

## THE "THEORY OF NEURONAL GROUP SELECTION" (TNGS) ESTABLISHES A BASIS FOR THE VALUE METHODOLOGY



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### ABSTRACT

The "Theory of Neuronal Group Selection" (TNGS) integrates many aspects of science into a unified, holistic concept of evolution and development of the human brain. Part of this theory is predicated on the evolution of "value centers" within the rudimentary brain structure of all animals. This paper links the establishment of value centers and value criteria in the human brain with the development and practice of the Miles value methodology. It proposes that the Value Method (VM) configured by Miles, provides a catalyst that facilitates communication between individuals by surfacing key criteria (functions) that relate directly to the diverse value criteria of individual perspectives. It also relates the use of function and the Function Analysis System Technique (FAST) technology as part of this critical evolution that makes the VM work. The concepts presented in this paper require a prior knowledge and working understanding of VM and its associated techniques.

### INTRODUCTION

"Value Engineering (VE) is something we do all of the time."

This type of statement, by the uninitiated, has been one of the major roadblocks facing practitioners of the Value Method (VM). Since Miles first arranged his thinking system into an organized approach, overcoming this initial roadblock has perplexed many value professionals. Often, we try to explain what it is by stating what it is not, such as:

- It is not just cost cutting.
- It is not just brainstorming or creativity.
- It is not just taking a third-party objective look.
- It is not just applying good human relations skills.
- It is not just conventional problem solving.
- It is not just team work.
- It is not just engineering analysis of alternatives.

While the VM is not just any one of these aspects, it encompasses them all, and much more. It spans a wide spectrum of techniques, scientific disciplines, philosophies, ideologies and concepts. It crosses and involves so many traditional areas of learning and knowledge that it has not been able to find a home in the halls of higher education or research. It does not fit engineering, biological science, business,

management or the arts. Yet, it encompasses elements of them all.

The power of the VM has been demonstrated through practical application and the results that it produces. From its early beginnings Miles recognized that the VM involved a way of thinking. As Miles said, "This system organizes the essential elements of the problem and the diversified capabilities of the brain into the one plan that promotes the solution of difficult problems."<sup>1</sup> But Miles had only touched the tip of the iceberg.

In the beginning the VM was applied primarily to products, but through almost 50 years of application, has been expanded to many diverse areas. It has been used in many areas of scientific endeavor. In 1979 the traditional VM formula (Value = Function/Cost) was shown through mathematical derivation to reflect a relationship identical to the "Second Law of Thermodynamics" when used to evaluate relative energy functions.<sup>2</sup>

Other applications of VM cover all conceivable areas of systems, procedures and processes. It has even been used to help define moral concepts and the evolution of religious beliefs.<sup>3</sup>

With the use of the "Function Analysis System Technique" (FAST) a detailed analysis of everything from planning a vacation, to defining an organization, to developing a business plan and understanding a product's function have been effected. The Japanese have recognized the system as a very important process because it helps define "purpose" and orients thinking toward the higher order objectives.

Why does VM work in all of these areas? Perhaps it is a matter of the mind. Perhaps everyone does use it to some extent. Perhaps we can find some answers in the "Theory of Neuronal Group Selection" (TNGS) proposed by Dr. Gerald M. Edelman, Nobel Laureate and first published in 1987.<sup>4</sup>

### THE "TNGS" PROPOSITION

Dr. Edelman's TNGS involves a holistic approach to the matter of the mind that crosses the boundaries

of many traditional scientific areas of specialization. It challenges many existing theories on the brain and the workings of the mind, yet it offers a concept that seems to be able to pull many things together and results in some explanations that have previously been unexplainable. The theory is focused on defining how the human brain has developed into a unique organ, through evolution, that uses a process that: "... resembles natural selection to develop during its own lifetime. Essentially Edelman sees the theory as part of his work in developmental biology, in that the outcome of neural Darwinism is decided not so much in the genes as in the developmental process that carries out the instruction of those genes."<sup>5</sup>

