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## Geometry of Knowledge Spaces: The Computational and Graphical Images of Knowledge

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### ABSTRACT

This paper extends the notion that the profile of knowledge is dynamic and oscillates continuously. It is derived/interpreted ceaselessly from information, experience, social interactions, Internet, etc. On an individual basis, the contours of knowledge thus derived are altered in numerous dimensions (as the user learns from the events in the society) thus altering its geometry. The dynamically updated knowledge blends onto concepts. The main theme of the paper includes time as a dimension in the knowledge space wherein nature, humans, and machines influence noun 'objects'. Further, in this paper, we also introduce a virtual object 'knowbula'. This word is derived as a merge of two words *knowledge* and *Nebula*. Mathematically, *knowbula* is a 3-D envelope of the all activities in any field of human endeavor, whatsoever. Such an assertion has three prerequisites: (a) that human activity deals with objects (real, abstract, virtual, or just about anything(s)), that bear coordinates in an more encompassing universal knowledge space, (b) objects relates to what they do, how they do what they do, or how they are affected by the actions of other objects, and (c) that there is time constraint (i.e., begin, middle and end identifiers) associated with such actions. Knowledge is thus contained in the *knowbula* and the change in the contour/image of this *knowbula* during/after the interval of activity: activity thus produces the incremental change of knowledge. Thus *knowbula* starts to become a three dimensional virtual object, with the (noun) objects (objective, subjective, or virtual) along the X-first, axis, the correlated (verb) functions or activity, (active, passive, or hypothetical) along the Y-second, axis and time along the Z-third, axis.



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## I. INTRODUCTION

Machines can distill what humans can conceive. The continuum of knowledge and concepts have prevailed since the human evolution. Signs and bits have been transmitted and received. More recently, data structures are assembled and enjoined, information is transmitted and received, but coherent bodies of knowledge are communicated as a well bounded modules. Socially, knowledge is the bond of civilization. It traverse the highway of thought that enjoins mind with mind, soul with soul, and compassion with love. In the 21<sup>st</sup> century, the widest gaps between the past, present and future are being linked through Internet knowledge bases in human civilizations and global internet-works. The basis of knowledge, human activity and high-speed networks form a triangle with the vertices spread far and wide around the globe if not nature itself. The foundation for the concepts deployed in this paper are presented in reference [1].

### 1.1 Noun Objects (NOs), Verb Functions (VFs), their Convolutions (\*) and Time (t)

The evolution of society is based on the systematic collection, validation, and deployment of gainful knowledge. Knowledge can range from gossip to well-guarded national secrets. Gossip and rumor which have little value are filtered out of the computational processes. On the other hand, knowledge that is rare or unique enters the computational domain to be examined, refined, and enhanced. Knowledge is collected systematically (from the Internet traffic), validated extensively (from the WWW knowledge banks), and deployed widely (from the dictionary of axioms available from the WWW wisdom bases). The true wealth of knowledge (if there is any) is thus evaluated rather than the raw format of knowledge in which it was presented. Knowledge processing becomes a precursor to the enrichment of knowledge or the distilling of wisdom.

In a symbolic sense, knowledge has two major components (*a*) the embedded “objects” around which knowledge is gathered and (*b*) the process that such objects have undergone to modify the knowledge around and about such objects. If there are attributes assigned to such objects, then such attributes needed to be measured, documented and/assigned. Hence, any object forms a nucleus of some knowledge around it. Nothing

without any history has no knowledge associated with it and nothingness of nothing is no attribute. However, in the more positive sense, every object has some history about it and some attribute(s) to go with it.

Knowledge is inclusive of objects around which knowledge is gathered. If objects are classified as nouns, then such objects undergo change by the verbs operating on and around the objects. Invariably, a verb causes a change in the status of a noun object and corresponds to a *kopc* (a knowledge operation code executable by a knowledge machine) executed on a *kopr* (a knowledge operand stored by the knowledge module). The combination of *kopc* and *kopr* in unison in a knowledge machine perform the function of *opc* (operation code) and *opr* (operand) combination as the assembly level instruction in a plain old computer.

In a sense, a sentence that is a part of any textual message in any language has at least one verb and one noun. Traditionally most of the messages processed by the human mind enhance the knowledge or understanding in the context (vectorial direction) in which the message is perceived. In the same vein, every executable statement of a knowledge program needs at least one *kopc* and one *kopr*. Multiple *kopcs* and *koprs* format structure for command structures of knowledge processors are discussed in Reference [1]. Invariably certain duration of time is essential for the verb function (force) to complete any change in the status of the object. If the extent of change thus accomplished is  $\Delta(S)$  in  $\Delta(t)$  seconds, then the symbolic representation of the incremental change of status is as follows:

$$\Delta(\text{Status of a noun object}) = (\text{Intensity of the verb function}) \cdot \Delta(t)$$
$$\Delta S = \text{Intensity of force (in the verb function)} \cdot \Delta t$$

An object undergoes a change in its status ( $\Delta S$ ) depending on the intensity of verb function exerting a force over an interval ( $\Delta t$ ) of time [1].

If status (energy) is considered as entropy in a particular discipline, then the change of energy is scalar product of force and displacement. The change of status ( $\Delta S$ ) of an object (i.e., the change of entropy for that object) is a vector in any given discipline and equals the intensity of verb function times the extent of change over an interval of time to

achieve the desired change. For example, if status is wealth, then the change of wealth equal the earning rate (i.e., \$/hr.) times wealth saved over the duration of the time worked.

In reality, such an interpretation becomes more complex in the knowledge domain. If status is knowledge of a learner in a particular discipline, then the change of knowledge is the scalar product of intensity (e.g., concentration of the learner dedicated to that subject equivalent to 'force') and the duration is study time. In such cases, concentration towards study should be considered as a vector in the direction of the discipline, and the knowledge gained is the scalar product of concentration towards study in that subject matter and the duration of time studied. The "object" is the learner; the "verb function" is the scalar product of concentration of the learner for that subject and the time spent. Once again if the concentration varies with time, then the scalar product becomes a time span integral of scalar products at any instant ' $t$ ' times  $dt$ .

The status (or entropy) of any one or a group of objects becomes akin the knowledge retained by a human being or a group. In a sense, when an object group is formed then the change of status of the combined knowledge undergoes change. Such changes can be slow and insidious or sudden and explosive depending on the intensity of the verb functions and nature of the noun objects.

In the knowledge machines, the object environments is tuned and optimized much like the adjustments of social groups in the society. The processing of objects within the knowledge machines thus leads to the optimality of performance and achievements of object groups. To this extent, the knowledge machine is capable of performing some preliminary managerial functions based on objects and their attributes.

There are at least three components of knowledge; (a) the information regarding a group of ' $n$ ' objects around which that knowledge is clustered and (b) the interrelationships within the group and (c) the status of each of the ' $n$ ' objects. Other secondary knowledge classified as (d) pertains to the relationships between the attributes of objects and attributes of the attributes also exist. It is unclear which of the components may

significantly change the character of the clustered group. However, a knowledge machine is well equipped to determine (by scanning the existing knowledge banks) which objects, their relationships, attributes and their relationships, attributes of attributes, and their relationship, etc.) had influenced the traits of the group. Such estimations may become necessary as the knowledge machine composes and recomposes new objects as it processes knowledge. Thus knowledge about anything can be written down as

- (a) The identification of 'n' objects in the group of 'anything(s)',
- (b) The status of each of the 'n' objects and the structural relations with other objects,
- (c) The status of each of the attributes, their relationships with objects, and their own interrelationships, and finally
- (d) The secondary relationships.

For developing a methodology for the machine representation of knowledge, if the list of the components is terminated at (b), then knowledge can be represented as an array of 'n' objects and a matrix of the status of each object. The matrix can become cumbersome because each object and have numerous attributes, and each object and/or each attribute (at any given instant of time) would have undergone a series of verb functions to change the status.

To be totally accurate the cumulative effect of each verb function from  $-\infty$  to now ( $t=t_1$ ) at this instant is necessary. However, simplification and standardization of objects can be deployed to write down the (b) components of the 'n' objects. For example, an 'object' car is a car with all the standard secondary objects/attributes (wheels, engine, steering wheel, etc.). If the application of this object is for transportation, the machine does not have to have any more information. But if need arises, the machine can look up the database of the particular make of the car and find its secondary attributes and the attributes of the attributes. A symbolic representation of knowledge can thus be written with two terms representing (a) and (b) constituents of knowledge as,

$$(\text{Knowledge})_{t_i} \equiv \sum_{i=1}^{i=n} (\text{Group of NO}_i) \text{..plus..} \int_{t=0}^{t=t_i} \sum_{j=1}^{j=v_i} (\text{Series of VF}_j) \cdot dt$$

This equation should be considered representational rather than mathematical. The symbol ..plus.. indicates that different natures of elements and verb functions (and how they interact), that are involved. The first term denotes ‘i’ noun objects (NO<sub>i</sub>) and the second term indicates the integrated effects of a series of ‘j’ verb functions (VF<sub>j</sub>) for each (i<sup>th</sup>) of the ‘n’ noun objects.

In the context of allocating memory to a body of knowledge (BOK), two linked arrays are necessary for (*a, the noun objects*) and (*b, the verb functions*). The matrix for (*b*) may have numeric, (integer, fixed point or floating point data), alphanumeric (to determine object identification), logical (linkage, types, and relational (with degree of influence), and/or qualitative (e.g., excellent, very good, good, acceptable, unacceptable, etc.). The storage allocation becomes an integral part of programming of knowledge based problems.



## 1.2 Machine Functions

Machines serve a two-fold purpose: they tracks the changes in objects, and they (if it is possible) extrapolate the circumstances for the change in objects to be desirable. Knowledge space of all times encompassing all civilizations is too vast even for the supercomputers. However, confined knowledge spaces have accrued over time and classified by the major subject classifiers such as the Dewey Decimal System (DDS) or the Library of Congress (LoC). It can be seen that the current Internet search techniques will create knowledge bases specific to any noun object or verb functions that are associated with any known noun object. Thus the DDS or LoC systems are initial mechanisms to enter into selected regions of the generic knowledge space, but the regions can be stretched far and wide depending on the whims and fancies of the knowledge worker in the modern information age.



