International Journal of Arts, Humanities and Social Studies
Website:https://www.ijahss.in/
ISSN(*Online*): 2582-3647
Volume 4; Issue 1; Jan-Feb 2022; Page No. 22-37

Open Access | Original Paper

Analyzing the "One–Variable-at-a-Time" Method and its Applications

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ABSTRACT
This article analyzes the heuristic method "One–variable–at-a-time", which is useful in solving various problems of science and daily life, and presents characteristic applications of it in various fields of human activities. Furthermore, the method is used to explain logical paradoxes as well as the logical fallacy of the two variables. Finally, a variation of the method is presented, which can be characterized as its mirror opposite and is used, under special conditions, in problems of many variables where the original method cannot be used.

Keywords: *"One–variable–at-a-time" (OVAT) method, logical fallacies, logical paradoxes, biases, heuristics, mirror opposite of OVAT, fuzzy Logic.*

***Citation*:** Athanassopoulos, E., Gr. Voskoglou, M., & Bastounis, E.-M. (n.d.). Analyzing the "One–Variable-at-a-Time" Method and its Applications. *International Journal of Arts, Humanities and Social Studies*, 4(1), 22-37.

INTRODUCTION

The need of applying the method of one variable was seen in all its breadth and depth in the complex problem posed to man by the current pandemic of COVID-19. Its official name is "One-variable-at-a-time" (OVAT) or "One-factor-at-a-time" (OFAT) method [1]. It is also referred, especially in Economics and Law Science, by the Latin phrase "Ceteris Paribus", literally meaning "other things been equal", which was firstly used in a non-technical sense by the Roman philosopher Cicero (106-43 BC) [2, 3].

In this article, after the presentation of the method and its general principles and after the example of the pandemic, OVAT is applied to other areas and gives new light in the logical paradoxes that have existed since ancient times by solving some of them in an easy way.

Then, we look at a group of very serious logical fallacies. Their examination under the light of OVAT, grouped these fallacies so that we can call them "The two-variable fallacies". Other examples also follow from science and everyday life.

It should be noted that OVAT is used by science in the Design of Experiments (DOE) field and specifically in statistical measurement. It is characteristic that Statistics do literal battle to remove from the sample hidden variables that modify the statistical results of a variable that interests us. The usefulness of this method in ISO & HACCP quality systems is also characteristic. The mirror opposite method of OVAT, which is systematically presented for the first time in this study, strengthens the fact that these two methods have a solid logical basis.

The OVAT is a general compass and lighthouse for the moving within the chaos average man, but also for science. It is at the same time a good method of developing an argument within a conversation to get a result. Finally, the combination of bivalent and fuzzy logic used in this study provides an additional guarantee of sound results.

ANALYSIS OF THE OVAT METHOD

Let us suppose we are in front of the amplifier shown in Figure 1, which is in working condition, but we do not have neither the instructions for use, nor the brand, nor do the knobs have writing on them. How do we find which knob does what?

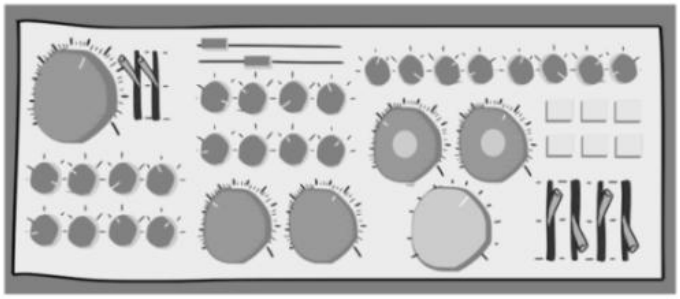

Figure 1: The amplifier

We simply keep all the knobs off and only turn one at a time by adjusting it from one end to the other. Seeing the result in the speakers we understand what the function of the knob is. If there is no difference, we do not go back but move on to another knob. Deciphering some knobs makes it easier to understand the more "difficult" ones.

Throughout the above process, we respectfully adhere to three principles:

1) Each time we only change the settings of only one knob (one variable) at a time, keeping ALL the others unchanged. If we make the mistake of touching two knobs at the same time, then we will not know which of the two gave the specific result. (The two-variable fallacy, see later).
2) We change the setting of the knob from one end to the other for the distinct difference to become evident. In other words, wedetect the extremes.
3) We also examine what happens in the intervals between the two ends.

The exploration of the extremes

Our main obligation is to change only one variable at a time. Our second obligation is to explore the edges of this variable and then explore the entire area enclosed by the two extremities. For example, the exploration of the edges is used by the ceramics manufacturers in various meteorological conditions, where they test the tiles in ice. The outdoor cables of electricity transport are subjected to extreme tests of climatic conditions and rapid aging to select the best materials. Car crash tests also use this type of testing.

It must be emphasized however that the examination of the extremes also involves risks. Movement of the tips at the extremes can cause punctures. (Figure2). Therefore, we only detect where the extremities are located without the risk of either piercing or falling off the cliff. We are not acrobats!

After the safe and approximate detection of the location of the edges, we will determine, with slightly less accuracy, the midway or any other point along the way we choose and proceed to these points with stability and safety.

Figure 2: Exploration of the extremes.

The course of people unfamiliar with the edges can be compared to the path of a car at night on a freshly paved road without the markings showing the middle and the edges of the road. The path of the car may be zigzagging and in danger of going off the road at any moment. It is easy to imagine what could happen if there is also fog. This fogginess can be easily compared to the foggy landscape of the mind, but also the fogginess of the problem itself which we are called to resolve.

Actually, how can you know the mean length of a certain line segment, if you do not know the ends? How can the golden ratio be determined? How can the center of a sphere or a circle be determined if there isn't first a sphere or a circle?

The ancient Greeks had prioritized the two questions very well. The apothegms «ΜΗΔΕΝ ΑΓΑΝ» (Avoidance of Extremes) together with «ΓΝΩΘΙ ΣΑΥΤΟΝ» (Know thyself) were the main (grandest) Delphic models that decorated the pediment of Apollo's Temple at Delphi. On columns and plaques around the Temple the remaining 145 apothegms were engraved along with the well-known "ΜΕΤΡΟΝ ΑΡΙΣΤΟΝ» (Excellent Measure in Things). The ancients considered that the greatest model was the Avoidance of Extremes and not the Excellent Measure. Indeed, the Excellent Measure cannot be defined, if the extremes are unknown. The Avoidance of Extremes chronologically preceded, and the Excellent Measure followed. Therefore, deservedly the Avoidance of Extremes was on the pediment and the Excellent Measure among all the others.

