesotita*" comprises both terms the *mean* and its *variance*. It is wrong to interpret "mesotita" as a "mean", as many researchers do, because scientifically the mean without its variance makes no sense.

Ideals and the definition of democratic procedures

Virtue, as defined by Aristotle is clear and not unambiguous but it is important to notice that an entire process exists so that one finds the midway or the mean and its variance even of a natural object. For example, in order to locate the middle of a straight line segment, a topographer uses a process that includes accurate surveying instruments which perform measurements of angles and distances, mathematical calculations and statistical treatment of measurements and concludes: "*the point in the middle of the straight line segment is here (showing a nail or a stake) with 95% probability of having error less than one centimetre"*.
Notice that, as mentioned above, "*midway*" can also be expressed as a *mean* (μ) together with its *variance* (σ^2). The process to locate the midway of virtue is not therefore an easy task, because everyone may understand the midway as a different intermediate location. Thus, it is important to locate it with as much consensus among people as possible, something that ensures democratic procedures. In this way, democratic procedures are philosophically founded and constitute the process of locating the midway of virtue.
It must be theretofore noticed that, a consensus has a meaning if and only if the voters have unlimited freedom with minimized bias (Hatzopoulos 2004, 2008a) which can only happen if the voters are educated according to the definition of education given by Plato so that they

maintain a consistent effort for a healthy mind and their views, intentions and actions are correct and virtuous.

Mathematical definition of the boundaries of wrong and right

Mathematics as stated by Franklin James, 1995 and Noss R., & C. Hoyles 2007, is the science to analyze structures and are used here to analyze philosophical structures. The above analysis has shown that human error can be quantified and its magnitude is varied from zero to plus infinity and from zero to minus infinity. Therefore, human error can be represented by an X - axis as shown in Figure 4, which is expanded from minus infinity to plus infinity. Similarly a Z - axis which is perpendicular to the X – axis through the location of zero, represents the number of people who commit, or, votes that commit in the corresponding category of error. No matter how strange it appears that someone is able to accept, or, vote that commits a specific error, this happens and it is quite clear. For example, the political parties declare clearly the category of error they belong to, the same thing happens to many social groups which declare their difference from other social groups. In this way the error or the bias of any social group can be relatively easy quantified and a diagram as shown in Figure 4 can be created.

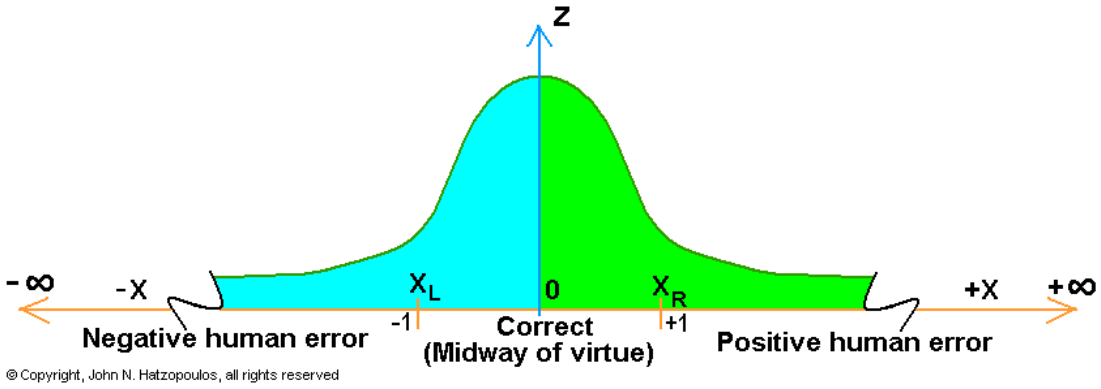


Figure 4. The error diagram of the ideal society showing the human error in the X – axis and the number of voters in the Z –axis.

It was discussed that when human error is below a threshold limit it is considered as correct (see Figure 1, 3). Therefore, it will be an effort to define this threshold limit which in Figure 4 is represented by the locations of X_L and X_R in the X – axis. The locations X_L and X_R are the boundaries which separate the wrong from the right (Hatzopoulos 2008b pp. 247, Hatzopoulos 2009). Taking into consideration Equation (1) which expresses the correct in relation to the error, then we are seeking these boundary points in the X – axis where we have:

$$X = Y \qquad (4)$$

Substituting Equation (4) to Equation (1) we have:

$$X = 1/X \text{ or } X^2 = 1 \text{ and therefore } X = \pm 1 \qquad (5)$$

In this way the boundaries of wrong/right are defined in a mathematical way and they are:

$$X_L = -1 \text{ και } X_R = +1$$

Notice that there are an infinite number of correct options in the midway space between -1 and +1 and therefore there is unlimited diversity and freedom. On the contrary as discussed before, the choices outside this midway space are not choices of freedom but they are choices of uneducated persons, or, they are biased choices and generally they cause damage and destruction. If the distribution of votes in Figure 4 follow the normal distribution, then the curve in Figure 4 is better represented by the *Gaussian curve of standard normal distribution* with mean value $\mu = 0$ and standard deviation (variance) $\sigma = \pm 1$ (Hatzopoulos 2004, 2009). One may observe that the boundaries of wrong/right are evaluated to be unique points as being *turning points* in the Gaussian curve (the radius of curvature changes over these points) thus the boundaries of wrong/right are also defined in a geometrical way. Notice that this midway space can be used as a unit of measurement with magnitude of: 1σ, 2σ, 3σ, etc. Basically the diagram in Figure 4 represents the ideal society where in the midway of: 1σ the 68.26% of human actions are virtuous and therefore correct. Within 2σ, there are 95.45% of human actions and within 3σ, there are 99.73% of human actions. However, if 68.26% of human actions are correct, then 31.47% of human actions are in the neighborhood to be correct and only a magnitude of 0.27% of human actions may be considered as extreme actions or dangerous and seriously damaging actions. One also may observe that the diagram in Figure 4 represents both the ideal society and the *specifications on which nature has been based in designing the error performance of human mind*.

Unfortunately, ideal society does not exist and the real society error diagram is shown in Figure 5. The real society, as shown in Figure 5, is composed by a large number of people to be located in the virtuous, or, correct region and many other smaller groups of people with various biases. It must be noted that the destructive energy of a group of people is equal to the number of people in the group multiplied by the bias of the group (Hatzopoulos 2004). Considering that bias works as a lever and it may be of a magnitude approaching infinite, then it is evident that a small group of people could accumulate a tremendous destructive energy. Usually groups of people with opposite biases move into conflict, wars and collisions and peace may be obtained if they have equivalent destructive energy. Usually world peace is obtained if the error diagram in Figure 5 has a symmetric structure and furthermore, if there are small biases there is a stable peace, while if biases are large there is unstable peace (Hatzopoulos 2004). Bias is also responsible for the deterioration of the environment and the social injustice.

Therefore, education has to explain to the people the structure of the real society today and help them to understand that peace, quality and prosperity in life can only occur if all groups of people minimize their biases. The best way to do this is to understand and evaluate the reasons groups of people maintain such biases and consequently to create motives and peaceful ways to minimize them. People must also be educated to evaluate correctly the destructive energy of small groups and take the necessary measures to defend against their destructive power.

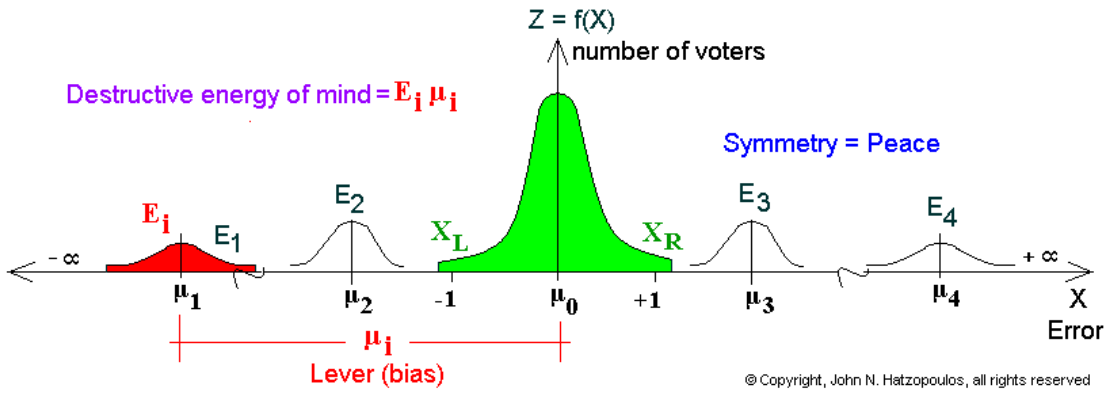


Figure 5. The situation of the real world with groups of people with biases $\mu_1, \mu_2, \ldots, \mu_n$

Considering Figure 4 one may raise the question "*what happens in the location X = 0?*" is there any person to vote as having at all times zero error? According to the previous analysis human mind is hosted in a neuron based structure and therefore it is impossible to act without error. If, for example, one may pass over the obstacle in Figure 1 several times, each time the height of the foot over the obstacle will be different. However, we may introduce a mathematical entity with zero error and call it "*supreme being*" with all its thoughts, actions and performance to have zero error.