Knowledge is contained in the *knowbula* and the change in the contour of this *knowbula* during the interval of human activity is indeed the incremental change of knowledge. Thus *knowbula* starts to become a three dimensional virtual object, with the (noun) objects (objective, subjective, or virtual) along the X-first, axis, the correlated (verb) functions (active, passive, or hypothetical) along the Y-second, axis and time along the Z-third, axis. The extreme limit for the volume of *knowbula* is infinite, and occurs when all the known objects from all the knowledge-bases around the world are placed along the X-axis, all the known and correlated verbs from the same knowledge bases are placed along the Y-axis, and an eternal chunk of time is allocated for the convolution of the verb functions with the noun objects. Inconceivable as it may sound, the convolution is indeed the evolution of the planet earth form an even more encompassing knowledge space of the Universe. However, by limiting the objects, verbs, and time, a human constraint can be enforced on the maximum volume of *knowbula*. The ratio of the volume a particular *knowbula* to its maximum volume is thus a indication of the success of that human activity in the particular society. We discuss the implications of this ratio in Section VII. When civilizations have their demise, the shape and volume of their particular *knowbula* gets frozen in time.

Future knowledge of the objects and its status is likely to be more structured, robust and coherent than past knowledge. The increasing role of computers and knowledge machines will assure the validity and precision of every fragment of information. The next generation of scientists will interject human creativity and intelligence into every concept conveyed by any body of knowledge ('bok'). Validity and accuracy are the main stays of science and mathematics and overlap with the broader overview of truth. Quick learning and predictive thinking are the main strengths of the new breed of knowledge workers. In synergy, humans and machine will offer structure and accuracy in knowledge that can now be viewed as a scientific entity.

Over the evolution of knowledge, scientists have not built 'social' machines and almost completely ignored 'elegance' systems. Engineers and scientists have ignored the disciplines that would have enforced human integrity and bondage. Perhaps such

machines could have instilled a sense of social justice and prevented wars based on deception and the corruption in political systems.

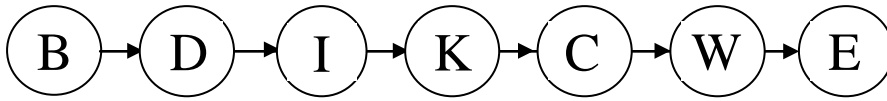
Based on current computational and network facilities, we can only address the question of validity and accuracy (or ‘truth’) in every sentence<sup>1</sup> in a paragraph, every paragraph in a page, every page in a chapter and every chapter in a book, every book in a discipline, and every discipline in the global classification of knowledge. Our ability to climb such a structured methodology in softer disciplines (such as arts and literature), declines rapidly. In the deepest folds of mechanization emerges the viability and the dependability of the CPU to execute every machine instruction with scientific validity and mathematical precision. Silicon chips and fiber highways do not respond to human whims and fancies as easily they can respond to clock cycles and binary bits.

The lack of ‘behavioral processors’ forces the social scientists to emulate the behavior on general purpose computers. Such an exercise is as naïve as grinding stones to get water. Yet such attempts are partially successful with extensive human-ware to clothe a bare silicon machine. Perhaps a general purpose computer with a silicon chips and behavioral code will generate the binary responses according to the intellectual rhythm of a human mind. It is not inconceivable that the firmware in control memories of such processors will carry the notions of Freud, Maslow, or Jung into the next generation of knowledge machines. Personalized behavioral machines stand a good chance to become neutered partners for humans as much as the spacecraft is for astronauts.

## **II. KNOWLEDGE LOOP AND ITS STABILITY**

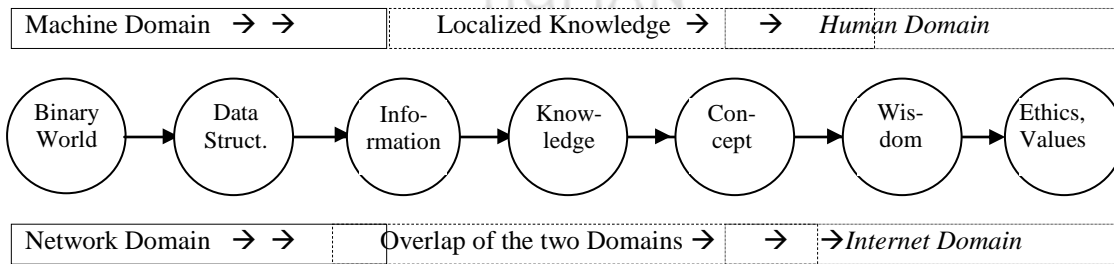
Formation of the profile of knowledge (K) is conceivable in the digital age by examining the “knowledge trail” shown in Figure 1a. The seven nodes indicate the “mind stops” in the thought processes and “procedure stops” in the computer processes. These artificial “stops” break the continuum that underlies both processes in the neural nets in human minds and in transistor imprints on silicon wafers. Both serve to integrate and enhance knowledge as depicted at the node K in the Figure 1a.





**Figure 1a** The forward movement of the B (binary), D (data and data structure), and I (information) nodes that result in the current status of the K (knowledge) node. Upon more human understanding and/or computer analysis, the K node leads to C (concept), W (wisdom) and the E (ethics and values) nodes. But these nodes are not stationary.

The feedback effects of the knowledge trail pursued by human activities in any society occurs through the environment or nature that sustains that society. In a sense, the trail becomes a loop, as depicted in Figure 1b, because the cumulative effects of the social, scientific, or the economic actions in a society come back to reward or haunt the society. The evolution of knowledge is a systematic process. From the computer science perspective, binary bits, data structures, and information are precursors to cogent, coherent, and consistent knowledge.



**Figure 1b** Partitioning of the Knowledge Trail into three domains to map to various tools to process the input at the nodes and the configuration of the Knowledge Trail.

In Figure 1a, the movement from left to right indicates the scientific processes that accompany processing of data in the routine computational environments at nodes B and D. The processing of information at node I, that leads to knowledge that is more universal but restrictive to the particular environment from where the data is derived. The processing of knowledge at the K node offers a concept that is more universal and

generic in most settings that are similar to the particular environment. The derivation of wisdom and ethics at the W and E nodes carries a social impact from one environmental settings to another. The trail of knowledge shown in Figures 1a and 1b becomes circular and loop shaped via human and social feedback into both (human and computational/network) processes. The dynamic nature of knowledge is thus reinforced by both. The enhancement of human and social processes/progression is greatly amplified by the transistor and fiber-optic process in Silicon in VLSI wafers and once again Silicon in Optical Fiber!

The knowledge loop shown in Figure 2, is defined as the K-loop, since the knowledge accumulated in the past plays a critical role (see Sections II to IV) in shaping the future. Over a long time, such loops can indeed alter (enhance, deteriorate, stabilize, destabilize, altercate, and/or even destroy) human nature and society/cultures.

The conceptual frame of the general theory of knowledge are presented in reference [1]. A node for Nature (N) was prefixed to the binary node and is shown in Figure 2. Three (TVB, SET and DAH) short-term destinations<sup>ii</sup> are feasible since human activity is influenced by the nature of wisdom that drives the humans and the machines that process the inputs to the D, I, K, C, W and E nodes. In essence, humans and their machines are seriously impacted by the motivations and objectives of the activities that are pursued.

The circulation of NO's and VF's along the knowledge trail over sustained long periods of time are depicted in this Figure. The three orientations of wisdom are pulled out to the left, even though their individualized effects become apparent at every microscopic movement (every arrowhead) in the Figure. In a computational environment, the stabilizing, neutral, or the destabilizing effects of the feedback processes involved can be tracked accurately and incremental effect of each social attitude can be traced. Similar approaches in econometrics offer a precise picture of every financial and social policy in a nation.

In the long-run, the cumulative activities (verb functions) of nature, humans and machines tend to stabilize or destabilize the environment that hosts the societies. This

effect is authenticated by the historic rise and fall of most civilization. In the recent human endeavors, nature has become a means to a (good, neutral, or evil) end. The harmony between humans and nature had prevailed in the Eskimo society while the Portuguese and British were trading slaves and waging wars. Over time, nature thus gets regenerated, depleted or even get destroyed due to cyclic feedback effects of human endeavors. Global warming is indeed, a retaliation of Nature against human exploitation of Nature itself that has led to the evolution of the species.

### III. CONTINUITY OF KNOWLEDGE

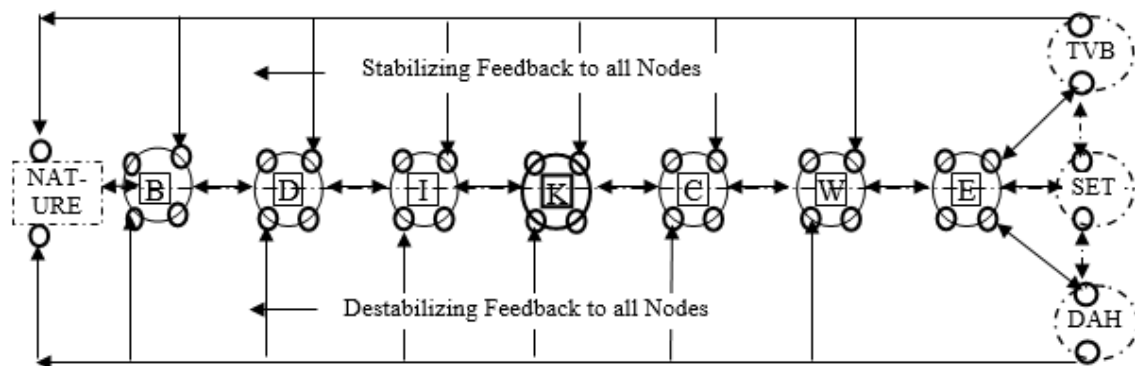
Knowledge is a dynamic entity. Nature, humans and machines continuously mould the size, shape and alter the entropy of knowledge. Like an image on the retina, the entropy of knowledge is a virtual object in the neural space. Machines processes overwhelm human efforts in tracking such rapid changes in the entropy of knowledge in any given subject matter or classification. When the knowledge trail is automated (by knowledge and wisdom machines), any significant change at the K, C, W, and E nodes (Figure 1a and 1b) will update entropy and be specific and precise about the changes and their causes, their deviations and their derivatives.

Such accuracy is captured by re-plotting the K-loop (Figure 3) for each discipline or subject into a Lamniscate<sup>iii</sup> (Figure 3) with two focal points. Conceptually, the two focal points are the CPU processes and the KPU processes. Each of the two sets of processes has a “multiplier” effect on the other. The locus of the point that traces the Lamniscate is that the product of the distance from each focus is constant. When the CPU and the KPU processes are constructive and balances, the Lamniscate assumes its preferred shape. When the two processes get uncoupled the product (and hence, the spread of the locus) can be oscillatory between infinitely large numbers.

Nature provides numerous instances where such balances have been successfully reached for many thousands of years. The life cycles of fig-wasp and fig tree; and the survival of leaf-cutter ant colonies and plants both have mutually beneficial dependencies. These cycles of stability (involving strong mutually beneficial relationships) have existed for

millennia before human societies evolved. The methodology proposed in this paper is to find the fine balance between modern societies (that depend extensively on binary data, data-structures and the infrastructure of computers and networks) and human wisdom (that depends on well founded ethics) with Nature as an integral part of survival.