The measure of the ancients is not necessarily the midpoint. Unfortunately, the perception prevails in common man that the logical path represents the "middle road" and even worse the "well-travelled" road, no matter how wrong it is. These paths are pure logical fallacies that have been studied since the Middle Ages as "argumentum ad modum" and "argumentum ad temperantiam" respectively.

In conclusion, the "One-variable-at-a-time and the detection of the extremes" (as could be the full name of the method), is a fusion of the ancient Avoidance of Extremes and Excellent Measure in Things into a single method.What remains is the graphic representation hidden between the two extremes of the variable under consideration.

Strictly increasing or decreasing functions

Here we examine the form of the previously mentioned graphic representation in cases where the extremes are as follows: False – true, sin – virtue, injustice – justice, immorality – ethics, wrong – right, stupid – wise, absurdity – logic, and so on. The common feature of these concepts is that they have the dual texture of "good - bad", where one end is the desired and the other the undesirable.

These concepts produce graphs which correspond to strictly increasing or decreasing functions. This is because the more truth, justice, virtue, morality etc. we have, the better it is. If, for example, we represent rationality on two axes as a function of the new and hopeful RQ index, we will get a curve whose general form is depicted in Figure 3.

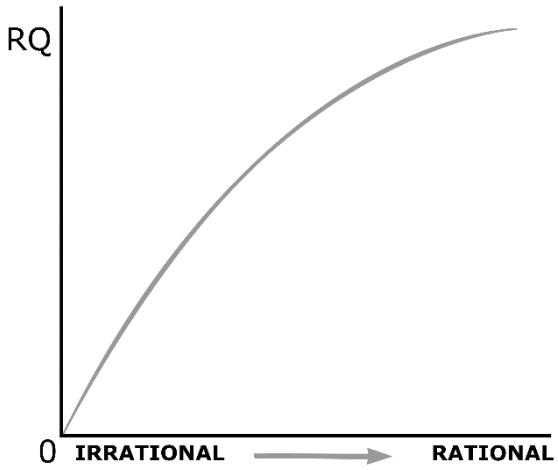

Figure 3: The curve of rationality.

Note here that Keith E. Stanovich, Professor of Psychology at the University of Toronto, after many years of research proposed a new and promising Rational Quotient (RQ) indicator [4], because the previous indicators such as Intelligence Quotient (IQ) and Emotional Quotient (EQ) have inherent weaknesses in the secure measurement of human intelligence or emotions.

The desirable point in such dipoles is close to the one extreme, but how close indeed? One such extreme is examined by Dr. Pellegrinis, Professor of Philosophy at the University of Athens, in chapter "Excellence" of his book "The game of Philosophy " [5]. Examining the far right end of good, he determines the danger of extremes. The height of Icarus's flight just before the right extreme represents excellence and the gap after the extreme represents the exaggeration (insult) by falling into the sea (Icarian Sea). The exact height of Icarus's flight coincides with the melting point of the wax with which his wings were glued.

The question now is what happens to the truth-false couple when bivalent logic is exclusively applied? If we take for example simple arithmetic from Mathematics, we only have one choice: A says 4+4=8 (true) or B says 4+4=10 (false).

But classical mathematics is an ideal space with only two values of truth 0 and 1. By the authority of the Law of Bivalency, it excludes all intermediate values. In life, however, degrees of truth reign in an infinite logic that in today's world is expressed excellently through Fuzzy Logic introduced by Zadeh in 1965 with the help of the notion of fuzzy set [6].They are infinite values between zero and one. Frequently in these cases, which are numerous in everyday life, a detection of what is happening at the two ends is sufficient to understand what is happening in the intermediate time. From the examples that will follow we can see that OVAT many times ends up being literally a "method of the extremes "without requiring all the values between the two ends.

There are also cases, however, where the change shows a maximum or minimum. In such cases, if we only examine the ends, we will be bitterly mistaken. These cases produce serious logical fallacies that we will expose.

THE EXAMPLE OF THE PANDEMIC OF COVID-19

Definition of the variables of the problem

The first step in approaching a problem is to identify the variables related to it and then their hierarchy in order of importance.For the pandemic we will consider the following variables:

1) Mortality
2) Transmissibility
3) Economic consequences
4) Psychological consequences
5) Educational consequences
6) Long-term consequences

The order of importance of the variables is not unambiguous. One could claim a different order. The only sure thing is that mortality is the first factor to consider because it concerns death which has no return.

The above series is quite convenient because we observe that the first two variables are completelyindependent. Another point is that a virus is transmitted and another more important fact is that,when it is transmitted, what the consequences are. One precedes the other in time. We are referring of course to the beginning of the epidemic, but also for a long time after. The transmissibility begins to bend only when the epidemic affects 60-70% of the population due to herd immunity. Consequently, all this time the two variables are completely independent of each other, and are derived from the characteristics of the virus which we also consider stable without mutations etc. If any mutation occurs, we simply must measure the first two variables again. What is certain is that until a mutation appears, the two variables are independent and the OVAT can be applied with excellent results.

In contrast the last four variables are dependent on the two first. Indeed, a high mortality and transmissibility have great psychological and economic consequences, whether the measures are taken or not. For example, an increase in deaths due to the virus means an increase in suicide rates due to depression or an increase in deaths due to the economic crisis and consequent famine.

So, when dependent variables are included in the arguments we mustgo back to the beginning and examine to what extent they affect the previous ones. The OVAT in this case is still valid but it becomes more complicated. This continuous feedback for dependent variables refers directly to another useful method, the well-known Trial and Error[7, Section 3]. In this method there is continuous feedback between cause and effect continuously approaching excellence. The combination of these two methods where dependent values with strong dependence gives very good results. It is well known that the American Psychologist, Thorndike has been emphasizing the value of the Trial-and-Error test method since the 1920's in the average person's daily life. This is not only true for the average person, but also for science. OVAT along with the Trial-and-Error methods are the two golden keys of science.

However, in the case where Trial-and-Error is required, the work and time required to carry it out is significantly increased. So, we cannot ask the average person to use the Trial-and-Error daily to make quick decisions. The immediate consequence is that the weight of the OVAT as heuristic increases.

The fact is that OVAT alone is an easy and simple method for independent variables or for those slightly dependent. For example, experience has shown that the psychological factor of inclusion has little to no effect to the variable of mortality. The economic factor has not shown, so far, millions of deaths from hunger. So, this variable can also be dependent but has little effect on total mortality. The degree of dependence is small. What is also certain is that these degrees of dependence must be considered by the respective specialties of Economists and Psychologists.

