Education as to develop a healthy mind, reunification of philosophy with sciences, scientific documentation of wrong and right, human error, virtue as a midway - variance.

John N. Hatzopoulos
Department of Environment, University of the Aegean,
University Hill, Mytilene 81100, Greece.
tel: +30-2251-0-36211, fax: +30-2251-0-36264
e.mail: ihatz@aegean.gr

Abstract

Education beyond training has to develop a healthy mind and to do so needs philosophical bases supported with strong scientific evidence which are obtained only if philosophy is reunited with science. This work is an effort to put together all elements which compose the education puzzle and identify the sources of human error anatomically and conceptually and how these affect education. Modelling human error to define the boundaries of right and wrong has a vital impact on education because otherwise education has no reason to exist and it is suppressed to a strict skill training which is the tendency today. The analysis followed in this research is based on the healthy mind model developed by Plato as it was improved by the model of human error variance developed by Aristotle as a midway of virtue. The aim of this work is to identify the real reasons of today's crises in human values which lead to economic crisis and to recommend solutions based on the education which creates a healthy balanced human mind.

Keywords: education, virtue, philosophy, healthy mind, freedom, democracy, super being, neuron networks, human error, human values, crisis.

Introduction

Philosophy as developed thousands years ago was united with science. At that time if someone wanted to study philosophy had to study math like arithmetic and geometry, and sciences like physics and astronomy. Most philosophical schools in their front entrance would have a sign with big letters saying "Μηδείς Αγεωμέτρητος Εισίτω" (do not enter if you do not know geometry). The separation of philosophy from science happened during and after the dark ages. Dark ages took place between the 6th century AD and the 16th century AD and it is a major setback in human history where human mind for almost one thousand of years is forced by clergy to work backwards. Of course this situation is against the nature laws and it was gestating the renaissance which we generally think it came after a thousand years but indeed it did not come yet. The reason for this is that the "smart" clergy managed to separate philosophy from science so that fundamental philosophical education issues such as: what is good, what is bad, what is wrong, what is right, to be on the disposal of the clergy since philosophy due to its separation from science did not have the scientific background to provide strong evidence to support these issues. As my professor in philosophy Dr. Dimitrios Nianias in a private talk said "philosophy today is dead" the reason is the lack in scientific evidence and the involvement of philosophy in no ended looping circles outside of human dimensions with all conclusions leading to nowhere. On the other hand most scientific achievements today, are in the hands of people who do not understand philosophy (άμουσοι) and use many of these achievements to manufacture bombs and bomb innocent civilians. This present work will show how the use of math and science will advance philosophy to cover the mentioned fundamental issues and to provide solutions for our needs particularly those related to current crisis.

Although comparing science at the Stone Age with current advances in science we think there is a tremendous progress, this progress is nothing comparing to DNA technology nature is using for millions of years and which is almost unknown to us. It is amazing how a fertilized cell curries all information and

actions to be taken under certain environmental conditions to create an elephant. To our capacity human mind is the only entity which is part of nature and is trying to explore nature and in that essence human eyes are probably the eyes of nature to see itself and human mind is the nature' s mind to understand itself. However, someone may say that the destination of humans is quality in life and exploration. Through the exploration humans discovered the laws of nature. Such laws as is the gravity law, the biology laws, the chemistry laws, etc., are mandatory for everyone to absolutely obey to them either likes them or not. This is in contrast to the various human laws which are created by humans to help a peaceful living together and even if there is severe punishment for no obedience, some humans may not obey to them. This present work will use some biology structures such as neuron networks which are also simulated in computers to solve complicated problems and which form the human brain which in turn hosts the human mind.