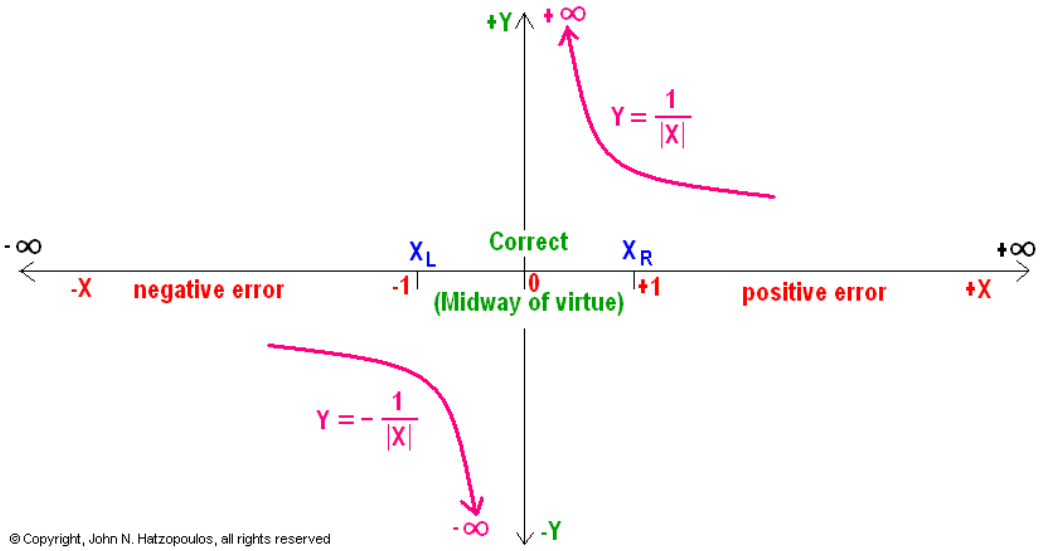


Figure 6. The correct/error function in the location X = 0, reveals an entity with zero error and a virtue which is expanded from minus infinity to plus infinity (Hatzopoulos 2009).

The extraordinary of this hypothesis, as shown in Figure 6, is that if someone approaches the location X = 0 from the direction X = -1, then the Y – values which represent the magnitude of "correct", or, "virtue", tend to approach minus infinity. Therefore, if someone approaches the location X = 0 from the direction X = +1, then the Y – values which represent the magnitude of "correct", or, "virtue", tend to approach plus infinity. This analysis can help to understand that any effort to search for the attributes of the Supreme Being must be focused on the fact that such a being must have no human weaknesses and as such ideal must be used to educate people. Furthermore, it must be noted that the quantification of the "correct" or, "virtue" has only theoretical meaning in the process to study the behavior of the wrong/right function and having in mind that for any human thought, action or performance, wrong and right coexist. However, in practice, "correct", or, "virtue" cannot be quantified and if, for example, someone is judged from the justice system as innocent, is not judged as more or less innocent, while if someone is judged guilty then may be judged more or less guilty (offence, felony, crime, etc).
The analysis performed and the given examples about the error variance or midway of virtue, introduce a fourth number e = 2,718 (base of natural logarithms - to describe the Gaussian curve) used for the geometric design of universe, which design, according to work published by Dakoglou H 2009, is based on three numbers namely: (a) unit=1 to provide the scale, (b) pi=3,14 to provide the shape and phi=1,618 to provide the harmony and proportion. These four numbers may also apply to biological or DNA structures and researchers may examine whether they apply to microcosm structures.

Conclusions

The following conclusions may be extracted from this present work:

Education must be clearly defined as: "*the effort to develop a healthy mind to the virtuous person*" with detail explanation using scientific analysis for the meanings of "*healthy mind*" and "*virtue*". These two meanings must be the ideals for the education of the educators and the people.
The meaning of "*democracy*" as an ideal must be founded on the effort to locate the midway of virtue with voters having education and therefore minimum bias.
The boundaries of wrong and right must be explained to the people using a scientific way as it was analyzed in present work, away from biases, prejudicialness, sick imagination, false hopes, secrecy, and wrong ideals.
The scientific approach to find the truth enhances the ideals of "*healthy mind*" and "*virtue*" and it helps people to actively participate in the solution of current problems such as peace, justice, quality in life, prosperity, social relations, protection of the environment, etc, thus maximizing the freedom for the constructive contribution of human mind.
The typical education must help people in a scientific way to understand that the meaning of the supreme being as an ideal does not imply any human weakness.
The analysis performed about human error must be carefully examined by the people from human sciences (philosophy, literature, history, law, justice, political sciences, social sciences, etc) in their effort to improve the scientific approach in these fields taking into serious consideration the quantified human error and maintaining their course within human dimensions. Part of such improvement must be the increased use of mathematics as a basic scientific tool for the analysis of relevant structures in their area.
It must be realized that there are always small groups of people with tremendous destructive energy of mind which try to gain political and economic power based on the ignorance of uneducated people. They influence education by disrupting the healthy mind balance either using wildfication mechanisms to increase the anger, or, using marketing mechanisms to increase the desires, or, excessive faith mechanisms to minimize logic. They also support the creation of other under their control small groups with huge bias and tremendous destructive power to perform divide and rule actions. Education is the only hope that people will identify and defend against the destructive power of such groups. Social sciences may also use scientific methods including hypothesis testing on historical data to identify these destructive mind power groups and reveal their disrupting mechanisms.
In conclusion, healthy mind and virtue is a unique way for someone and for all social groups to have peace, quality in life and prosperity and to be able to face serious problems as is the protection of the environment, the terrestrial and extraterrestrial hazards and other problems related to wrong human activities.

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