Degrees of dependence vary from country to country. For example, in a very poor country where a part of the population is already dying of starvation, a further drowning of the economy can bring far more deaths from starvation than from the virus. Therefore, the presence of an economist is necessary in the committee of crisis management in a very poor country.

Another example is prosperous Japan where there is no problem of hunger. The habit of suicide is already widespread there. The risk of its rapid growth due to the measures is serious. In this country, a psychologist/psychiatrist must definitely participate in the committee. The variable of psychological consequence is possibly strongly dependent on the measures taken in this country.

Certainly, on such a committee, a Mathematics specialist is necessary. He is the one materially responsible for the application of Probability theory and Statistics connected to the dependent and independent variables, for the "hidden" variables of Statistics, for the necessary calculations, and generally for the logical arguments and the avoiding of fallacies. It is not wise for doctors to speak continuously about Mathematical Models of the pandemic without a Mathematical consultant.

Measuring the variables

A single way of measuring a variable must be agreed upon from the beginning and this way to be maintained until the end of the survey and the last variable.For example, we cannot refer to mortality and measure it one time by the number of those who become sick and another by infected whether or not they are ill. The same happens for the measurement of transmissibility and for every variable.

Transmissibility is measured by the reproduction number R_o, which gives the mean number of people infected by the virus during the infectious period by one person who has been already infected [8]. In general, any well-established measuring method is acceptableso long as it is a stable method of measurement for the entire study of the corresponding variable.

Application ofthe OVAT to the pandemic

In order to proceed with our reasoning, let as assign here a random and quite low value to mortality, say 0.1% of those who become sick.

What is the general principle of OVAT?When we look at the second variable which is the transmissibility, we must keep all the other variables constant and will only change this one from end to end to see what effect it has on total deaths.What does this mean?That with a constant mortality of 0.1%, a constant number of suicides due to psychological consequences, constant deaths due to economic consequences and starvation, and all other variables we may consider along the way remaining constant, how many deaths we will have with infinite transmissibility and how many with zero?

At zero transmissibility we observe that the number of deaths is at most one; the first person to become ill has a 0.1% probability to die.At the other end of the spectrum, infinite transmissibility means that we have one Chinese person from Wuhan who sneezed and in a short time, a European person becomes ill!In this case, all humanity will become infected in a short period of time and 7.000.000 people will die (7 billion x 0.1%), without the opportunity for any kind of reaction.

The above reasoning demonstrated that transmissibility is in fact the most important factor in assessing whether an epidemic is limited or is a human pandemic, even though we first examined mortality that for psychological reasons only is the one which terrorizes. After all, first the spread of a disease must occur and then we must calculate its mortality rate. Without the spread, mortality does not make sense.

The final calculation of mortality with the expected number of people infected due to transmissibility will be the one to determine the risk of the disease and whether it will be classified as a local epidemic or global pandemic and how serious it is.

Figure 4 represents the graph of the change in deaths along the transmissibility (R_o) [8]. The curve is obviously strictly increasing because, if the transmissibility is increasing, the deaths also increase. At zero transmissibility and the worst-case scenario we have the death of the only infected person, but the virus is not transmitted to any other person. When R_o is between 0 and 1 the number of deaths due to reduced transmissibility steadily decrease, always measured over the same period. Over time, the epidemic disappears.

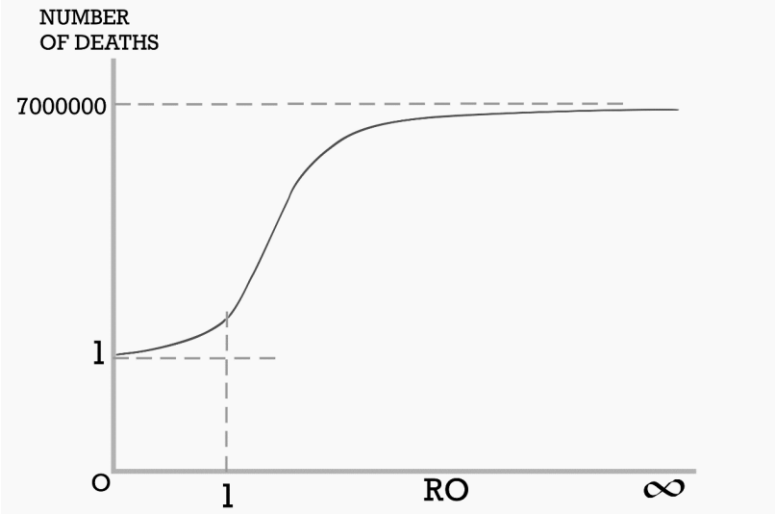

Figure 4: Graph of the deaths along the transmissibility

From R_o=1 and up the death curve increases rapidly because every person who becomes infected transmits the illness to many more than one person. In this way a geometric progression develops of the infected population. In high transmissibility we approach asymptotically the maximum number of deaths.

In such functions we are not concerned with the exact shape of the curve between the extremes. It is enough to realize that transmissibility is a continuous aggravating factor in the total mortality. In other words, it is enough that the curve is increasing. The two ends of the curve are enough to make that ascertainment. With such variables the OVAT ends up being a simple "Method of the Extremes".

Understandably, when we looked at the first variable, mortality, and consider all the other variables constant our reasoning has no logical error because at the beginning of the epidemic, but also some time later, other variables such as the economy or psychology had not been affected yet. These variables start to have an effect later. Also, the transmissibility has not been affected by herd immunity. Transmissibility will change much later, when at least 80% of the population becomes immune in some way.

So, famous professors of American and European universities,fell into this error of calculating mortality without examining transmissibility,But not only them. The World Health Organization (WHO) itself in the swine flu"pandemic" of 2009 gave bad tests [9]. Declaring the epidemic on 11-6-2009 as a human pandemic based on only 26000 people who had been infected in 34 countries with only 150 deaths thus far. In other words, it found a mortality of 0.6% and nothing else. It is obvious that it did not even consider the transmissibility because in a few months the epidemic had ended on its own without the intervention of vaccines. In the meantime, vaccines were developed (!!!) supplied to countries, but the epidemic was not very contagious. Naturally the vaccines were trashed worldwide…. It was confirmed once more that pandemics are characterized by high transmissibility and not mortality. Or to be more precise the combination of these two factors.