As mentioned above the discussion in this work will be limited within human dimensions with other words within the capacity of humans to use philosophical approaches which bring practical and useful results. The following example will make it clear: think about the eye glasses which, as a practical result, improve vision. The eye glasses are based on three conflicting theories of optics: (a) geometric optics – light moves on a straight line, (b) physical optics – light moves on a wave form, (c) quantum optics – light moves as packages of energy. Although we do not know exactly how light moves we manage to have practical results as is the improvement of vision. What is philosophy is given by the Oxford University: "*The study of philosophy develops analytical rigour and the ability to criticize and reason logically. It allows you to apply these skills to many contemporary and historical schools of thought and individual thinkers, and to questions on such subjects as the fundamental nature of reality, the nature, possibility and limits of knowledge, the nature and grounds of moral judgements, the nature of the mind and its relation to the body, and the fundamental principles of language, science, religion, art and literature*" (http://www.philosophy.ox.ac.uk/admissions). However, philosophy by its definition can easily get off the rails and drive to nowhere especially in case of exceeding human limits. It is quite certain that human capacity is limited and there are many things about nature which at this time are not known. Therefore, the idea to stay within human dimensions is to focus on practical results supported by scientific evidence and avoiding any exceeded speculation which leads to superstition. It is interesting to study Aristotle's view on human dimensions demanding practical results (Nichomachaean Ethics B:13-14): "ρητεον ουν ότι πάσα αρετή, ου αν η αρετή, αυτό τε εύ έχον αποτελεί καί το έργον αυτού εύ αποδίδωσιν, οίον η τού οφθαλμού άρετή τον τε οφθαλμόν σπουδαίον ποιεί και το έργον αυτού". (It must then be premised that every virtue not only renders the thing to which it belongs itself good, but it also causes it to perform its function well. For example, the effect of virtue in the eye is that the eye is good and functions well; since having good eyes means having good sight).

Another thing under consideration in this study is the specifications in a design process. A clock can be designed to give the time with a precision plus or minus 2 seconds in a year. This 2 second value is related to the error variance and it is part of the design specifications. The same specification concept applies for the design of various objects and systems performed by nature. The design of the planetary system, for example, allows all planets to move within certain orbits whose specifications include similar variance limits (an object, like a planet, never follows exactly the same orbit but it moves around an average orbit within specific variance limits). The same kind of specifications applies for the design by nature of human mind error performance expressed by an error variance. However, variance is a quite interesting parameter because it allows things not to be deterministic but stochastic, thus allowing evolution. Without the variance in the design performed by nature, there would be no evolution. Aristotle in the following expression (The Nikomahean Ethics A-III) indicates the design by nature: "*τα δε καλά και δίκαια, περί ων η πολιτική σκοπείται, πολλήν έχει διαφοράν και πλάνην, ώστε δοκεί νόμω μόνον είναι, φύσει δε μη*" (The subjects studied by political science such as well being and Justice involve much difference of opinion and are misleading, and while appear to be according to the law they are against the nature).

The last consideration has to do with duality of biological beings including humans. Duality was attempted in a scientific approach by René Descartes, 1649 but at that time information science was not advanced to provide the necessary scientific evidence. Today information and computer science has been advanced enough to develop working systems based on the hardware / software dual mechanisms. Therefore, hardware is the human body which is made of material obeying to nature's laws and it is mortal while software is the *genetic software* which is explained in the next section, it contains all information and instructions to run and control the body, as well as, to generate through the body system new information and instructions (intellectual objects) and it is immortal. Genetic software is curried through the human body on neuron based structures while it is transferred from one person to another through the DNA gene biological structures of the fertilized cell. There is similarity to the hardware / software structures of electronic computers the difference been on the fact that computers have a serial architecture thus prohibiting any capacity to develop will while the

effort to create parallel architectures on electronic computers is very limited. It is interesting for someone to study the object oriented computer programming approach (software) where from a designed class with certain attributes, a number of run time objects can be derived which have the same attributes but different attribute values. If, for example, the class "humans" have the attribute of "one stomach", then, the stomach in each object will be of different size. Objects in computer programming are mortal; they have birth and death and in between perform certain tasks or actions. The other interesting thing in object oriented software is that from a superclass, i.e. mammals, one can create subclasses, i. e. goats and the subclasses inherit the attributes of the superclass, i. e. breast feeding.

Neuron based structures

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. The genetic software which runs human mind has an initial form by birth varying from person to person expressing the inheriting talents. 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.