The TNGS is an extremely complex proposition that is difficult to fully understand, especially for those individuals who do not have a strong foundation in neuroscience. To present his theory to a wider audience and individuals who are not in the business, Dr. Edelman published his TNGS in the book, *Bright Air, Brilliant Fire: On the Matter of the Mind*.<sup>6</sup>

To fully explain the TNGS would take a significant effort that far exceeds the scope of this discussion. Early in his lay presentation of the TNGS, Dr. Edelman states, "I must warn the reader that I have to explain a series of complex processes that must be grasped to understand brain function. The main ideas to grasp are neuronal group selection, reentry and global mapping."<sup>7</sup>

A key premise to the TNGS is that each species of animal evolved a "value system" which helps the brain interface with the body to select patterns of activity which support the conditions necessary to continue life. This "value system" as initially evolved, provided the animal with the behavioral reactions necessary for species survival and satisfying the corresponding physiological needs. Further, the theory "proposes that categorization always occurs in reference to internal criteria of value and that this reference defines its appropriateness."<sup>8</sup>

"The brain stem, together with the limbic (hedonic) system --- is a value system."<sup>9</sup> It is connected to all parts of the body and is primarily concerned with appetite, sexual behavior, consummatory behavior and evolved defensive behavior. The "value system" influences and affects all aspects of development and learning. In the

all aspects of development and learning. In the human brain, the value system permeates all aspects of conceptualization and categorization. Mapping within the brain is affected and categorization occurs in reference to the value system, value criteria which have evolved from the system and value patterns which have developed based on various stimuli and experiences.

It would seem logical that the basic “value system” tenants, concerning species survival, are the same or very similar in all humans. But then, the evolution and development of each individual brain varies depending on many factors. This results in different value patterns and criteria, that are unique to each person, and results in a “Total Value System” (TVS) which affects learning and behavior.

The TVS of each individual is extremely complex and all encompassing. It is also dynamic and has the potential to change throughout life, through ongoing experimental selection and reentrant mapping. This particular aspect of the TNGS would appear to open many doors to the many mysteries of the human mind and human behavior. If the TVS of an individual can be understood perhaps such questions as “What is motivation?” can be answered.

The potential of the TNGS in bringing together a diverse spectrum of science, ideology, philosophy, physiology and other concepts is awesome. Further research will certainly demonstrate its compatibility with concepts such as Maslow’s Hierarchy of Needs, Dr. Claire Grave’s concept of value systems, Dr. Deming’s quality concepts and the Miles value concept.

**VALUE IN THE MILES CONTEXT**

When Miles began to develop his concept, he focused on the idea of function and the clear definition of function using a single verb-noun description. His idea was to identify the basic purpose of a device or component of a product in the most basic way possible. He then defined value as a relationship between cost and function, as follows:

$$\text{Value} = \frac{\text{Function}}{\text{Cost}}$$

Best value then, would be to achieve the function for the lowest cost.

If we consider function as a “value criteria,” defining what needs, or is intended, to be done, then the Miles concept should have a relationship to Dr. Edelman’s “value system” and perhaps represent a form of expression which facilitates the investigation and analysis of the entire spectrum of value.

If we consider the basic physiological needs of any animal, it is evident that one value criteria is that it is better to eat than to not eat. The function, using the Miles approach, is then identified as EAT FOOD. For prehistoric man, there were several ways to accomplish this function, and the method to accomplish the function required some behavioral action, which can be reflected as a cost. What options were available to prehistoric man? Let’s consider a few:

HUNT  
GATHER  
STEAL

The natural reaction to satisfy the function would be to do that which is the easiest (least expensive). If fruits, berries and nuts were readily available, then the selected approach would be to “gather.” In making a decision, the mind would have decided that:

$$\text{BEST VALUE} = \frac{\text{Eat Food}}{\text{Gather Fruits, Berries \& Nuts}}$$

If this method of satisfying the function continued to be easy and worked all of the time, then a “value pattern” would be established. However, when the climate changes, fruits, berries and nuts may not be available in a particular geographic area. Thus, other alternates would have to be pursued (e.g., hunt animal, store nuts, migrate, etc.).