Characteristically, a professor at an American University, advocate of the low mortality of COVID-19 and the simple "flu", was asked in October 2020 in a televised interview by a journalist on the transmissibility. What did he answer?? That it was too difficult to measure…..

The fact that transmissibility is indeed difficult to be measured accurately is, however,the half-truth. In contrast, mortality, because it has to do with the number of known dead and the infected through extensive testing, it is more accurate to measure. But the fact that one variable is difficult to measure does not mean that it should be omitted!! Especially when it is independent and so important.

Let us now compare the transmissibility of the common flu and COVID-19 using OVAT. Let's assume that influenza and COVID-19 have the same lethality and equal to 0.1%.The OVAT tolerates even proximate measurements of transmissibility, provided that they are the same in all diseases.So, measuring with the same measurements the transmissibility of the common flu and of COVID-19, we see that the transmissibility of COVID-19 is at least six-fold of influenza. So, COVID-19 is not the flu because it does not have the transmissibility of the flu even though it has a mortality close to that of the flu.

The fact that the WHO and famous university professors have fallen into the trap of not using OVAT in the independent variables of mortality and transmissibility demonstrates that OVAT is frequently ignored in science.

Development of the argument and the confirmation bias

We observed previously that the addition of the second variable (transmissibility) literally overturned the reassuring results of the first (mortality)! Let us now proceed in the same way with the other variables to see how OVAT works in general.By keeping the two previous variables constant and examining the third variable (the economic impact) from end to end, let us assume that the result of the combination of previous two variables is reversed and the decision is to remove the existing measures or to limit them. For example, this can happen in a very poor country.

The rest of thevariables to be added in the same way can tilt the scales of the measures from one side toward the other. For example, let us consider the long-term effectson either those infected with the disease (long COVID), vaccinated (due to the vaccine), the economy or any of the other variables. In this case one must avoid long-term predictions as a strong argument. This is because the prevailing randomness in long-term developments makes any correct prediction impossible. This is advocated by Dobelli with the fallacy "The illusion of predictions" [10]and Mlodinow with his book "The Drunkard's Walk"[11],but also by life experience. After all, if we look carefully at the long-term effects, we will see that they are not all on the same side of the decisions. It is doubly futile, therefore, to put into discussion the precarious long-term effects when one has not calculated the immediate and short-term ones that are well predictable.

In this way, the argument isdeveloped in a discussion and the final winner in fact does not exist. For example, if after examining n variables and deciding, someone appears the next day with the n+1 argument, with the n+1 variable, with the n+1 parameter, it is possible to tilt the scales to the opposite side!

To summarize, we assume that with the first variable (mortality) the result is that no measures are taken (low flu-mortality). After examining the second variable (transmissibility), the logical decision is to take tough measures. After reviewing the third variable (economic impact) the logical decision is to not take tough measures. In the fourth variable could decide again tough measures etc. This could be done constantly, an ongoing Ping-Pong. The "odd" arguments are against the measures and the "even" ones are in favor of the harsh measures

If now a cunning arguer, gathers all the "odd" arguments and ignores the "even" ones, makes a forceful scenario that there is no pandemic. Also, if another also cunning arguer collects the "even" arguments and ignores the "odd" ones, also makes a logical and convincing scenario that the pandemic is dreadful and terrible!

In the end, where is the truth?The truth lies only in the correct argument that does not omit any variables and puts them in order with the help of OVAT and edge detection.

All the above happen when all the arguments have a logical basis and are well measured. Let us now imagine what happens if some of them contain errors. For example, if the calculated mortality is not 0.1% but 1%, the beginning is already wrong. The many big or small mistakes of the arguments because they ''sit'' on top of each other lead to a completely wrong conclusion.

Even if all the individual arguments are right, and the measurements are also correct, the collection of arguments that suits the pre-taken decision to support one side or the other is referred as confirmation bias**.**The above prejudice is endemic not only to the ignorant but also to the scientific circles. If, for example, a scientific study that costs time and money turns out to be wrong, then its instigator, who suffers from this prejudice, will seek to find all the arguments that support his view, ignoring all the opposites. Of course, it is not only the prejudice that blinds logic, but also selfishness and other elements of a person's personality that only a Psychologist can investigate.

FUNCTIONS WITH OPTIMAL VALUE

A farmer's problem

Suppose a farmer cultivates 30 acres with primitive tools for our time, that is, with animals and a lot of human labor, Produces a product. At the end of the growing season makes a calculation. First, he adds up to how much money he received from the product. He puts this number as a numerator in a fraction. Then he calculates the cost of cultivation including the man labor and puts it in the denominator of the previous fraction. He makes the value for money division and finds a number, P_1 (Figure 5).

If he now asks how much a reasonable piece of mechanical equipment costs for these acres he cultivates, and makes new calculations, he will see that the amount of product increases and at the same time the cost of cultivation is

reduceddue to the lack of man labor. Of course, it also considers the depreciation costs of these machines. The new division brings out a larger number.

We said above about reasonable mechanical equipment, because if he chooses very large and expensive machines, the product does not increase anymore, the few part-time jobs required by simple mechanical equipment are not limited, and the cost to the denominator can become huge due to expensive and unreasonable equipment. The new division again resulted in a small number, P2, smaller than the first number of manual cultivations (Figure 5).

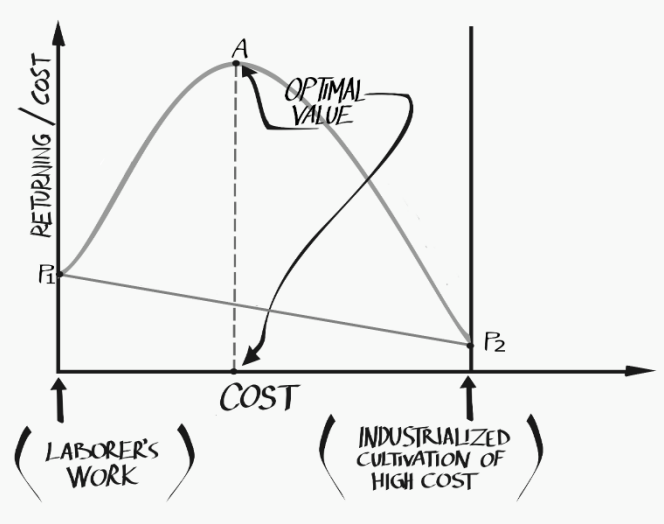

Figure 5: Graph of the farmer's calculations

What is the "best"? Of course, the maximum of the curve. This is the optimal point. What is the "measure"? The projection of "excellent" on the cost axis. In Figure 5 the two ends are unattainable. The optimal point is in between.Eventually, all life's phenomena are described by curves. In somecases, we may be interested in the maximum and in the others the minimum of the curve. The one thing we must not forget: it all started with the identification of the edges. The farmer may have won a large sum in the lottery and be able to spend the money on expensive and irrational equipment, i.e., the other end of his current situation. Does it make sense to spend it?Even worse, if he does not have the money, does it make sense to borrow it?