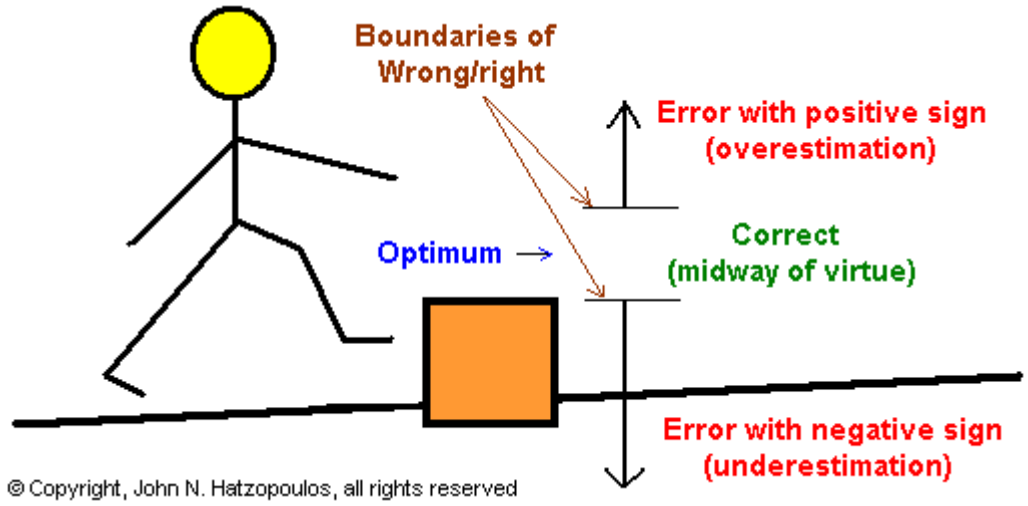


Figure 1. The functioning of a neural network and the error variance (for more detail see: "Ideals and definition of virtue" bellow) (Hatzopoulos 2009)

As shown in Figure1, if someone wishes to walk over an obstacle while 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. It must be mentioned that the existence of error limit is well-known in natural sciences and in everyday life. 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 is an adoptive mechanism and can be trained to develop genetic software which will 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:

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

This equation is further analyzed in the section "Mathematical definition of the boundaries of wrong and right" and it is shown in a graphical form in Fig. 6.

(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 thus freedom is defined; it shows the way to make humans understand how freedom is scientifically defined.

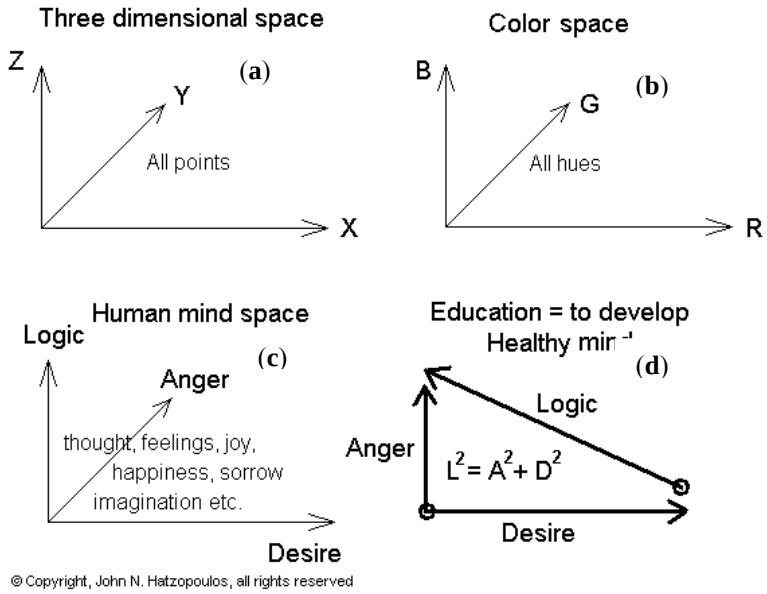
(g) Options outside the error variance or mid-space of correct (see Figure 1) cannot be considered as diversity options or freedom options because they do not help to solve the problem which is to pass over the obstacle and on the contrary they introduce difficulties because they may cause a serious 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 indicates the scientific definition of bias or deception on human actions.

This example explains the way human mind works, as a neuron based structure, in order to perform a specific action such as to walk over an obstacle and defines in a scientific way the terms human error, correct / wrong, freedom, educated / uneducated, bias, deception.