Computational processes and conceptual processes (within the framework of knowledge processes) get intertwined in the modern society, such that every computational processes has a conceptual process as a counterpart (to conceive and predict it). Conversely, every conceptual processes has a computational process as a counterpart (to confirm and validate it). Knowledge serves as a fulcrum to balance the two processes.



**NOTE:** N- Nature or Environment that hosts a society, B- Binary Data, D- Data Structures, I- Information, K- Knowledge, C- Concepts, W- Wisdom, E- Ethics and Values in the society. TVB represents truth, virtue and beauty. DAH represents deception, arrogance and hate. SET represents science, economics and technology that can be deployed in both the TVB or DAH environments. In some cases the inter-nodal feedback is also dominant. The effect can that of a multiplier (from traditional macroeconomics). Such “multipliers” can accelerate or decelerate the feedback processes. By suitable control on the magnitude and direction of the feedback (generally by a well-intentioned News media), the characteristics of a tapped delay line filter (from traditional filter theory [2]) can be imposed on maximizing the desirable effects on the society. Conversely, the undesirable effects can be minimized.

**Figure 2** The framework for truth, virtue and beauty (TVB) are ingrained in most societies if the environment is self-preserving, beneficial and natural. The cycle is completed from nature that gives rise to the environment from where the knowledge-cycle exists in the society that is hosted by the nature, thus providing a feedback signal for stability of the loop. In Nature, numerous examples exist. The life cycles of fig-wasp and fig tree; and ants and plants both have mutually beneficial dependencies. These cycles of stability (involving strong mutually beneficial relationships) have existed for millennia before human societies evolved.

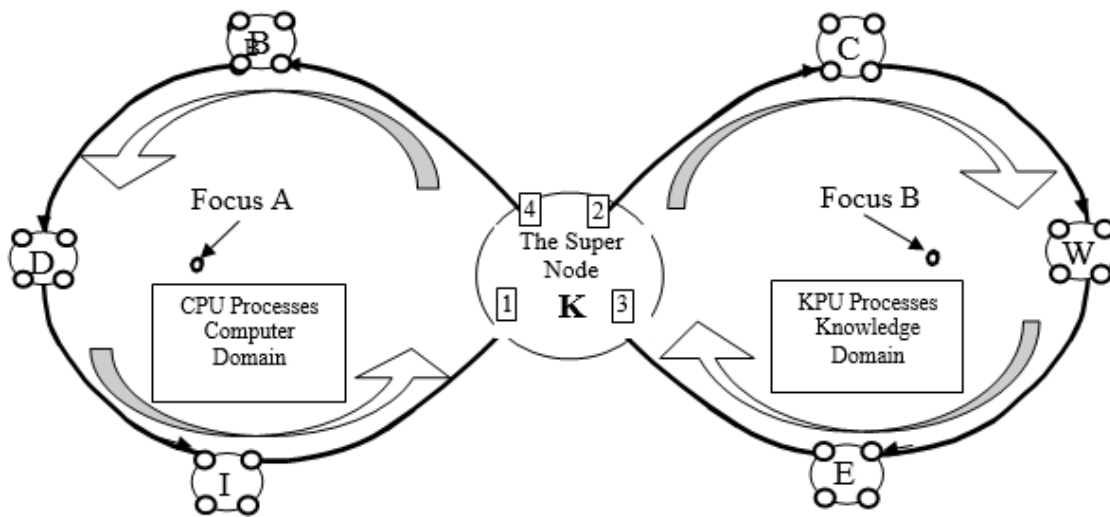
The representation of the trial can be enhanced dramatically to incorporate the impact of science and technology over the centuries. In order to depict the movement over the

decades, six zones between B and E nodes are shown in Figure 3. The rules for localized navigation through these zones depends on the (TVB, SET or DAH) orientation of the wisdom. For example, the manipulation of bits at the B and D nodes for deception of information contradicts the laws for enhancing the objects for truth at the I and K nodes, and so on.

Knowledge plays a crucial key role in the economic cycles in societies, social cycles in nations, national and political cycles in world, and power and control cycles around the globe. This aspect is explored further in the following Sections. Computer Processes are CPU-based and Knowledge Machine or KM Processes are KPU-based. The Super Node K serves as the union space between CPU and KPU group of processes.

#### **IV. THREE ORIENTATIONS OF WISDOM**

Knowledge precedes wisdom. The past wisdom permeates the current knowledge. A constant and irresistible flow of time is implied. The cycle is pervasive. Knowledge being more abundant forms the foundation for wisdom and wisdom determines the shape and entropy of future knowledge. In studying the prior societies, wisdom can have infinite variations, but three orientations are discernable. Three right lobes of the knowledge loop on in Figure 3 correspond to the three (TVB truth, virtue and beauty; SET, sciences, economics, and technology; and DAH, deception, arrogance, and hate) orientations of wisdom presented in Reference [1]. The forward paths from Node - I or Information penetrates the K or knowledge node and yields concepts that are oriented toward TVB (based on DDS 000-300), SET (based on DDS 500 and 600) or DAH (no DDS numeric assignments). In addition, the K-node plays a crucial role in all cases since it is penetrated twice and exited twice during the routine human activity in almost all computational and conceptual domains.



**Figure 3** The rearrangement of the BDIKCWE chain as BDIK1-K2CWEK3-K4B loop which is continuous in the current knowledge society. The focus of this (regenerative) loop is the knowledge node. The directionalities of movement K1-K2 and K3-K4 are important if the effect of time is to be considered. The cycle time for this loop can be a few hours or minutes (as in the stock-market environments) or it could be centuries (as in the Chinese and Buddhist cultures).

It is evident that there are infinite locations for the right side lobe in Figure 4. In fact, the lobe can have as many variation as humans can conceive what the orientation of wisdom can be or should be. In order to simplify the machine processes, we can broadly align the TVB, DAH and SAT orientations on three radial lines  $\theta = +60^\circ, -60^\circ$  and  $0^\circ$ . Human nature being variable can make the alignments swing incrementally or dramatically over time. For instances, events in society (such as wars, economic booms and busts, successes and failures, etc.) can alter the human psyche. Events in nature (such as calamities, epidemics, droughts, etc.,) can alter the social norms.

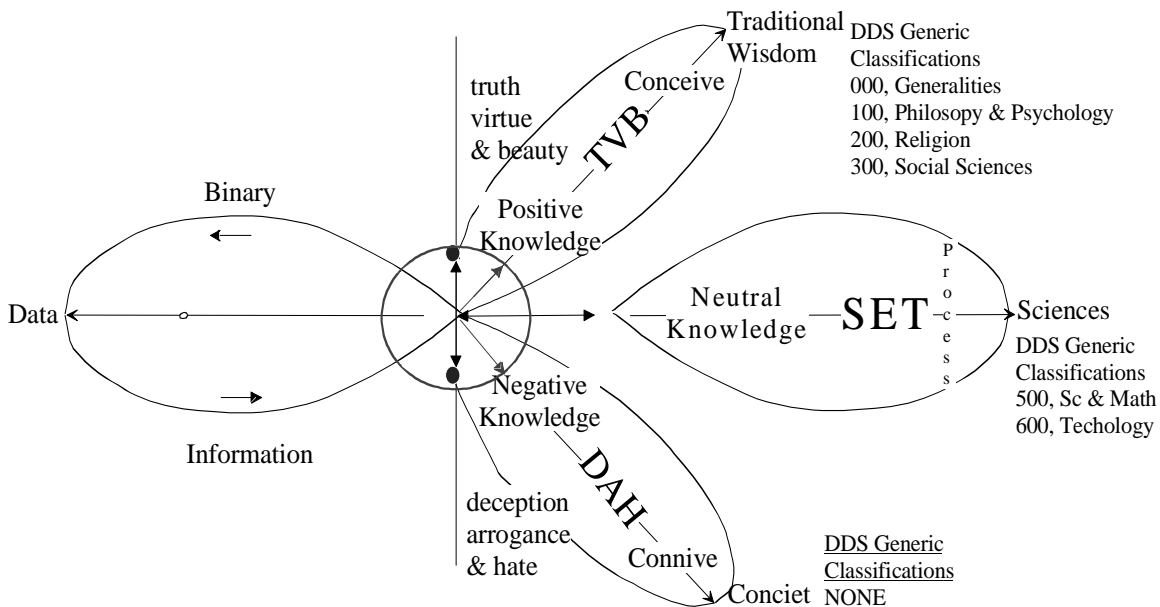
**V. LONG-TERM MOVEMENTS WITHIN THE K-LOOP**

Over the short term and during the routine activities within a social environment, the movement of societies along the K-loop is small and well articulated. In fact, it could be a so minuscule that it is hardly noticeable at a KB level. However, protracted effort in the

society leave an impact behind. For example, the research at NASA is more appropriately by a K-loop depicted by Figure 4 than by Figure 2.

Space science has a well defined beginning at the START node and has not yet reached the FINISH node. But it is likely that it will reach its end. The routine activities in a typical society are confined to the BDI (K1-K2) CWE (K3-K4 )B loop. This scenario is depicted in Figure 5. The movement of the knowledge loop from the N (Nature) node to the positive wisdom of TVB, occurs rarely in societies. The entry point is the B node. The final breakaway point occurs from the E node. Major shifts to break from routine are quite rare and bring about pretty drastic changes to the social norms. During this phase, the entire value system is scrutinized and changed for the better.

Typical examples from the recent history are the French Revolution and the Abolition of Slavery and Equal Right Amendments in US. Though the computer systems have evolved recently, the human estimation of the overall effects of drastic changes (such as the French Revolution, Antislavery, Equal Rights, etc.) has preceded any computer models. Other changes in society have also occurred due to natural events such as tsunamis, earthquakes, and ice ages. Such natural events leave a trail of knowledge behind.