It becomes evident, when considering cost on a basis that goes beyond dollars, and encompasses effort, and various behavioral options, that the Miles Value relationship may provide a means to correlate Dr Edelman’s “value system”, “value criteria” and “value patterns” into a format that can be represented in relatively manageable terms. This is not to say that understanding how the mind works in relation to value is simple, but rather that understanding the relationships can improve the ability to investigate and analyze why people do what they do and how

they conceptualize.

Because each individual brain develops into a unique organ, its "value criteria" will be different, to various degrees, from that of any other individual. It is this difference in conceptualization and categorization that creates products, companies, systems, processes and other human developments that may contain elements of an individual's value criteria that may not represent the best value or the consensus value of a group.

The VM is predicated, in part, on the fact that value can only be determined by those who will pay for the function or expend the necessary resources to achieve the function. For instance, to "obtain education" requires an effort and involves a cost. A parent may be willing to spend the money to educate a child because it satisfies their value criteria, but the child must expend the effort. If the child does not perceive that the function (obtain education) is worth the effort (cost) then their value criteria does not coincide with that of the parent and the likelihood of success is diminished.

The function approach of the VM appears to provide a linguistic form of identifying activities, features, considerations, characteristics and objectives that can be related to value systems criteria and patterns of individual minds. Using the verb-noun technique in group sessions facilitates communication and provides a means to attain a consensus understanding as to the nature and purpose of any particular subject under consideration. It often facilitates the surfacing of an individual's "value criteria" relative to a specific condition or set of circumstances.

On a VM study of a military communications center, located in the secure area of a central USA military base, a VE team identified the function of a 3 ft. high planter wall that extended around the entire perimeter of the facility as "enhance appearance." The VE team developed an option that would achieve the function, but reduce the cost by \$250,000. When the VE team presented their proposal to the owner in the presence of the designer, the designer interjected that the VE team had incorrectly identified the function. The function, according to the designer was to "inhibit terrorists."

The owner was startled! The facility was located in a very secure area that did not require further protection from terrorists and no requirement had been presented to the designer to indicate that protection was needed. What happened though, was that the designer, who was aware of a general

concern about terrorist acts, took it upon himself to incorporate the "inhibit terrorist" function into the design. His "value criteria" said that this was good, but he failed to discuss it with anyone and with all of his good intentions, built in a \$250,000 unnecessary cost to achieve an unnecessary (according to the owner) function.

This is not a unique situation. It happens all the time. When functions are identified in such clear terms, and costs are associated with them, the owner (he who pays the bills) can readily understand what he is paying for and make a clear, sometimes easy, decision on whether that particular function is worth the cost.

What the VM does is arrange costs according to function, thus creating a clear value picture of certain elements of the project, product or process under consideration. This facilitates the evaluation of things based on the "value criteria" of the decision makers.

Further, this aspect of the VM brings to the surface the "value criteria" of those who are charged with carrying out a plan, a design, a management task, or whatever it is they undertake. If clear definition of the effort is provided at the beginning, then it would seem that everyone would understand the goal and stay on track.

It sounds like we're discussing communications. Perhaps we are. Let's look a little further.

### COGNITIVE SEMANTICS

Pig! Don't think about one, but of course, the image has already appeared in your mind. In all likelihood, almost everyone envisioned the same type of animal. But not everyone envisioned the same identical animal. You might have visualized a brown pig, a pink pig, a black pig, a big pig, a little pig, a wild pig or Porky the Pig. On the other hand, you might have also pictured a person ... , a policeman, an ugly person, a fat person or a slobbish person. Since there was no further description your mind brought forth its own unique image. And, even more complexing, the image might be different for an individual based on a specific point in time and circumstantial reference.

After a meeting is over, how many times have you discussed what was said with a few of your associates who were also there, and found that you each heard something a little different? I'll bet that most of you have experienced the phenomena more than once. What happened? It's relatively simple. Each person's brain processed the words that were spoken

in a different manner, according to the specific individual's conceptualization of the words and their combinations.