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 focus on how human mind works as a system. Human mind as a system has many functions such as: will, 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 which is using three components X, Y, Z to describe the location of any point (see Figure 2a), or, to the trichromatic color space http://en.wikipedia.org/wiki/Color_model (color cube) which is using three components R, G, B to create any color hue (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? 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) representing the rationality or reasoning, *desire* (D) and *anger* (A) as shown in Figures 2c, 2e. Desire is related to the will and usually helps to initiate an action while anger contributes to finish the action within time limits and logic provides the reasoning. Feelings usually depend on whether or not desirable results through the action(s) have been achieved. In Figure 2a, as mentioned, is shown a three dimensional space system where the geometric position of any point is represented by three values (X, Y, Z) called coordinates. Similarly, in Figure 2b is shown a color space where any color hue is represented by three



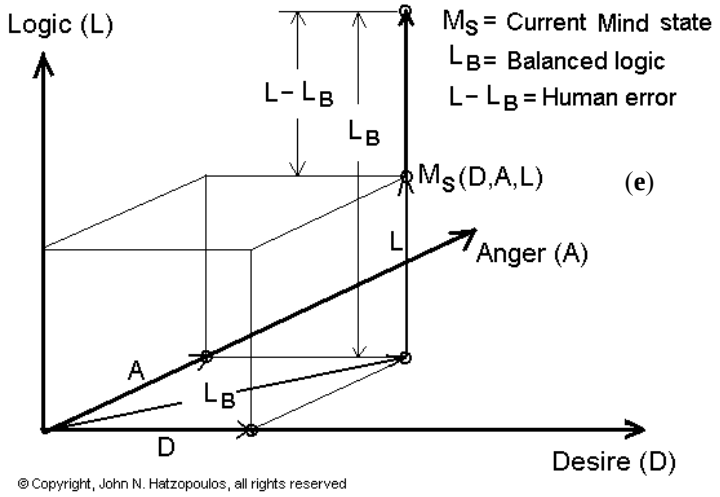


Figure 2. (a) Three dimensional space, (b) Color space, (c, e) Mind Space (Plato's mind model), (d) Plato's healthy mind condition. (Hatzopoulos 2008a).

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 mind model (L, D, A) is adopted in this work because on the one hand describes with threecoordinates 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. This example illustrates the equilibrium of three vector forces and perfect equilibrium is obtained when the Pythagoras theorem or the Euclidean distance 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 vector while L is the current logic vector corresponding to the current mind state $M_S(L, D, A)$. This means that education is obtained by the effort of any mind action to be guided by the ideal that: "*Current logic L must approach as much as possible the balancing logic L_B*". In this way