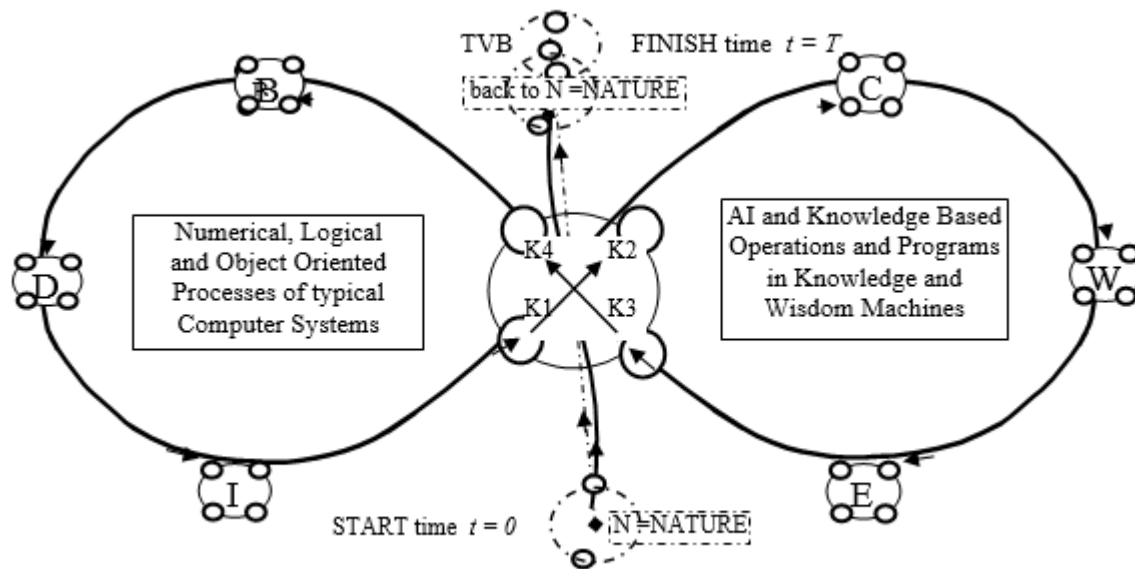
**Figure 4 Three lobes of the knowledge loop (or the orientations of wisdom) are shown in the right side and correspond to the three (TVB truth, virtue and beauty; SET, sciences, economics, and technology; and DAH, deception, arrogance, and hate) orientations of wisdom presented in Section IV. The forward paths from I or Information node penetrates the K or knowledge node and becomes the concepts oriented toward TVB, SET or DAH.**

#### **IV. CONFLICTIVE ROLES OF TVB AND DAH ORIENTATIONS**

Sustained social attitude leaning towards either side can be more easily tracked by machines rather than by human beings. The moving window average of collective record of achievements that favor one orientation over the other will indicate the trends and shifts.

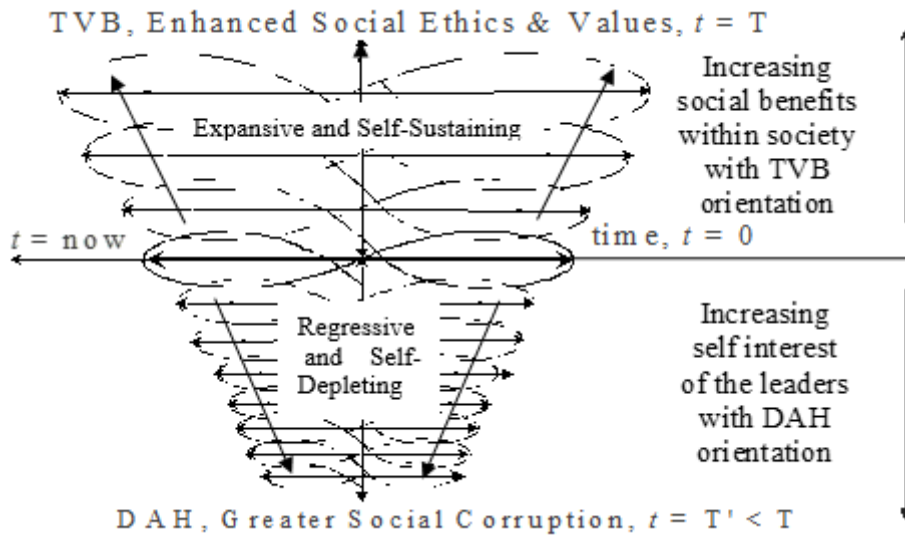
Such an approach is adapted in economic studies to determine the stock market trends, public confidence, social preferences, etc. Social accounting of this nature becomes crucial in bring about the desirable change and blocking the undesirable change in small and large societies. In enhancing the progress of the society, ethics and value systems will not be sacrificed by the machines. Over any given duration, the group velocity of indicators along the forward path in Figures 1a and 1b will achieve the desired goals of a society or of a nation.

Human nature can be volatile, ranging from the saintly to the savage. In a more controlled social environment truth becomes science, virtue becomes generosity, and elegance becomes art. Conversely, in such an environment, deception becomes politics, arrogance become intolerance, and hate becomes war. Fortunately, moderation prevails. And the society offers a tolerable refuge for most human beings. The conflict between these two extremes of orientation do exist and machines that “sense” the insidious movements of the K-loops will “respond” in an intelligent and stabilizing fashion.



**Figure 5** The movement of the knowledge loop from the N (Nature) node (Figure 2) to the Positive wisdom of TVB, twice through the K or Knowledge node. The entry point is the B node. The final breakaway point occurs from the E node. Major shifts to break from routine {BDI (K1-K2 ) CWE (K3-K4 )B} loop occur rarely in the society. During this phase, the entire value system is scrutinized and changed for the better. Two example from the recent history are deliberations in preparing the US constitution and the abolition of slavery in US.

Figure 6 depicts the continuous movements through the knowledge loops and include the effect of time. The K-loops lie in a plane perpendicular to the plane of the paper. These loops though not plotted and tracked, do prevail in societies. For example, King’s efforts to bring about social justice, the scientific efforts to expand and stabilize Internet, the Federal efforts to curtail sex offenders, fall in the upper half of this figure.



**Figure 6** The two (TVB and DAH) opposite orientations of wisdom and their insidious role in enhancing (upper K-loops) or depleting (lower K-loops) the society are shown. The TVB orientation brings about social benefits and the DAH orientation serves the self interests of the leaders. In this Figure the time axis is the vertical axis and is in the plane of the paper. Each of the K-loops are in a plane perpendicular to the plane of the paper.

By the same token, Nixon's Watergate Scandal and his efforts to cover up, Clinton's impeachment for lying, Bush's deception about weapons of mass destruction (WMD) and Bush's invasion of Iraq are a few examples that point to the insidious social tendencies that can creep up in any healthy society thus bringing down the values in well established societies and cultures.

## VII. TRACKING OF THE K-LOOPS

The movement between the numerous K-loops shown in Figure 6 is also a continuous process in society. In some cases, the shift between one K-loop to the adjoining loop is gradual process and follows an orderly legal process (e.g., the constitutional amendment to abolish slavery). In other cases, it could be chaotic (e.g., a natural calamity) and sudden event. When the shift is an orderly process, then discontent of the society with the ethics and wisdom in the current loop (e.g., the current corporate scandals in the greed

for wealth, or the injustices delivered to the black community during the mid-19<sup>th</sup> century), will provide a window to explore higher goals and aspirations for the society. Two variations exist; the loop can (incrementally) move up or move down. Its movement is presented in Sections 7.1 and 7.2.

### **7.1 Expansionary Upward Movement (TVB)**

In the expansive mode, the passage from level 1 and level 2 is depicted in Figure 7. Since the feedback path has an enhancement of the values for the society in an environment or nature that supports the society, the society perpetuates the nature that hosts the society and vice versa.

This symbiosis between society and nature assures continued growth of values system and level 2, knowledge loop (K-loop) will be stronger and more stable than level 1, K-loop. Over time this symbiotic growth continues till the DAH orientation of wisdom corrupts the society, nation, or culture and the K-loop starts moving downwards. Like wealth of nations, knowledge and wisdom also experiences cycles of expansion and contractions. Bankruptcy of knowledge based on truth virtue and beauty is the abundance of deception, arrogance and hate that is written in the dark pages of history. Despite the negative pressures, peace and prosperity has prevailed many times in many cultures.

### **7.2 Recessive Downward Movement (DAH)**

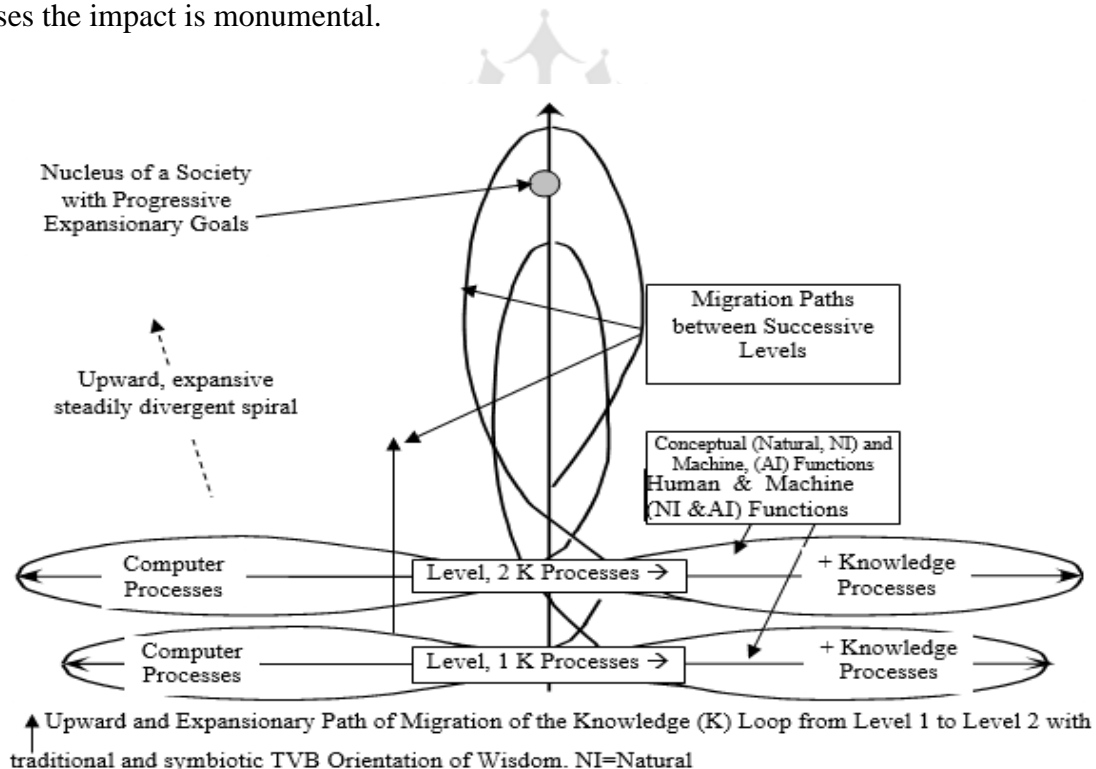
In the recessive mode, the feedback path of the K-loop drains the society of its moral and ethical values. In a very deceptive way, the downward migration, shown in Figure 8 depletes the society in its own environment or Nature that supports the society, and the society in turn depletes the Nature that hosts the society.

This destructive relation between society and nature soon depletes the respect and integrity of the social system and level 2 knowledge loop will be weaker and less stable than level 1 K-loop. The DAH orientation corrupts the society, nation, or culture as the K-loop starts moving downwards.