Polarization,The fallacy of the edges

The fallacy of polarization accepts only the two ends of the farmer's machinery P_1 and P_2 and ignores everything else. Here is a farmer's possible answer in this case:

"What do you want; to end up like my fellow villager Anthony who is full of machines and owes money to the Banks? He lost his property and still owes, and the machinery is rotting."

In the sketch of the farmer's investment, the excessive machinery P_2 has been deliberately designed to be more unprofitable than the manual labor, P_1. Examining also the second edge p_2, can produce the fallacy of unprofitable mechanization of the crop and therefore the abandonment of the idea of mechanization. This is because we do not yet know the shape of the curve between the two ends. We therefore have an obligation to examine the whole area from end to end. Examining the whole area results in finding the best measure.

Apart from the polarization and the error of the edges, the errors are everywhere, to take advantage of every point on the curve different than the optimal one as we will see in the following.

Theslipperyslope

We can identify two slippery slopes, the straight lineP_1P_2 and the steep slope A-P2 [12] (Figure 6).

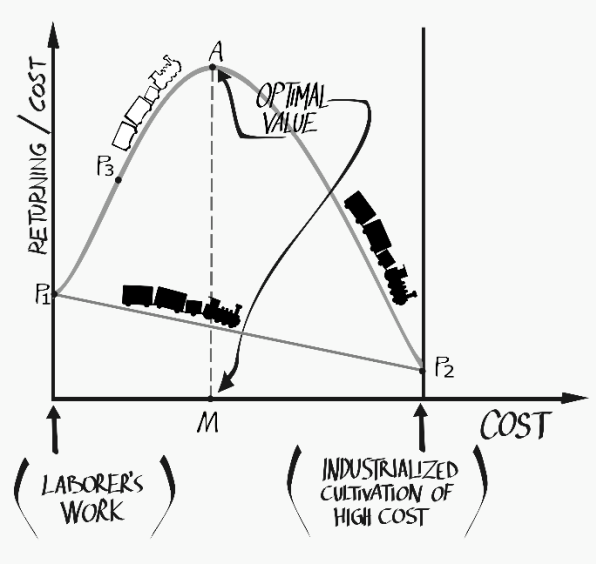

Figure 6: The slippery slope

The first case has already been examined in the previous section. In the second case the farmer is convinced, because of envy, of the neighbor's progress to the first investment which leads him to the point P_3. The investment was made without any planning. It was completely left to chance, for example by what the neighbor had done. When he sees after a while that the investment was successful, he decides to climb the slope of the curve and reach area A without knowing that he is already at the best point. The way he has been sweetened, he continues to invest and is financially ruined (from A to P_2) experiencing a sharp decline. Slippery surfaces are so difficult and so dangerous that the first step is enough to send you into a wonderful slide to the bottom.

So, once again the "Avoid Extremes" is confirmed, as well as the OVAT, which requires the safe detection of the extremes and then the search of the area between the extremes to the "Excellent Measure".

Derailment of the train of logic

In the example of the manual farmer there is also a fallacy on the uphill side of the curve, that is, the side of logic.One objection that the farmer can tell us is this:

"Since mechanization will work for me, then I should also get a dishwasher, a clothes dryer, an ironing press, a razor, a nose hair clipper, a massage chair for my back, an electric knife, a drone, to supervise the cultivation and a robot pressing all those buttons."

What does he actually do with this argument?He adds other variables to the problem and confusion.

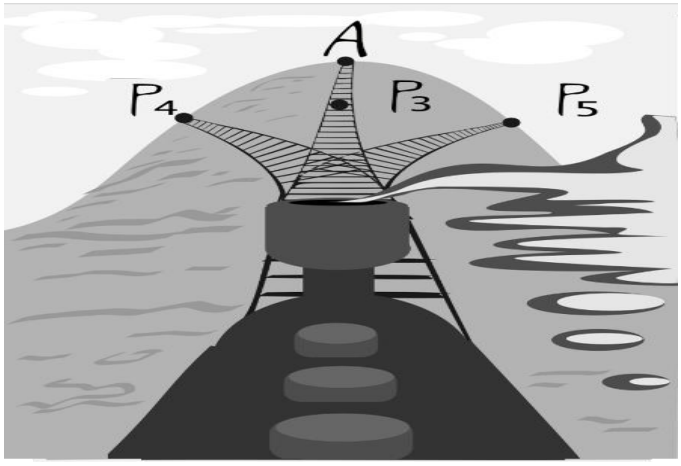

Figure 7: Derailment of the train of logic

The derailment on the uphill of logic (the left part of the curve) happens because the train of crop modernization is launched on other tracks, on other issues that produce other curves with other reasons for cost-effectiveness and other variables.In Figure 7, we see the returning/cost curve as an uphill line P1-P3-A. It is the mountain of logic and the train climb up the hill of logic toward A which is the best. While in the previous fallacy of slippery slope, the train take the slippery slope with increasing speed until its destruction, moving along the same lines, now the train is climbing, panting up the hill of logic. The only way to destroy it is to send it to other dead-end tracks. These fallacies are ultimately very cunning…

Today, smoking burdens the health system and is the reason cigarettes are heavily taxed. The argument that cigarettes should not be taxed since trans-fats are not taxed, or the argument that trans-fats should be taxed just like cigarettes is a derailed train of logic because cigarettes produce a different damage curve and fats produce a different curve. In any case, it is not yet time to examine the fat. The power of the derailment from the controversial issue of cigarette taxation is such that some suggest they be taxed wildly and those who do not exercise,because their health is burdened by their laziness, and they pass on the cost of their care to the athletes. But if you compare the health damage from smoking and laziness, the difference is night and day. The derailments have no end, because one would add athletes of races and dangerous sports who suffer from fractures, injuries, etc., the climbers, everyone would be taxed.With such extreme derailments, an uninformed audience will fall into error and giggle at the original anti-smoking argument, resulting in the cancellation of the original rationale for cigarette taxation many times over. The force of this error is as great as that of the slippery slope.