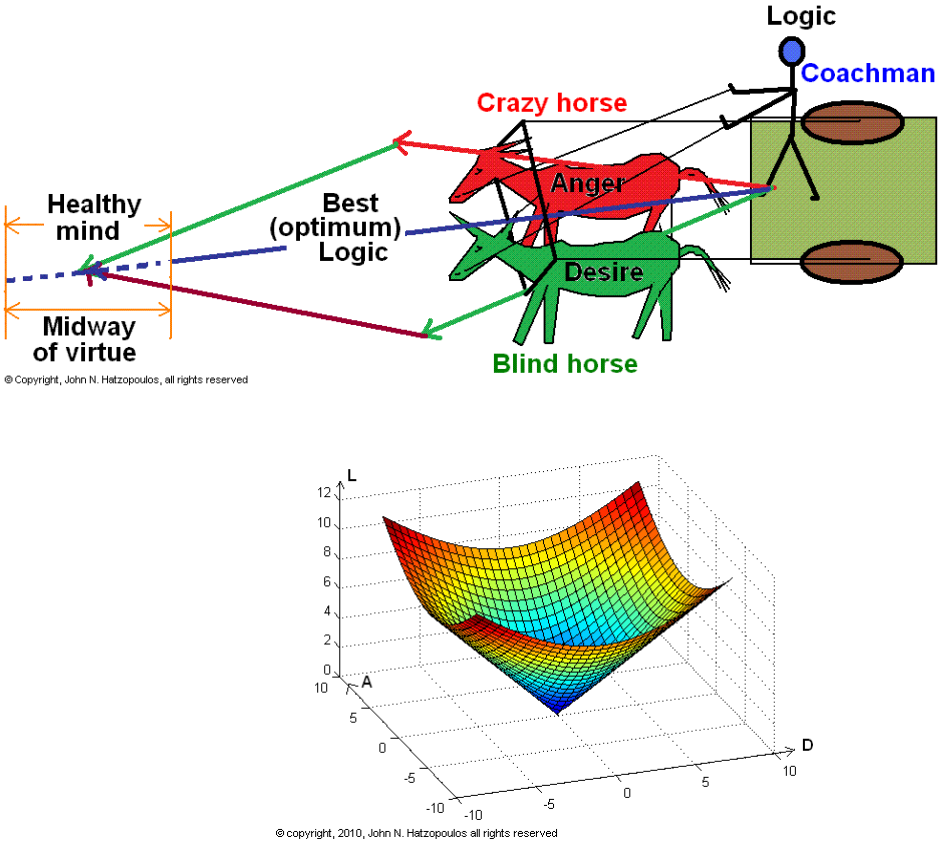


Figure 3. (a) A healthy mind as defined by Plato where the logic balances desire and anger. (b) The absolute healthy mind space according to Pythagoras theorem: $L = \sqrt{D^2 + A^2}$

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:

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

The example with the horses given by Plato makes it quite clear that logic vector in mind space must balance the two other vectors of desire and anger. If logic is too much there is a problem i.e., if someone has the desire to eat and start debating whether or not to kill an onion to put it in the salad the result could be to spend days for such a debate and be dead from hunger. Plato tells us why anger is necessary i.e., if a wild animal attacks to someone there is no time to think logically and the anger is the solution. A careful look at Figures 1 and 3 reveals that there is a perfect logic (*optimum* – see Figure 1, *best logic* – see Figure 3a, 3b) which is expressed by Equation (2) and also there is an accepted as correct logic which corresponds to a human error which is smaller than a threshold or error variance limit (see Figure 3a). 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 accepted as correct (constructive) and this area is also defined by Aristotle as "*the midway of virtue*" (see next section) 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 Nikomahean Ethics B-VI". 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: "*περί μεν φόβου και θάρρη, ανδρεία μεσότης*" (If bravery is a virtue then the brave person is to be found in midway, between the provocative and the coward person), and continues *...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… ", (The Nikomahean Ethics B-VII). 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.
It is quite interesting the fact that Aristotle is trying to explain human error with statistical terms using the word "mesotita" (mid space) for virtue which can be understood today as the *average* together with its *variance*. Also in the expression: "*η δ' αρετή πάσης τέχνης ακριβεστέρα και αμείνων εστίν ώσπερ και η φύσις, του μέσου αν είη στοχαστική*" (virtue like nature is more accurate and more well being than any art, and could be stochastic of the mean). This expression indicates that virtue is designed as such by nature (*like nature*) and this design is based on statistical terms (*stochastic of the mean*) which on the one hand represents the word "mesotita" on the other hand defines a stochastic model for human error.
However, the Aristotelian midway of virtue includes *the mean and the error variance* and also 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.
Although Aristotle and Plato seem to have strong arguments in their developments, in this particular case the way virtue is defined could be understood as the evolution of Plato's healthy mind model. Plato's model is expressed in Figure 1 with the "*optimum*" while Aristotle' s improved model is expressed in Figure 1 by the "*correct (midway of virtue*). The same conclusion is drawn from Figure 3a, Plato's model is expressed with the "*best logic* (*optimum)*" while Aristotle's improved model is expressed by the "*midway of virtue*".
It must be noted that most people specialized in philosophy because their lack in scientific background they interpret the word "mesotita" as the *mean* and this creates two false understandings: (a) as stated above mean without its variance has no scientific meaning, (b) using just the *mean* to define virtue then, virtue is losing its degrees of freedom making almost impossible for someone to be a person of virtue (see from Boston University: http://people.bu.edu/wwildman/WeirdWildWeb/courses/wphil/lectures/wphil_theme03.htm). Therefore, midway of virtue as shown in Figure 1 and 3a, defines also *freedom* in a scientific way giving almost unlimited choices in a particular state of the mind (*μεσότης μεν ελευθεριότης* – midway has unlimited choices, The Nikomahean Ethics B-VII). This means, (see Section Neuron based structures f, g, h) that mind states which are outside the midway of virtue are not *freedom* options but they are options of an *uneducated* person or *biased* options.