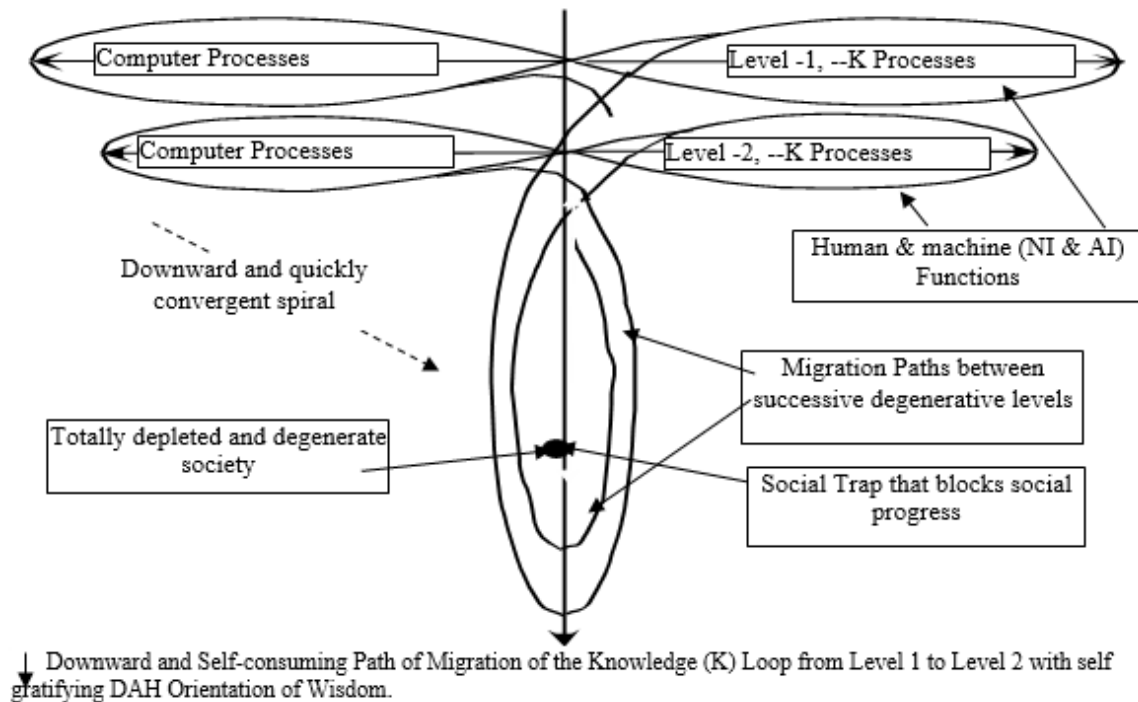
Over time this mutually destructive relation continues till the society is morally bankrupt. The nature runs into environmental disasters such as global warming and depletion of the Ozone layer. Like wealth of nations, knowledge and wisdom also experiences cycles of expansion and contractions. Indulgence in DAH orientation is the bankruptcy of accumulated knowledge based on truth virtue and beauty. Death and destruction of societies have occurred many times in the dark pages in the history of human civilizations.

### VIII. DETAILS OF THE UPWARD MIGRATION

The bounds, frontiers and the entropy of any body of knowledge (*bok*) are dynamic and volatile. Every act of nature, humans, or the processes of the machine modifies some aspect of knowledge. Like the ocean, knowledge has a profile. Ripples and waves persist. In a vast majority of cases, the microscopic contour is unimportant, but in some cases the impact is monumental.



**Figure 7 Migration between Level -1 of the knowledge loop to the next higher loops based on truth, virtue and beauty (benevolence).**



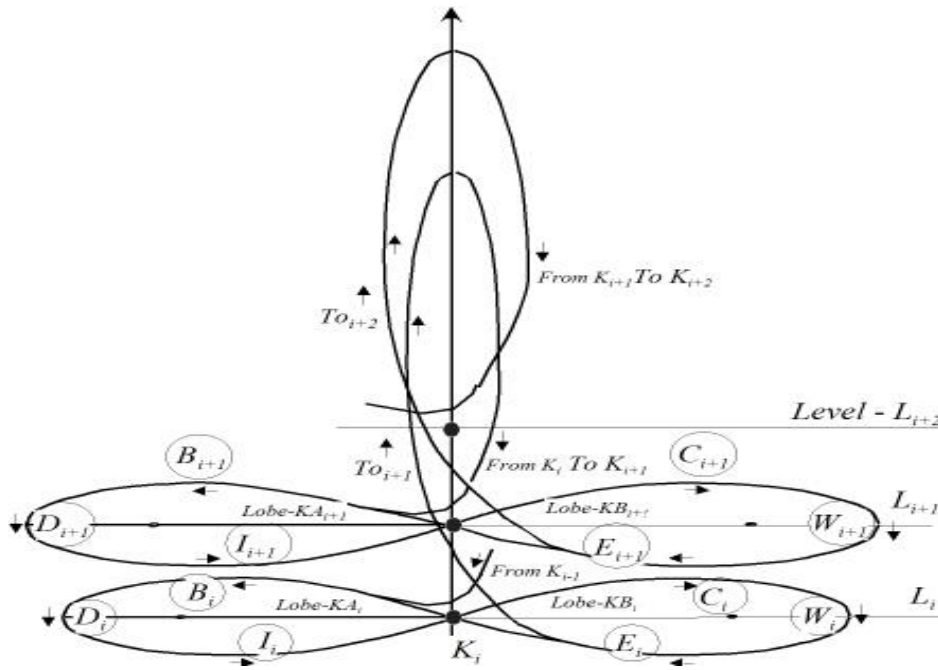
**Figure 8 Migration between Level -1 to Level -2 of the knowledge loop to the next lower loops based on deception, arrogance (aggression) and hate.**

On the upward movement of the K-loops, a relatively simple statement such as the ratio of the circumference of a circle to its diameter gives rise to  $\pi$  whose value is held fixed has profound implications in mathematics or  $P = E \times H$ , is extremely significant in all electromagnetic field propagation, etc. Other less important and profound manipulations of knowledge occur on a continuous basis. When the contour of knowledge is shifted up, the sense of truth, social benevolence or the elegance gets reinforced. Human beings themselves (e.g., those in the judicial system) make it impossible for hypocrisy to survive, political and corporate leaders to cover up, and criminals to be pardoned (e.g., Clinton's series of end-of-term pardons, pardon for Nixon as he was forced out of Presidency, etc.).

When the processing of knowledge becomes as common as the processing of data, machines will sense and track the illegalities early and block the spread of rampant political and corporate crime. Sex offenders, drug and porno dealers will be stopped before any crimes occur and long before crime becomes a way of life.

### IX. DETAILS OF THE DOWNWARD MIGRATION

On the downward movement of the K-loops, the process gets reversed. The illegitimate and unethical manipulation of knowledge has profound effects. When the information networks and mass media can carry falsified and corrupted facts (e.g., Bush’s assertion about the weapons of mass destruction during the early 21<sup>st</sup> Century, Nixon’s Watergate cover up, Clinton’s continued denial about the Lewinsky affair, etc.), the media becomes a weapon of mass deception for the public. In a sense, the knowledge machines assure the authenticity of information and force a dead end to hypocrisy and cover up that follows to protect those in power.



**Figure 9 Migration between Level  $L_i$  of the knowledge loop to the next higher loops  $L_{i+1}$ , and  $L_{i+2}$ , based on TVB orientation of wisdom. All the nodes along the Knowledge (K) loop are shown. The path starts from the K node  $K_{i-1}$  at Level (i-1) and trace a K-loop at the  $i^{th}$  Level. Most of the routine social functions occur in traversing the K-loop at any of three levels shown. At the inception of a major change in the society (such as a knowledge revolution, freedom of the nation, space-**

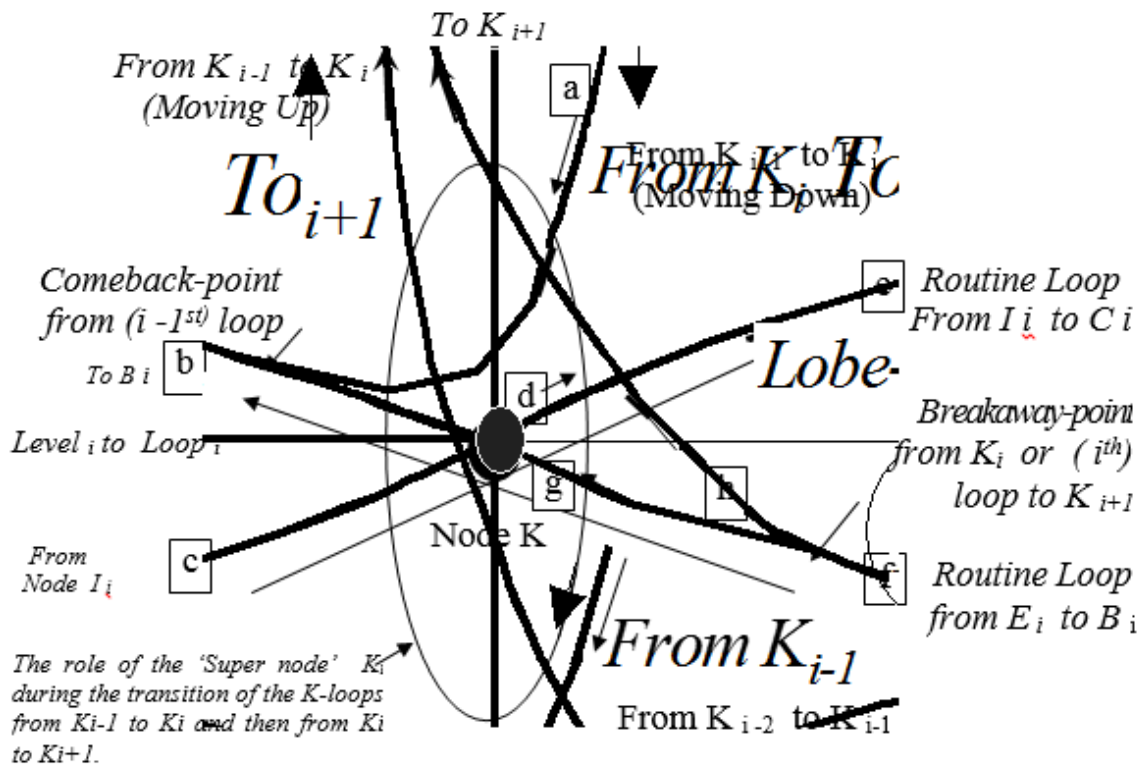


travel, etc.), the path shifts from level  $L_{i-1}$  and moves up to the K-node  $K_i$ . The same process repeats at the  $i^{\text{th}}$  Level to continue the movement to  $K_{i+1}$  node.