Languages have evolved from the minds of men. Yet, each individual interprets words and combinations of words differently. Communication is a complex concept. It spans a wide spectrum of human endeavor to impart information, of diverse nature, from one person or a group of persons to other persons. It can include an event, a situation, a concept or a feeling. It is accomplished through words (written or spoken), pictures, sounds, inflections, noises, experiences and gestures. Often the most effective method of communication involves several methods in combination.

Dr. Edelman relates the TNGS to the evolution and development of language. He also demonstrates the integral relationship between the biological functions of the total brain and its value systems to language. He challenges many of the formal views of language in favor of a cognitive model approach based, in part, on concepts suggested by G. Lakoff and related work.<sup>10</sup> According to Edelman, the Lakoff approach to grammar and semantics is consistent with biological and psychological facts encompassed by the TNGS.

The mind first conceptualizes a model. According to Edelman "the mind creates a propositional idealized cognitive model ... uses basic level concepts ... entities, actions, states, and properties. Simple propositions follow the part-whole schema: the proposition is the whole of which the predicate is one part and the arguments (agent, patient, experiences, instrument, location, and so on) are the other."<sup>11</sup> Then, when linguistic components are applied to the conceptual model, it becomes a "symbolic idealized cognitive model" (SICM). The SICM uses the specific language of a particular culture and is made up of central radial categories of words which include verbs and nouns. Non-central categories of words are then adjectives, abstract nouns (e.g., strength), prepositions and other words which are motivated by the central members.

### **FROM LANGUAGE BACK TO FUNCTION**

In the earliest development of language, sounds were used to identify objects (nouns). In a particular grouping of prehistoric humanoids, sounds were used to identify common objects such as "tree", "rock", "bear", "female." By agreement certain sounds became associated with specific physical objects. Next, came the verbs: "go tree"; "get rock"; "bring food." Then came the adjectives: "go big tree",

"get big rock" ... and that was just the beginning. However, if you also stop a second and think about it, doesn't that sound similar to how children develop their language skills today? Certainly. Nouns come first, then the verbs, then all the glitter.

Today, modern language systems are extremely complex. A simple statement of many years ago like "eat food" has evolved into something much more difficult, like: "I'm hungry for a one-pound, medium-rare, rib-eye steak, baked potato with all the trimmings, and a piece of apple pie."

While our evolved complex language systems are used as a major component of communication, all of its enhancements (glitter) often cloud the issues and the basics get lost. Lost, like a small piece of garlic in a bowl of spaghetti. You sense (taste) the influence, but may never see the source.

The function definition approach used by the VM, has a cleansing effect on our language and thinking. By forcing clear-cut "verb-noun" statements of purpose, need or action, the subjects of study, discussion or analysis are forced to a basic thinking level. In a team effort, this serves to get everyone on the same track, because the verb-noun function statements force cross-communication and consensus understanding. This represents a convergence of the different mapping systems of each unique brain. Understanding these basics then facilitates the understanding of the value systems that are involved and often a clarification of value criteria. In some cases such activity may even have an altering effect on the higher order value patterns of specific participants.

The "verb-noun" definition approach is consistent with the central radial categories of words which fit into the SICM and the total TNGS concept. The definition of "function" used in the VM, would appear to force the language into a mode that is consistent with the cognitive processes of the brain and bring whatever is being evaluated down to its very basic level.

It then follows, that everyone can look at the problem from its basic aspect (basic function) and then move forward to identify all of the other related functions being performed (secondary, all the time, etc.). Completely unnecessary functions often surface, such as the in the earlier example of "inhibit terrorist."

### **FROM FUNCTION TO FAST**

Functions arranged in a manner that will answer

the questions of How? Why? and When? result in what we typically call a Function Analysis System Technique (FAST) diagram. It appears, that the FAST diagram is a form of SICM which may mirror the mapping effect of the brain. It may, in fact, serve as a reentrant mapping mechanism or catalyst which improves understanding and sets the stage for creative activities and analysis.