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. It is interesting to study Aristotle's view about this problem (Nichomachaean Ethics B:17-18): "ου γαρ ει τω δέκα μναί φαγείν πολύ δύο δε ολίγον, ο αλείπτης εξ μνας προστάξει· έστι γαρ ίσως και τούτο πολύ τω ληψομένω ή ολίγον Μίλωνι μεν γαρ ολίγον, τω δε αρχομένω των γυμνασίων πολύ". (Suppose that 10 lb. of food is a large ration for anybody and 2 lb. a small one: it does not follow that a trainer will prescribe 6 lb., for perhaps even this will be a large ration, or a small one, for the particular athlete who is to receive it; it is a small ration for a Milo, but a large one for a man just beginning to go in for athletics). Thus, it is important to locate the midway of virtue 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 and Aristotle 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 right and wrong

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 analysis shown in Figure 1 indicated 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, a political party declares clearly the category of error it belongs to, or to emphasize its values, it may analyze the categories of error other parties 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 produced.

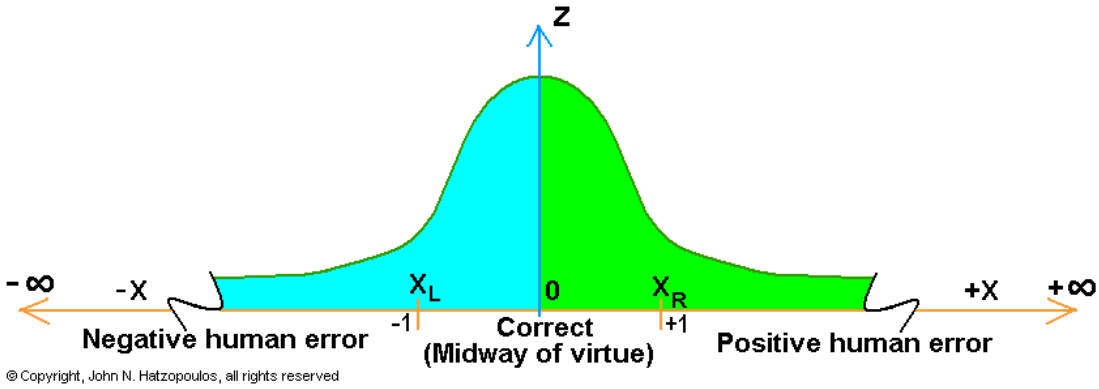


Figure 4. The error diagram of the ideal society showing the human error in the X – axis and the number of voters in the Z –axis.

It was discussed that when human error is below a threshold limit it is considered as correct (see Figures 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). As stated in the Section: *Neuron based structures (d), (e),* correct and error coexist in the same action and they are inverse proportional to each other. The X was defined as being the error and Y as being the correct and therefore Equation (1) was derived as X=1/Y which expresses the correct in relation to the error. If a boundary between correct and error exists, then the value of X and Y on this boundary must be the same:

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

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 is 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 or scaling factor 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 99.73% - 68.26% = 31.47% of human actions are in the neighborhood to be correct (i. e., traffic violation tickets, eating less than normal) 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, may be 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. The bias of a group is the magnitude of its mean value μ_i (for the ideal society $\mu_i = 0$).

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, freedom, 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.