The movement from K-loop to a higher level is a well-planned procedure. Much as in a surgical process, the numerous steps collected, assembled, graphed and optimized. A series these steps are depicted in Figure 8, and the migratory path can be smooth as the rationality in science, rather than the crimes in war. The entry into and exit from the loops at the K node is also elaborate. Bulk of human activity is inconsequential to the structure of knowledge during any given interval of time. The effect is portrayed in Figure 9 as the knowledge loop traverses its mundane path, i.e., f (from E-node) to g, a location in the K-node, to b (towards the B-node). The entire K-loop (i.e., BDIKCWEB, Figure 8), is thus uneventfully completed. When the major expansive or cataclysmic social events occur the entire loop is shifted up or down respectively. For the upward movement, the breakaway point to  $K_{i+1}$  from  $K_i$  loop occurs from the E node along the path 'k', and the comeback point from  $K_{i-1}$  loop to  $K_i$  loop occurs along the 'a' path. Thus only monumental events in society that mould the directions of future knowledge.

## X. KNOWLEDGE LOOPS IN X AND Y DIMENSIONS

Knowledge is a virtual entity. However, it is centered around (noun) objects of varying complexity that perform and experience (verb) functions and processes. Objects can be grouped as easily as processes can be programmed. Groups of objects undergoing sequences of valid and realistic processes constitute knowledge programs. The progression along the knowledge loop offers a methodology for building knowledge banks and axioms of wisdom that contribute to the progress of the society per se.



**Figure 10** Details of the movement at the “Super node K”. Routine Loop (bcdefgb, also see Figure 9) is shown. Break-in path from  $K_{i-1}$  and onto the routine loop is (a- bcdefgb), and Break-out path to  $K_{i+1}$  from  $K_i$  loop is (h – (abcdefgb)) of the (i+1) st loop.

The knowledge super node K, shown in Figure 10, has at least two entry and two exit points. Through each of these four points ( $K_1$  to  $K_4$  see), a whole array of related noun objects and a whole string of corresponding verb functions get (computationally) threaded. The circulation along the K-loop continues. In order to arrange an orderly passage through these point, the implicit noun objects (NO's) and their corresponding verb functions (VF's) can be aligned on two axes in a virtual plane (see Section 1.2). If such a virtual plane is shrunk to a point, then this Euclidian point traverses the knowledge loop. Totally disoriented and disordered human activity does not become a knowledge loop.

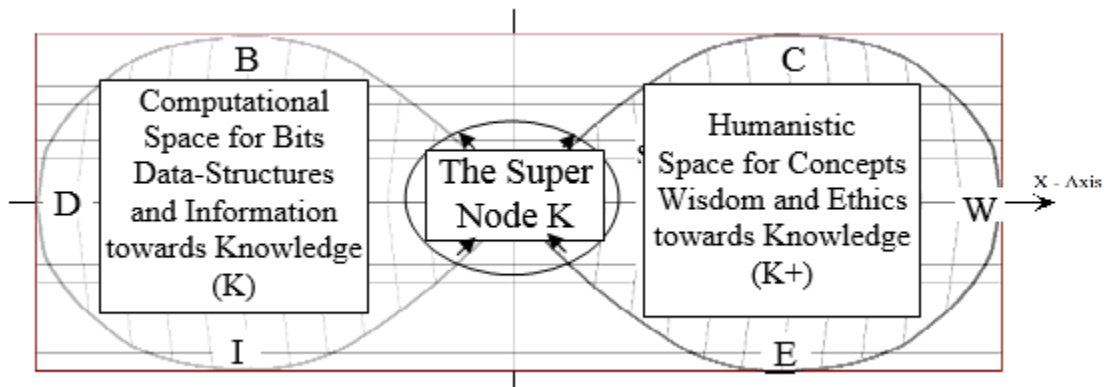
However, systematic, orderly and consistent effort brings about knowledge from information, concepts from knowledge, wisdom from concepts and then values and ethics to make the society richer and more civilized<sup>iv</sup>.

Historically, the knowledge loops are poorly organized. When integrated over decades, hundreds of such major loops (such as the inceptions, maturity, and decay and demise of major corporation, social programs, institutions, etc.,) can be detected. A snapshot of an organized K-loop can now be projected on an XY plane by collapsing the NO's (as they pertain to any given discipline or any organized entity) on the X-axis and VF's on the Y-axis. The process is depicted in Figure 11.

The purpose of this representation of the K-loop will facilitate the design of the architecture of a knowledge plane and then a knowledge space. Ordered knowledge space will provide mathematical means to penetrate the zones of unknown knowledge coherently and cogently as it has become possible to penetrate the outer space coherently and cogently.

## **XI. FOUR PORTS OF SUPER NODE-K**

Positively cumulated knowledge loops in society provide a platform for forward social mobility for sustained growth. Such loops serve as catch basins to avoid a downward social drift that depletes the society. Social enhancement and regression are the two phases that are triggered by the use and abuse of current knowledge bases and the incessant turmoil within them. Whereas the deployment of knowledge bases (e.g., authenticated information bases of the Cancer Research Centers) is desirable, the deployment of knowledge bases (e.g., porno and prostitution Internet sites of sex abusers) with negative intent is deplorable.



**Figure 11 In routine instances, the activities of humans and machines are mapped as incremental movements within the BDIKCWEB loop. Traversing the K-loop alters the entropy of noun objects in the society during that interval of time. A time sequence is thus generated due to the execution of the processes (VF's) on the noun objects (NO's). A time series analysis depicts the migration of knowledge in the time domain.**

The two entry points to the K node from I and E nodes and the two exit points to C and B nodes are shown in Figure 11. The procedures at these four points need special protocol for the passage of appropriate information in and out this super node K. The I to C path via K needs to ascertain that the content and quality of the information from the I node is suitable for knowledge processing in the K node and output generated at the K node will be appropriate for the C node to examine the new concepts (if any) in the output.

The convolution of VF's and NO's (see Sections 1.1 and 1.2) has its effects on the knowledge trail (Figures 1a and 1b) is shown in Figure 12. The iterative movement along the trail along the loop becomes the constant incremental change in entropy. Major convolutions lead to new objects and notable inventions and innovations may thus be generated anywhere through this loop, but the overall continuity of the major disciplines is a relentless process through the ages.

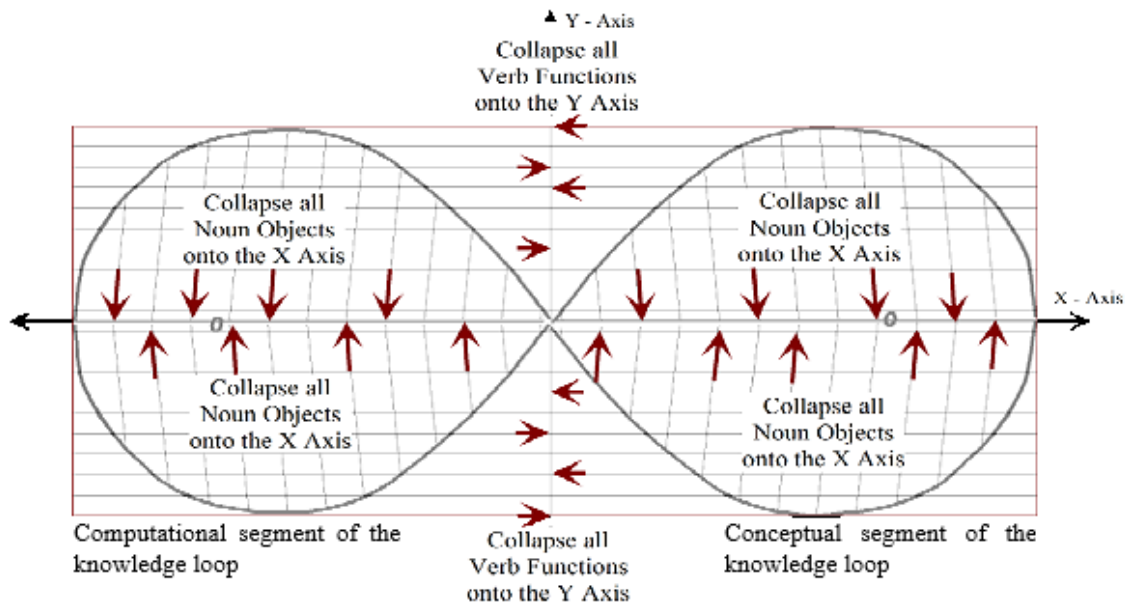
## **XII. CONSTRUCTION OF A KNOWLEDGE PLANE**

When the noun objects and verb function are collapsed in the X and Y dimensions, a plane of reference for knowledge starts to emerge. Two following discrete steps are necessary to construct the knowledge plane and presented in Sections 12.1 and 12.2.

### **12.1 Embedded NO's and VF's**

The source for such noun objects (NO's) and their associated verb functions (VF's) are embedded in the nodes of any knowledge or K- loop. The process is depicted in Figure 12. Whereas the current K-loop gives rise to NO's and VF's, the convolution between the two sets of NO's and VF's gives rise to new NO's and VF's appropriate to the context of the K-loop traversed. Properly navigated the K-loops occurring in nature, human mind, and KPU's provide the group velocity for NO's and VF's as they circulate through these loops to offer a stable and steady pace of social progress. Conversely, disorganized and jittery movements along the loop only results in noise in the knowledge that leads to confusion and chaos.

In computational environment, collapsing the noun objects and verb functions is routine data/object base operations/management function. The entire process simply consists of building two data/object oriented bases: 'X Noun Object Base' and 'Y Verb Fuction Base'. In practice, such object bases are routinely built in almost all application environments, such as patient, drug, procedure, physical therapy, etc., databases in medicine, or human resources, inventory, sales, revenue and profit, etc., databases in corporations.