Figure 1 represents a form of FAST diagram which was developed from a 30-page document which defined the business plan for a new chemical/polymer processing plant. This diagram allowed the entire document to be condensed to a single page. When it was developed in a VM team study environment, it helped everyone to clearly understand the project and its purpose. It put many things in perspective. When the diagram was presented to the steering committee who had developed the plan, they readily understood it and were amazed to see what they had composed put into such a simple, logical arrangement.

See next page for figure 1.

One unique aspect of FAST that has been picked up by the Japanese, is that the higher order functions define the purpose. Since they do not have a word equivalent to our "Why?", they use their best equivalent which is, "for what purpose"? As a result, the functions at the far left of the diagram (i.e., higher order functions) define the purpose.

### INTELLIGENCE

Over time, those of us who have taught Value seminars have observed that some individuals embrace the concepts rapidly and see them as a vehicle through which they can increase their ability to think, analyze products/projects and solve problems. Many have commented that learning the VM of Miles has helped them improve the way they perform their normal jobs. Several have even changed their profession.

Based on observations by Larry Miles, this author and others in the industry, it would appear that the impact of learning the VM increases in some relationship to intelligence. This was first formally proposed in several presentations in Korea<sup>12</sup> and Japan in 1991 and was published in the U.K. in 1992<sup>13</sup>. Figure 2 graphically indicates the suggested relationship.

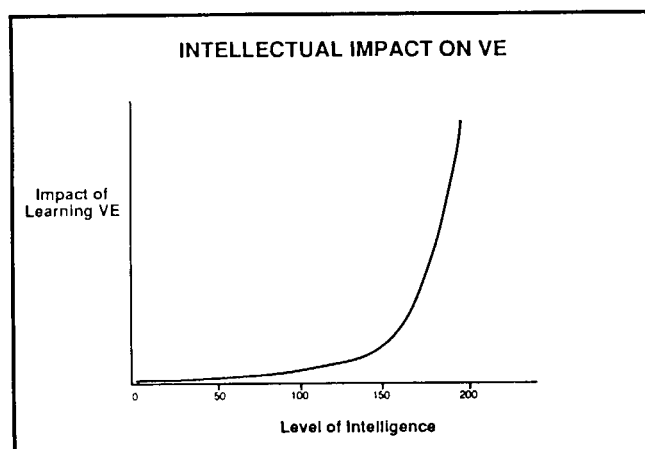


Figure 2. Impact of Learning VE

There is no empirical data to support this proposition, however the observations are not unique to American culture. In 1988 Dr. Takehiko Matsuda of the Sanno College of Japan, proposed that the VM is one important element that can be used to increase organizational intelligence.<sup>14</sup> In 1991, when the concept shown in Figure 2 was presented to representatives of Fuji Photo Film in Japan, Mr. Sadao Kawamura, the top VM specialist in the company, shared an alternative concept which he had evolved, which is represented in Figure 3.

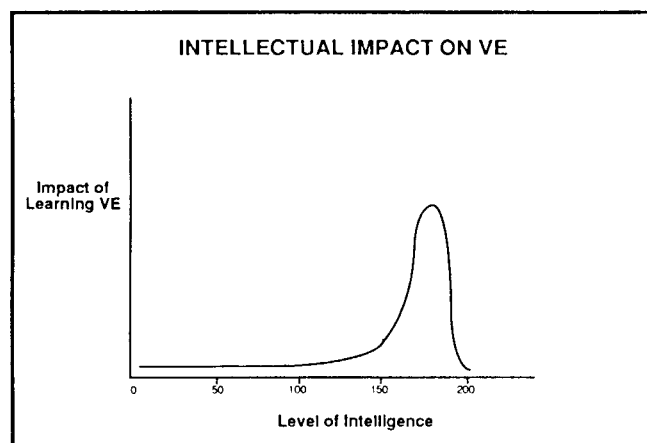


Figure 3. Kwamura Concept of Impact on Learning VE

It is interesting to note that until the 1991 American-Japanese interchange, there had been no prior cross-cultural communication of these concepts. The independent observations, in two drastically different cultures support the premise that there is