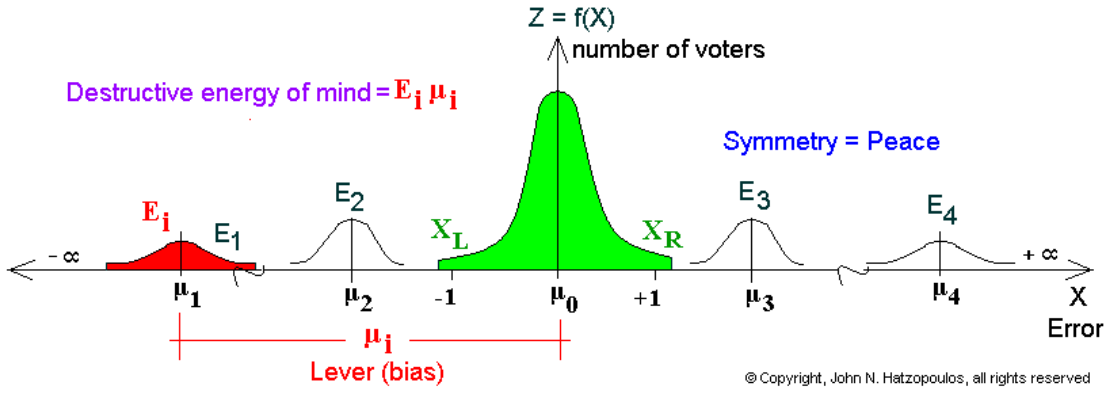


Figure 5. The situation of the real world with groups of people with biases $\mu_1, \mu_2, \ldots, \mu_n$

Considering Figure 4 one may raise the question "*what happens in the location X = 0?*" is there any entity committing 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 "*hyper being*" having all thoughts, actions and performance with zero error.

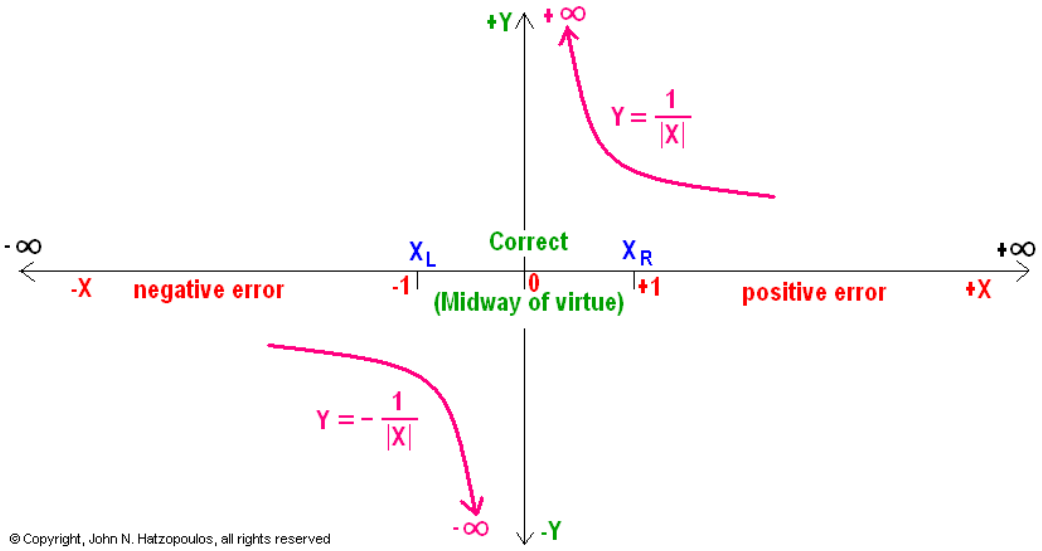


Figure 6. The correct/error function in the location X = 0, reveals an entity with zero error and a virtue which is expanded from minus infinity to plus infinity (Hatzopoulos 2009).

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, thus in a single location (X=0) virtue takes all values from minus infinity to plus infinity, in any other location (X≠0) virtue takes a single finite value.

This analysis provides evidence of an interesting attribute a hyper being may have such as zero error, unlimited virtue and no human weaknesses and therefore Mother Nature may be considered as such a being.

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 right/wrong 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).

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 right and wrong 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. These boundaries also represent the limits and the definition of freedom while performance outside these boundaries is considered slavery of uneducated people. With other words, the education of people must make quite clear that freedom provides a diversity of choices but within certain limits as shown in Figure 1.
The scientific approach to find the truth enhances the ideals of "*healthy mind*" and "*virtue*" and it helps people to actively participate in an unbiased 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 analysis performed about human error must be carefully examined by the people from human sciences (philosophy, literature, history, law, justice, political sciences, social sciences, theology, 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. A great improvement would be the reunification of science and mathematics with philosophy so that to revitalize philosophy which at present is almost dead because lacks in scientific arguments and also sciences without philosophy are causing destruction as used by uneducated people i.e., is used to make bombs and bombard innocent people and civilians.