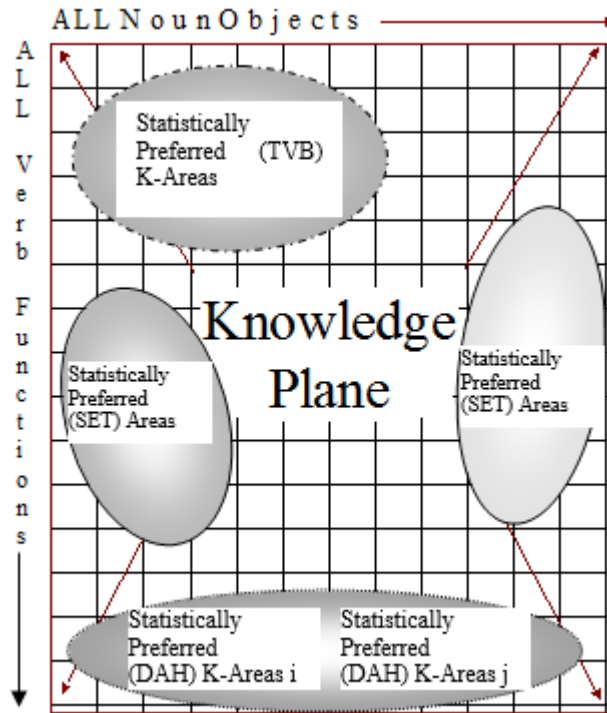
**Figure 12 Collapsing the noun objects (NO's) onto to X Axis and the verb function (VF's) onto the Y Axis to generate an interim 2-D plane for the knowledge loop.**

## 12.2 Primary K-Plane in XY Dimensions

The convolution of the NO's and VF's was introduced in Section 1.2. From the mathematical perspective of implementing the process, the NO's and VF's were arranged as a row and column of a matrix. From a computational perspective, we have considered the NO's and VF's as two data/object bases in Section 12.1. From a conceptual perspective, we construct a virtual knowledge plane of NO's (X-axis) and VF's (Y-axis) and depicted in Figure 13. Two major reasons for constructing the K-plane, are to accommodate (i) the threev orientations (tvb, set, and dah) of wisdom and (ii) the effect of time (T) that are instrumental in circulating NO's and VF's in the K-loop. The construction of the K-plane leads to the building of a XYT knowledge space, or to many four/five dimensional XYT-t/s; XYT-t/e, XYT-t/t, XYT-v/s, XYT-v/e, XYT-v/t, etc. spaces.

### XIII. KNOWLEDGE BASES IN PRIMARY K-PLANE

Knowledge has evolved randomly across cultures and civilizations. At the outset, evolution of knowledge appears as complex as the evolution of species. Rather than tracking the evolution of knowledge, it is more practical to track the NO's and VF's already evolved and embedded in existing knowledge bases (KB's). When the KB's are scanned based on the DDS or LoC classifications, the shadows of NO's and their associated VF's appear haphazardly on the knowledge plane (K-plane), as shown in Figure 14.

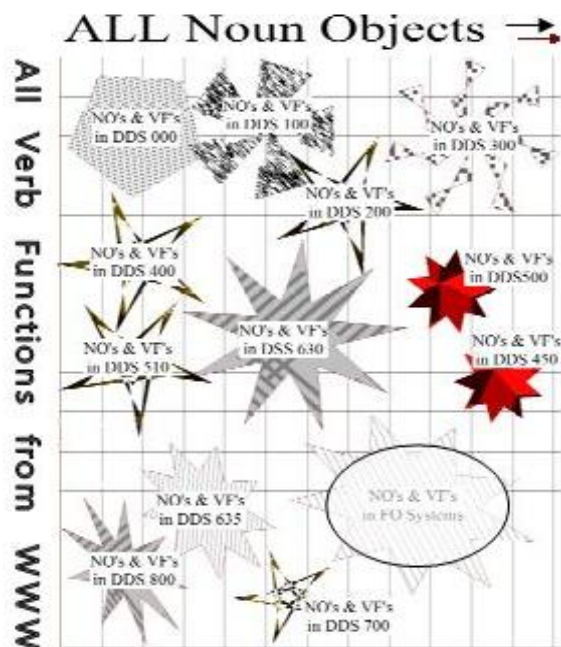


**Figure 13** The enlargement of the knowledge node to a knowledge plane to indicate that the entry the exit points can occupy different levels of knowledge in the node. The three paths (TVB, SET, and DAH) in the right side of the lobe (Figure 4) will alter the return path, thus providing an impact on the knowledge loop.

(TVB) Areas



In more recent sub-classification such as fiber optic communications, VLSI, cancer research, etc., the area projected on the K-plane becomes discernible and the data/object bases become manageable. In particular, when the NO's and VF's are limited to a specific time frame and/or from certain local/WWW geographical bases, the number of entries in the cache-bases becomes specific. The K-programs at the K-node perform specific tests to validate or repudiate any localized information in order to verify the truth, the virtue or the elegance in the newly found local noun objects/verb functions. This methodology is common to all generic topics, even if they are not classified by the DDS or the LOC numbering systems.



**Figure 14** Grouping of Noun Objects and Verb Functions that exist in the knowledge bases around the world for each of the Dewey Decimal System, DDS classifications. For example, all the NO's and VF's that exist only for fiber optic communication systems are grouped in a FO knowledge base and become a subset of the DDS classification 621.3. When the verb functions in FO (e.g., Raman Effects ) overlap with the noun objects in other groups (e.g., theoretical and mathematical physics, with a DDS classification of 530.1), then forward and backward linkages provide the web of knowledge with commonalities of NO's and VF's as they have been studied in the past.

#### **XIV. SUCCESSIVE K-LOOPS IN T (TIME) DIMENSION**

Much as space and time form an incessant bond, knowledge, its spatial coordinates and the instant for the change in entropy constitute an incessant spinning triple helix. The (XY-) space and (T-) time coordinates are firmly connected by the information highways on the Internet. However, barring the noise in knowledge, major historic knowledge events have well defined coordinates. For example, the US Constitution, the Bill of Rights, Marshall's marginal utility theory, Maxwell's Equations, Einstein's  $E=mc^2$ , etc. all have definite knowledge (i.e., DDS, LoC), geographical location and time coordinates as well as the (XY-) space and (T-) time coordinates. Events within the society also occur in the hyper-dimensional knowledge space. Mapping the movement of noun objects along the K-loop thus becomes conformal in the 'object-space' of a knowledge machine (KM).

##### **14.1 Stacking of K-Loops**

In order to build knowledge space, if the numerous K-loops in any definite discipline are stacked in the plane of the paper, and the time is orthogonal to the K-loops, then a 3-D virtual book with XYT dimensions can be envisioned. The structure of such a 3-D knowledge space is shown in Figure 15. All the NO's and VF's at any instant of time fall along the K-loops. In scientific and idealized settings, the migration from one loop to the next loop occurs as a well designed transition as shown in Figure 10, but it can also be disorderly and chaotic driven by natural calamities, or by acts of war and vengeance of humans.

In the past, the transition of knowledge from one generation to the next have not been smooth. The major monuments of knowledge (K-loops) of many civilizations have been squandered, disjoined, disintegrated, and in some cases lost forever. With the tools and techniques of modern information age, an orderly XYT coordinate system will prevent such knowledge disasters. More than that, the progress of any civilization that has been frozen in time can be recovered and reshaped the modern or future times. When the three coordinates are combined to generate a knowledge space, the idealized cube of knowledge is shown in Figure 16. The continuum of noun objects, their correlated verb

functions, and time is evident from Figure 15. It establishes a frame work, that the future NO's and VF's can be extrapolated from current and prior NO's and VF's, and the innovations of prior generations becomes a leading indicator of future creativity. Such a knowledge space almost resembles a curtailed non-Euclidian space with appropriate rules for the geometry of knowledge. Extrapolation and prediction become complex but viable mathematical operations.

#### **14.2 Lessons from Knowledge Lost**

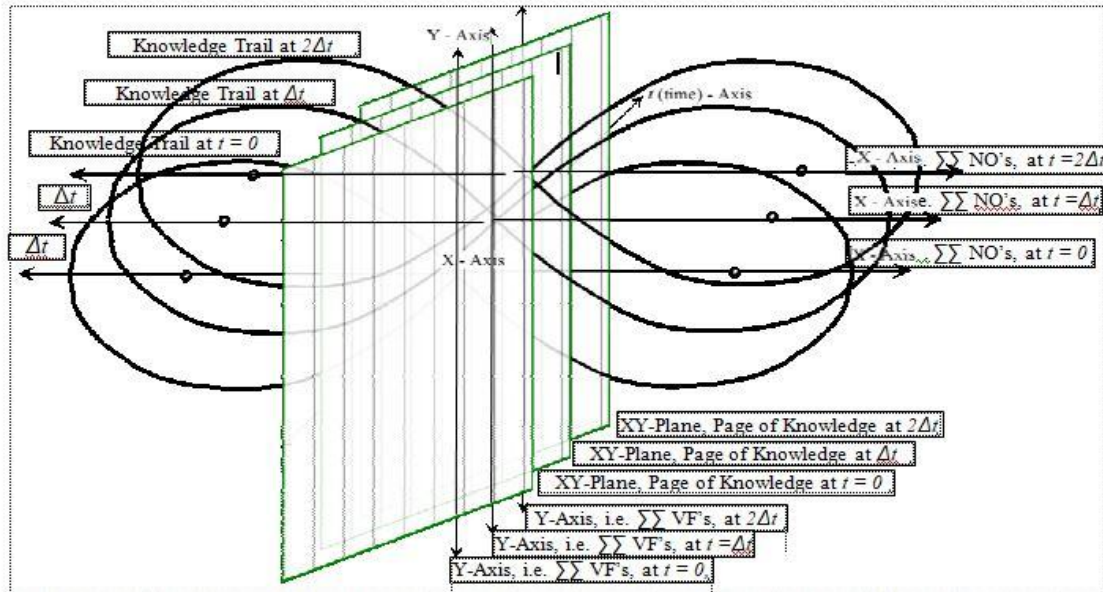
The achievements of the past generation have left behind scores of physical splendors. The path of their intellectual processes can hardly be captured from their monuments. In fact, the greed of some vi has even destroyed the remains of tell-tale signs of civilizations. The reconstructed K-loops from the earlier generations shed disordered imagery in the current knowledge space. In fact, there is no sufficient proof that their K-loops were robustly designed or the circumstances that provided enough stability such that major concepts (Aristotle's democracy, Newton's gravity, Pharaoh's Pyramids, Aztec and Mayan temples, etc.) could be conceived. If such major and conclusive K-loops are pushed into a virtual K-space, the picture appears disorganized and disconnected. A portrayal of the cluttered knowledge space is shown in Figure 17.

Currently, human knowledge has two major means for classifications: the DDS numeric and the LoC alpha-numeric systems. To push the human understanding beyond these systems and maintain scientific methodology, we transport this smaller cube of knowledge into a bigger knowledge space and that is the XYT space for all NO's, all VF's and all times. Even such a bigger knowledge space is too vast for supercomputer systems and elitist human comprehension.