The characteristic error in the above examples is firstly, the mixing of many variables. If we want to put these variables into play, we must quantify the truth of the new arguments by means of an infinite logic as for example Fuzzy Logic of which we will discuss next.

According to the above, the mixof many factors, parameters and variables is irrational and malicious. The One-Variable Method that insists on considering only one parameter at a time (e.g., mechanization) with all other variables held constant, has its merits.

THE FALLACY OF TWO-VARIABLES.

The value of the OVAT method becomes clear when we let two variables change at the same time.The simultaneous operation of two variables is so insidious that it looks like a logical paradox, but in fact they are not paradoxes at all.Here we present some characteristic examples of the fallacy with two variables.

The paradox of the court

One of the best examples of the fallacy with two variables known as the paradox of the court [13] was presented by the ancient Greek sophists who were masters of such things. Evathlos was a student of Protagoras, an eminent sophist of the ancient world. After finishing his law studies, Evathlos paid the teacher half the fee, with the agreement that when he won his first lawsuit he would pay the other half, but if he lost, he would pay nothing. Time passed and Evathlos neither practiced the profession nor meant to pay his Master, and Protagoras took him to court to collect his due payment. There, the two opponents develop their arguments.

- Protagoras: Whether I win or lose the lawsuit, I must be paid. If I do not win, that will be the decision of the court. If I lose, it will be the first case Evathlos wins and we have an agreementin this case for him to pay me his debt.
- Evathlos: Whether I win or lose that lawsuit, I have no obligation to pay. If I win it**,** the court acquits me. If I lose it, it is my fist trial and we have agreed that in this case, I do not pay the rest.

It is obvious that in each argument there are two bases, two variables which are completely independent. One variable is the court's decision based on its own laws, and the other is the decision based on the private agreement between the two. The decision must be the same for both based on a single law, and not based on whichever lawsuits each one at the time and on a case-by-case basis.These two variables are used by both opponents in their argument at the same time, and for this reason they manage to contradict each other. They used two different units of measurement and two different weights as it suits each one, with the consequences being the whole of the two plans seems like a logical paradox, when it is not.

We must observe that the two variables are very close as concepts, which is why they are artificially mixed. One is the justice of the court and the other is the justice that is the product of an agreement. That is what creates the confusion.

The fallacy of the irrelevant conclusion

This fallacy constitutes a classical violation of the principles of the OVAT method. It is created when an argument is presented in a discussion related to a certain variable and the delegate replies with a counter argument based on a similar, but different variable, which leads to an irrelevant conclusion [14]. For example, a minister answers a journalist's remark that more than 25% of people in the country are living under the boundaries of poverty by stating that the government makes every possible effort to relieve our undeserved fellow-citizens.

Aristotle was the first to study this fallacy in his "Sophistical Refutations" and called it "Ignorance of refutation"[14].

The crusades

The crusades give us a wonderful historical example. How did the Popes manage to inspire the crusaders to make such long journeys while fighting with rage on the way? They did it by using two variables. If they win and return alive, they will enjoy the spoils in life. If they die, they will please God and will enjoy paradise after death.

The two variables here are: we love life with rich loot (theft), or we love God, his morals and death for Him with the implied Paradise.These are two variables that cannot be applied to the same person at the same time as they are incompatible with each other.

Experience or knowledge? Practice or theory?

The insidiousness of the fallacy of the two variables is also evident from the fact that even modern "teachers" of logic fall into. Rolf Dobelli, a former novelist, decided to get involved with logic in 2010. His two books on the subject [10, 16] have been an international success and have been translated into over 50 languages with millions of copies. This makes any mistakes in these books quite dangerous. In a chapter of his second book, «The Art of Practical Thinking»[14], he states: «Why experience is more important thantheory. The illusion of theoretical knowledge».The chapter begins with the following question:«Would you like to be operated on by a doctor who has read thousands of medical books but has not yet had any experience performing surgery or a doctor who has not read any medical books but has performed a thousand surgeries»?It is understood here that experience wins.

The comparison, however, that Dobelli makes is not equal and fair, it is misleading. The error lies in the fact that two variables change at the same time, personal experience**,** and knowledge from books, which are completely independent. This is because the sources of knowledge from reading are different from the sources of our own experience. In reading we accept a foreign experience, while the knowledge we gained without reading comes from our own experience alone. The difference is huge.

Let us apply the OVAT method by keeping the experience constant and changing only knowledge from books.We use the following reasoning:

1) At the beginning of the operations the practitioner knows nothing of books and at the same time has zero personal experience, while the doctor already has available the experience of others through the reading of 1000 books.
2) After 1000 surgeries of the doctor and after 1000 surgeries of the practitioner again the doctor will excel, because the doctor always has additional experience of the others through the books. So, the theory wins again. In conclusion, with equal experience and changing knowledge derived from books the knowledge wins.

Now let us keep knowledge from books constant, and change the experience.We make the following considerations:

1) "Would you like to be operated on by a doctor who has read thousands of medical books but has not yet performed any surgeries or a doctor who has read the same thousands of medical books and has performed a thousand surgeries?"
2) «Would you like to be operated on by a practitioner who performs his first operation or a practitioner who has performed 1000 operations?»

The conclusionin this case is that with equal knowledge from books and changing experience, experience wins and the overall conclusion from the combination of the two cases is that the experience does not always win as in the original Dobelli's claim. We understand, therefore, that to confuse two such peculiar variables as knowledge from books and knowledge from personal experience is a delusion that only OVAT can easily distinguish.

Dobelli then builds on this logical-looking argument and gives historical examples to support it. In 1903 the Wright brothers flew the first airplane without any aerodynamics textbooks. The first aerodynamics book was published 20 years later. But this is how science advances. If there are no medical books,no knowledge, I can accept any practitioner even

in his first operation! Something that happened a few thousand years ago. There was no other solution. Likewise, if there is no knowledge of aerodynamics, I agree to fly with the Wright brothers even on their first flight. From the fact that there is no prior knowledge of anobject, we cannot condemn the knowledge when it exists and glorify the experience, and only the experience.In [7, 17] we analyze in detail what really happens with theory and practice (deduction and induction).

Another indication that something is not right with this delusion is that Dobelli, in the 104 fallacies and prejudices described in his two books, includes a bibliography on most of the fallacies, and in fact on each one separately. The above wrong argument, however, does not include a bibliography.