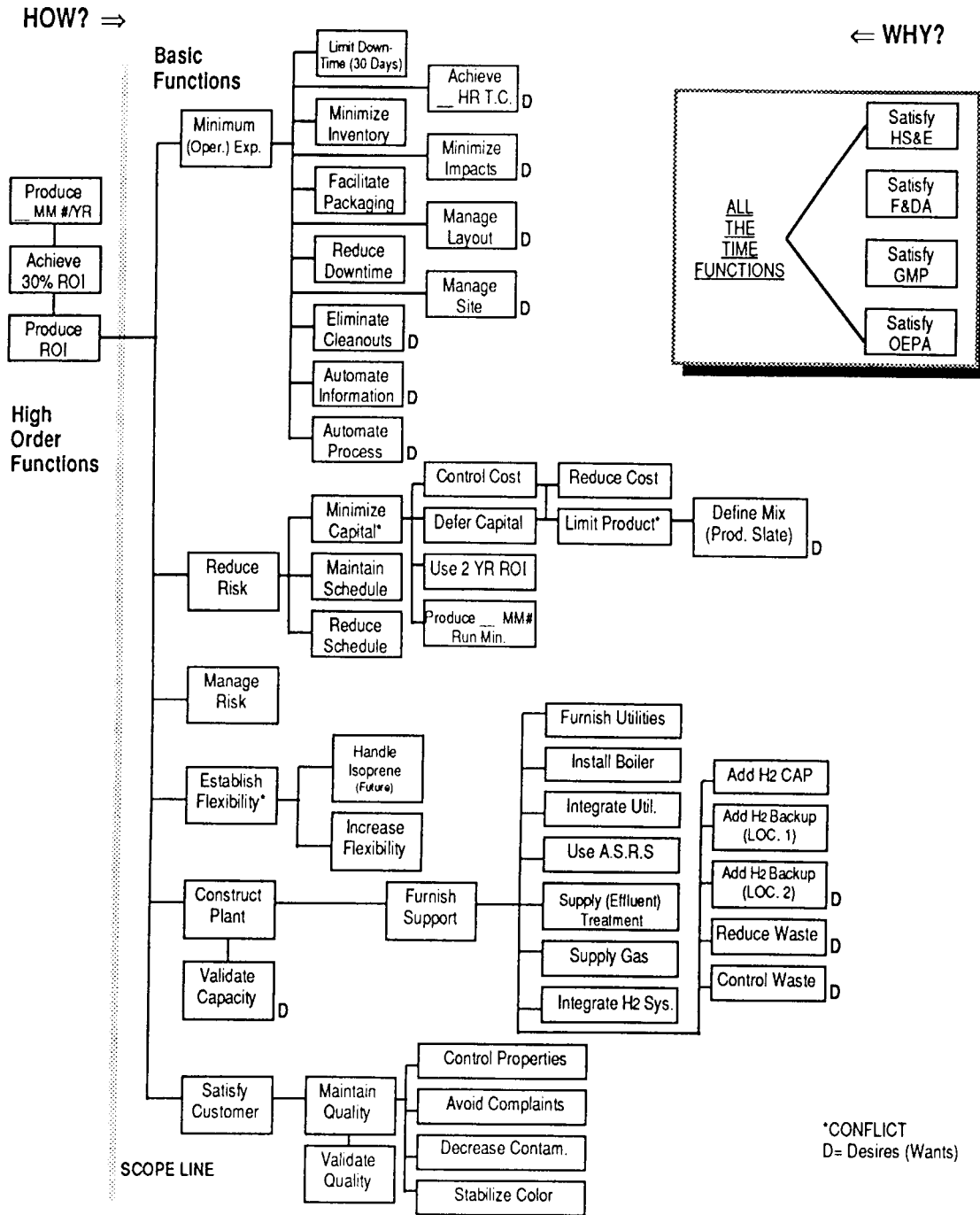


FIGURE 1: FAST DIAGRAM OF A PROJECT PREMISE