It must be understood that current globalization processes moves the wrong direction because allows small groups of people with tremendous destructive energy of mind to try to gain political and economic power based on the ignorance of uneducated people. They influence education by creating a wrong cultural flowing atmosphere and they disrupt the healthy mind balance either using wildfication mechanisms to increase the anger, or, using marketing mechanisms to increase the desires, or, excessive faith and mutual support mechanisms to minimize logic. They also support the creation of other under their control several small and large 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 and impose legal limitations to those who exceed the freedom limits. Social sciences may also use scientific methods including hypothesis testing on historical data to identify the planners of these destructive mind power groups and reveal their disrupting mechanisms and their evolution through human history.

As mentioned in the introduction clergy created the dark ages forcing human mind to work backwards against the nature design; therefore, the crisis humans live today is due to the fact that they do not realize that dark ages are not over but have been mutated into brain programming process where people are programmed to destroy their traditional values, loose the sense of beauty, loose the sense of freedom, loose their ability to produce goods, they are transformed from healthy minded mid class citizens to sick minded proletarians.

In conclusion, healthy mind and virtue as defined scientifically, is a unique way for someone and for all social groups to put aside the dark ages and the crises and move into the renaissance process in order to have peace, freedom, 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.

References

Aristotle: *The Nikomachean Ethics*

Descartes René, 1649, "Les passions de l'âme" (Passions of the Soul). Dedicated to Princess Elizabeth of Bohemia.

Franklin J, 1995 (Interview) *Philosophy, Mathematics and Structure*, (Philosopher 1, (2), 31-38), http://www.maths.unsw.edu.au/~jim/interview.html

Gross R. E., Zeleny L. D., Editors 1958. *Educating, Citizens for Democracy*: Curriculum and, Instruction in Secondary Social Studies. New York: Oxford University Press;. pp.341-367.

Hatzopoulos J. N. 2004, *Practical Philosophy of Thought and Virtue*, *The Bases to Develop a Philosophical Thought by the Ordinary Citizen*, Universal Publishers, 106 pages.

Hatzopoulos J. N. 2008a, *Education for a world of virtue* (in Greek) Pedagogic Step in the Aegean, No. 69, July - Sept., pp. 105-118.

Hatzopoulos J. N. 2008b, *Topographic Mapping*, Universal Publishers 750 pages.

Hatzopoulos, J. N. 2009, *The boundaries of right and wrong - Learning and the human brain*, ACSM BULLETIN, February 2009, pp. 20 – 22.
http://www.webmazine.org/issues/bull237/documents/rightWrong.pdf

Manolas Evangelos, 2006, *Designing a sustainable society: An Application of the Richard E. Gross Problem-Solving Model*, Proceedings of the Naxos International Conference on Sustainable Management and Development of Mountainous and Island Areas.

Noss R., & C. Hoyles 2007, *What is the next step in Designing Constructionist mathematical learning Environments?*, invited paper, Proceedings of the 5th MEDCON on Current Trends in Mathematics, Rodes, Greece, pp. 16-25.

Plato: *The Republic*

Saxe R 2010, *Theory of Mind (Neural Basis)* In Press at: Encyclopedia of Consciousness

Reinhart C. M. & Kenneth S. Rogoff 2008**,** *This Time is Different: A Panoramic View of Eight Centuries of Financial Crises*
http://www.economics.harvard.edu/files/faculty/51_This_Time_Is_Different.pdf

Jaeger Werner 1945: "*PAIDEIA*", 2nd Ed., translated from 2nd German Ed. by Gilbert Highet, Oxford University Press, New York Vol-1,2,3, pp. ~1300.

Vasilakos Christos, Kostas Kalabokidis, John Hatzopoulos, Ioannis Matsinos, 2009, *Identifying wildland fire ignition factors through sensitivity analysis of a neural network*, Nat Hazards (2009) 50:125–143.