Sport and OVAT

It is known that the pole jump is done with a precisely defined pole to properly evaluate the athlete. When a few decades ago, identical poles in dimension suddenly appeared in races but from other material, the heights soared. OVAT would impose in such competitions the use of the same pole by all athletes so that the variable of the pole is constant and only the abilities of the athlete are highlighted.

In car racing we cannot say that the first driver is the best, nor that the first car is the best brand. To say who the best driver is, there must be special uniform races where all drivers compete with the same type of car. To determine which the best brand is we must go to a track with different cars that will all be driven by the same good driver.OVAT is the norm in sailing competitions. There are categories of sailing boats where athletes show their true abilities by competing in the same type of boat, etc.

The placebo

An important application of Statistics is the testing of drugs and vaccines. When there is a need to test a new drug or vaccine it has been observed that some patients feel better even if the product contains plain flour or sugar. The reasons are psychological. Therefore, there are two variables mixed in the administration of any drug:

He got well because of the medicine.
He got well due to psychological factors.

Therefore, we do not know the exact effect of the drug on the disease. To remove the effect of the second variable, we give a placebo to 100 patients without the patient's knowing that they took placebo (control group). We give the real medicine to another 100 patients. Nor do they know if they took the real or fictitious medicine. Of course, the sponsor knows to whom he gave placebo and to whom he gave the drug. If we observe an improvement in 10 of them in the former group and in 50 in the latter, then the net contribution of the drug is that it helped at least in 40% of the patients, i.e. the difference of 50-10.

We must note that the above variables are completely independent because in a completely different way the good psychology of the patient fights a disease and completely different the drug with its targeted action. Statistics therefore struggles to remove each variable that interferes with its results and to leave only the one it examines.

THE «HIDDEN» VARIABLES OF STATISTICS AND THE SIMPSON PARADOX

The «hidden» variables of Statistics, as the previously mentioned variable of the patient's psychology, are a big problem. When such variables are discovered, their effects must be carefully removed for the statistical results to be correct. Most frequently these errors are made from ignorance of the sample variables. There is so much insidiousness of the hidden variables that they can end up in a paradox, as happened in the already presented Protagoras-Evathlos example. One such paradox connected with "hidden" variables is that of Simpson [18], which we are going to describe here with the following example:

We decide to have an operation. We must choose between two surgeons, A and B. Ais successful in 95% of the surgeries he does and Bis successful in 80% of surgeries. Which surgeon does it make sense to do the operation? The immediate answer is of course A.

Surgeon A, however, serves in a private clinic where all operations are well planned, after a complete examination of the patient, with adequate materials, etc. Surgeon B serves in a mobile military operating room in the aftermath of a war. The cases he operates on are all extraordinary, serious, and massive. As for the materials, they are not always sufficient.It is obvious that B is probably the best. If we want to measure their ability, we must find a way to allow the two doctors to compete in the same environment. Only in this way do we respect the OVAT, keeping all other variables constant.

In this example we chose two extreme environments to emphasize the difference. This clearly proves how important the second stage of OVAT is, i.e. the edge detection, for avoiding the polarization error or the edge error. Which variable is missing? What variable is hidden in our rough decision? It is not one, they are many. The importance of surgery and the other factors that everyone operates. We only count how many surgeries each succeeded in, ignoring the other variables. Simpson's paradox has many hidden variables.Therefore, the two doctors must compete in the exact same space, with the same tools, and with all the other variables constant and only the doctor being different. This is the only way to respect the OVAT. The type of surgery must also be considered. Given that one can be an expert in pathologies and the other in trauma.

APPLICATION IN DIFFICULT ENVIRONMENTS -THE MIRROR OPPOSITE OF OVAT

The OVAT applications usually concern few variables such as the amplifier buttons described at the beginning of this chapter. In chaotic environments with too many variables the method is not easy to apply.This is because it is extremely difficult to keep all the other variables constant and to change only one.There are cases, however, where something analogous could be done evenin chaotic environments, like the human brain and in psychological research and experiments.

American psychologist Benjamin Samuel Bloom studied pairs of twins who had grown up in different environments. With Bloom, having two identical brains and changing only the variable of the twin's upbringing environment, he saw that the twin, who was raised in a stimulus-rich environment, became smarter than his brother, who grew up deprived of stimuli. Bloom was able to do the experiment through OVAT, but where external factors (not internal to the brain) were studied such as the upbringing environment of each twin.Naturally, we cannot do in vivo experiments on humans to see what the internal "buttons"of the brain do, such as the amygdala or the hippocampus.

Let us examine, however, the accident of Phineas Gates in 1848 [19], which destroyed part of his frontal cortex. Phineas lived for thirteen years with completely different behavior, and his story remains historic. In tumor removal in the amygdala area, great observations have been made in human behaviors post operatively. These rare cases are thoroughly investigated because they show the function of the chaotic environment with some factors zeroed, e.g., emotions. In fact, we observe that in the above cases there is no change of one factor with all the other constants butthe absence and zeroing of this factor with all the others changing. We can call this method a mirrored opposite of OVAT.

Patient Henry Molaison revolutionized the study of human memory. After the removal of the hippocampus in 1953 and until his death in 2008, for 55 years he was constantly under the microscope of science [20] He was known in a closed circle, only with the initials «patient HM» so as not to be bothered by journalists and the public. His name and history became widely known after his death.

On the other hand, the failed history of lobotomy [21] also has a lot to teach us. These extreme cases are hard to find for researchers. Science is waiting for such exceptional cases, to draw its own conclusions. In fact, in recent decades, advances in brain surgery (tumor removal) have 'produced'such new patients, valuable for observation. This variant of OVAT is valuable in science.

BIVALENT AND FUZZY LOGIC WITHIN THE OVAT

As we have seen in Section 2 OVAT includes three stages:

a) The definition of variables and their type is simply the definition of what object we are talking about. Without it, no discussion, no research can begin.
b) The detection of the two ends of a variable is within the premises of bivalent logic, with which one must start every logical effort being careful to avoid any two-dimensional fallacy.
c) The investigation of what happens between the two extremes, is within the premises of an infinite logic that for our days is perfectly expressed by Fuzzy Logic [6].

In conclusion, OVAT achieves a combination of bivalent and fuzzy logic which is the best way to look at human things, because even science today cannot be based on bivalent logic alone.

THE OBJECTIONS

It is characteristic that many of the objections that exist for the non-use of OVAT approach in everyday life include at the end the confession that there are many sources that emphasize its usefulness [22]. The human mind seems to be naturally armed with other heuristics so as not to use OVAT in strongly bound variables. It understands it subconsciously. For example, if one has four worn tires in his car, he changes all four and not one by one as OVAT commands. If a twin-engine airplane has a problem with the engines, the pilot does not try to land with one engine at a time, as OVAT quickly "commands",discovering what the damage is, but does the same job on the ground and in the

appropriate laboratory in applying OVAT to each engine. He then tests them both in collaboration, to see if they work properly on the ground. Only then does he make a test flight.

In a family when a member has a mental illness, modern psychotherapists prefer group (family) psychotherapy because the interdependencies within the family are very large. The mentally ill person is not an independent variable within the family. Thus, each member of the family easily accepts family psychotherapy.

In strong addictions, man himself abandons the OVAT. He feels their strong dependencies. OVAT errors are also moderate in moderate dependencies. In this case there is a high probability that the average person will realize that he should avoid OVAT. In small dependencies of the variables the errors are also small.In independent variables the OVAT is absolutely correct. This shows that we do not expect serious mistakes with the daily use of OVAT.

Other objections consider the OVAT approach as being scientifically surpassed for designing experiments and praise the complex mathematical methods currently used in computer programs [23]. Not every person, however, can solve under the pressure of time everyday problems with the use of computer programs without having deep mathematical knowledge.

DISCUSSION AND CONCLUSIONS

The usefulness of OVAT in science

Being historically judged,the OVAT was the dominant method in the research of Science until the 1920's. By 1920 Science had made huge leaps with the help of OVAT. Since then, other more accurate but quite complex mathematical methods have been developed that require the use of a computer and special programs and a user with a high mathematical education.These programs began to be applied recently when computers became accessible to everyone. Therefore, OVAT was in use in science until the last decades.

On the other hand, the complex mathematical methods are often infiltrated by mistakes, precisely because of their complexity. Let the experts look at this. OVAT is probably a good tool to check the result of each method for gross errors, something like a "strainer" of the results of these methods.The practice proved that famous University Professors with the title of Statistician, but also the WHO, ignore entire independent variables of the Pandemic, which OVAT does not allow. At the same time the OVAT is correct on the independent variables. If these people cannot handle the OVAT, can they avoid mistakesin handling modern and complex mathematics programs? Simpson's paradox also happened because of hidden variables. OVAT by definition required all other variables except one not to change. In other methods where all variables are free to change, the hidden variable trap is not properly labeled. It must also be recalled that the mirror opposite of OVAT works in special cases, where we have too many and often unknown dependent variables. In these cases, even the most accurate mathematical methods cannot give a result. In concluding, OVAT with the advent of other methods was not abolished, it was simply supplemented.

The usefulness of OVAT to the average person

An important advantage of OVAT is that,apart from its usefulness in science, is also useful to the average person as a simple and easy to apply heuristic method.It is recalled that the heuristics or cognitive shortcuts are processes that people use to express judgments under conditions of uncertainty, which elevate the complex problem solving in a simpler features review [24]. Heuristic processing can have imperfections, but they usually lead to correct answers. When, however, they systematically lead to wrong decisions then they become cognitive prejudices [25].

As for the heuristics that each person uses, we observe that if individuals were to act completely rationally, they would have to make judgments and make decisions having weighed all the pros and cons. However, due to the abundance of information and the time it would take the individual to process it, it would be unreasonable to believe that we operate in this way. People make effective decisions but not always the best possible decisions. For example, we do not expect the average person to accurately calculate a complex problem that has all variables strongly dependent on each other. But we expect to solve well a problem that has three independent variables. The wisdom of Protagoras-Evanthlos has been analyzed thousands of times in the literature. In Papanoutsos' "Logic" [26] we can see an analysis with the help of the truth table**.** But such an analysis presupposes the knowledge of Logic at a deeper level, the knowledge of the tables of truth and how they work, which the average person does not have. The analysis through OVAT and through the two variables does not need such tables. In fact, the opposite is true. The new perspective of the two variables can discover errors that go unnoticed and have not been analyzed in the literature or with the truth table.

The detailed study of heuristics may be a nice field of research for scientists, but the average person needs a simple and understandable heuristic method, to cope better and faster with daily adversity and dilemmas. One such method is OVAT. Additional indications that the method works satisfactorily are the following:

1) From and educational point of view, cunning the common man with one variable is a huge step forward, because he will abandon emotional decisions for the first time. Already today, an overwhelming percentage of society does not include even this variable in its calculations. He moves emotionally. Leaving him in the dark or referring him to a complex mathematical method is not correct. The OVAT is a candlelight in the dark, not a spotlight. It's a good start. And the candle is accessible to everyone. The method does not aspire to solve all the chaos quite accurately, always with some risk.
2) The emotional decisions we mentioned above are hidden in the extremes. Logic is at the peak of the curve. Thus, abandoning one's purely emotional decisions or at least to check and balance them by applying logic to the game [27] is a huge benefit. In fact, if we consider that in addition to the subconscious emotional decisions, we also have those of the unconscious [28] then we will see that logic has a lot of work to do to fight or at least balance these two fields.
3) The "poverty"of one variable is not a problem because everyone can then put a second variable and a third and as many as they want. But in turn one by one!That is what OVAT commands. The second variable modifies the result of the first; the third variable modifies the previous result and so on. We put each variable one after the other, while the paradoxes we described and the errors happened, because two variables worked at the same time.
4) One should not think that with OVAT he will solve all his problems in a perfect way. A possible failure would probably weaken confidence in the method and for some would act as a deterrent. For example, if a farmer gave all his savings to buy a small machine and the next day got sick, it is difficult to convince him that it is not the method's fault but that he did not keep a little money aside. It is difficult to convince him that the other 999 farmers who bought the same machine did not get sick the next day and are very satisfied.

POETIC EPITAPH

Sigmund Freud, wanting to exalt the high mental and emotional intelligence of the Poets said: «Wherever my theories may have taken me, I discovered that a poet had al-ready been there.». The Nobel Prize-winning poet Odysseas Elytis(1979), felt the need for OVAT and the detection of the edges to find the coveted course of excellence, «The middle of the edges» as he poetically calls it. In his poetry collection, Maria Nefeli and Antifonitis, in 1978, one year before being awarded the Nobel prize for Literature, includes this poem:

It has its middle and the edges
how I wish I could find out now, today, this middle of the edges
and I wish I can always find it
because the extremities on which I often find myself are filled with danger and grief and impasses
both for me and for those opposite me
much more when those in front of me push me to this edge.

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