#### **14.3 Cosmic Space, Knowledge Space and Intellectual Space**

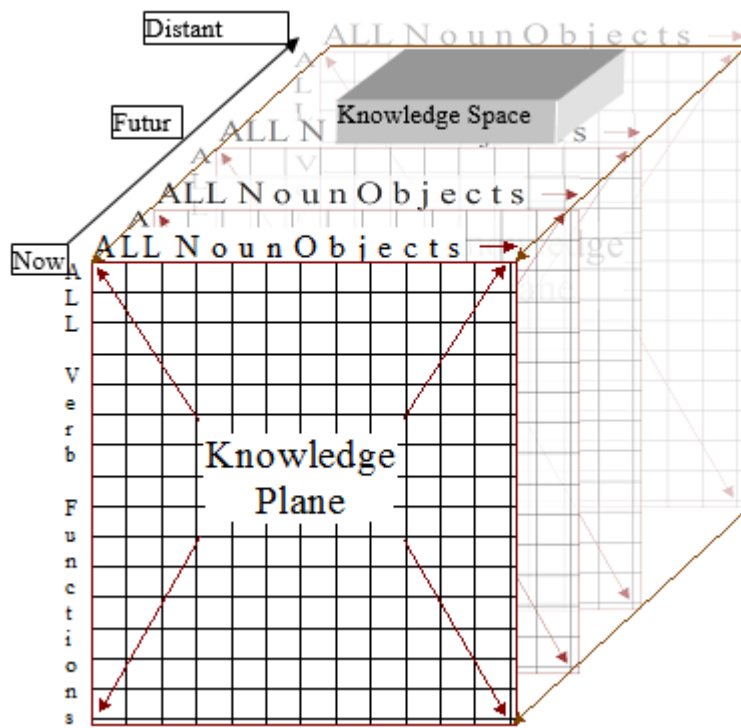
Cosmic space with celestial noun objects and colossal verb functions forge their own script of knowledge. For philosophers and scientists, their knowledge is a subset of the knowledge derived from cosmic and from sub-cosmic laws of nature. To bring the

universal picture within human comprehension, scaling down the cosmic and scaling up the microscopic knowledge spaces become necessary.

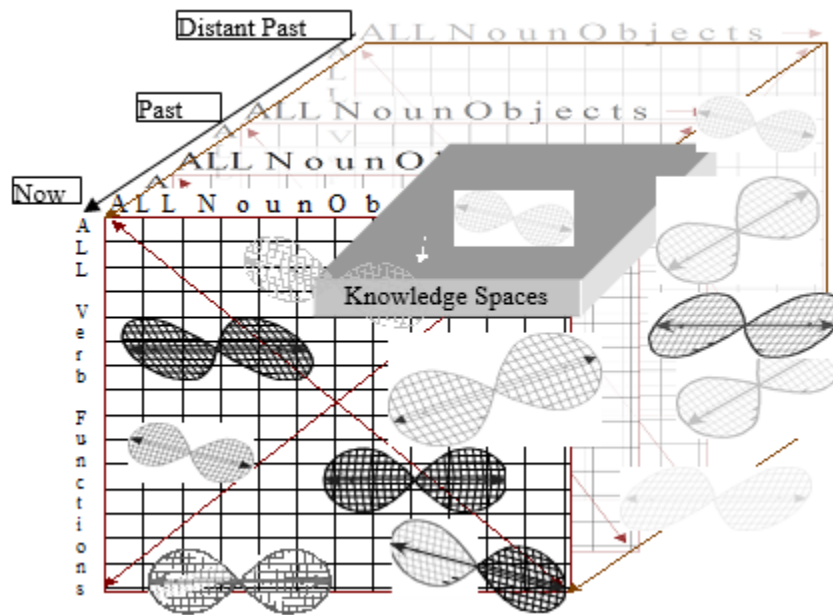


**Figure 15** Depiction of the insidious nature of change in the entropy of knowledge with time. Three instants are chosen at  $t = 0$ ,  $\Delta t$ , and  $2\Delta t$  along the  $t$  – axis. The  $XY$  plane carries a cumulative record of all ( $\sum \sum$ ) the noun objects, NO's and all ( $\sum \sum$ ) the verb functions, VF's. These may be convolved to get the desired changes in NO's. In this Figure the time ( $t$ -) axis is perpendicular to the plane of the paper.

The human understanding of the entire universal space of knowledge and time is limited at best. Cognizance of the cosmic space simply provides the outer bound of the knowledge of all human civilizations. The human knowledge is a tiny segment shown in Figures 18a and 18b carved out of an irregular (and vastly un-understood) cosmic space<sup>vii</sup>. The laws of physical sciences and mathematics start to fall short beyond the documented knowledge in the human civilizations shown in Figure 18b. For this reason, we suggest that the cosmic space be so finely subdivided that within its own elemental cube the laws of sciences and mathematics become applicable.



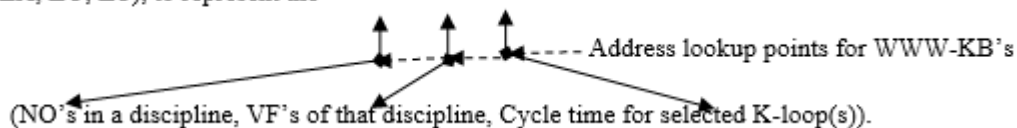
**Figure 16** The effect of time to process knowledge is shown by adding the time dimension (perpendicular to the plane of the paper). Time moves away from the instant  $t = \text{now}$ , and follows the  $t$  dimension in the right handed system of coordinates. Time lapses independently of the paths of the K-loops. Only major shifts of the K-loops bear significant impact on the  $t$  axis and become islands of human achievement in a positive sense, or become scars of hurt, in a negative sense.



**Figure 17** A disordered collections of knowledge loops in the knowledge space over a period of time leading to uneven and unpredictable path of knowledge into the future. It appears that if a dictionary of knowledge-loops is uploaded in libraries of arts, literature, sciences, technology, etc. then the progress and paths for knowledge can be arranged to have order and structure. A well defined course for the development of knowledge is thus feasible.

The intellectual space is well structured for sciences and mathematics with DDS classifications of 100-600 (see Figure 4). When a smaller, elemental cube is carved out for the science of knowledge for a particular discipline, then the cube has a configuration shown in Figure 18c and the dimensions are

$(\Delta X, \Delta Y, \Delta T)$ , to represent the



The volume within the elemental cube (Figure 18c) of knowledge is thus organized to perform the guidelines of convolution of VF's on appropriate NO's that are specific to the discipline. The connectivity between the numerous disciplines is established between

the (known) domains of knowledge and it will be possible to modify, enhance and translate the rules of convolution from subject to the next. Such translation of rules and transportation of elemental cubes of knowledge from one knowledge space to another, adds a new dimension in being able to program at least one aspect of automated machine-based creativity.

The graphical superposition of the three images of cosmic, universal, and subject specific knowledge spaces is shown in Figure 19. The composition of the three spaces presents possible techniques for navigating through surfaces between the adjoining spaces. The relaxation of the rules of one discipline and the simultaneous tightening of the rules from the other discipline can now be forced to be dependent on the XYT coordinates of the rules for dealing with non-linear transformations.

Enormous flexibility in the creative manipulation of NO's and VF's in almost any discipline is gained. In fact, it is possible to go back in time and perform a forensic study of development of knowledge during any give era in hindsight with the computerized vision of current objects and technology and foresight of knowledge predictability. Knowledge, though a virtual entity now becomes a super-object in the object space of knowledge machines.

The representation of a ordered knowledge space (K-space) in the (XYT) dimensions shown in Figure 19, facilitates the orderly transition of structured knowledge from one discipline to the next. The subject specific elemental K-space is a block within the generic infinite space of knowledge. A block may the identified in the generic K-space by limiting the X dimension ( $\Delta X$ ) to consist of all the noun objects (NO's) in a particular discipline (such as biology, cancer research, medicine, etc. initially, and then the similar disciplines combined later for broader research). The Y dimension can also be limited ( $\Delta Y$ ) to all the verb functions (VF's) that occur in that particular sub-discipline or the combined disciplines. Now adjoining elements correspond to the sub-classifications in the overall DDS subject classification of knowledge. Thus the knowledge machine (KM) performs its knowledge domain (KD) functions in a limited or an expanded K-space. Such an expansion or contracting is accomplished by expanding or contracting the



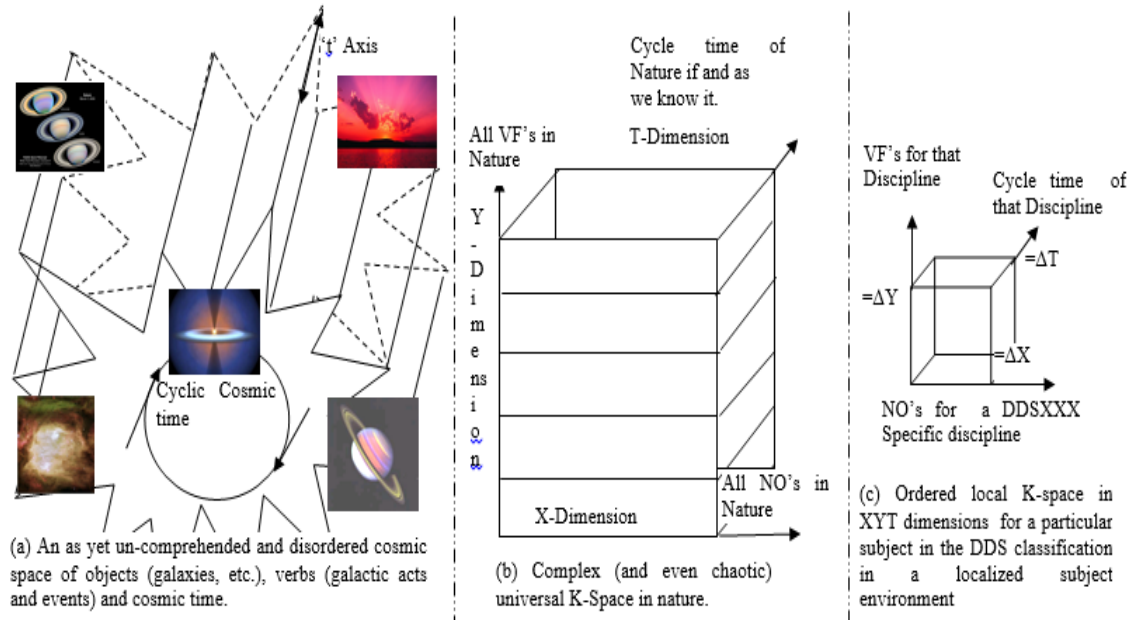
WWW addresses for the knowledge bases (KB's) accessed by the KM. The T dimension enforces the timing constraint on knowledge about the era or a window of time ( $\Delta T$ ) during which any K-loop was traced in that discipline. All the aspects of knowledge, its changes (caused by nature, humans, and machines), its entropy, and its processes is stored and processed in this (XYT) knowledge space.

#### **XV. THE NEBULA OF KNOWLEDGE (*KNOWBULA*)**

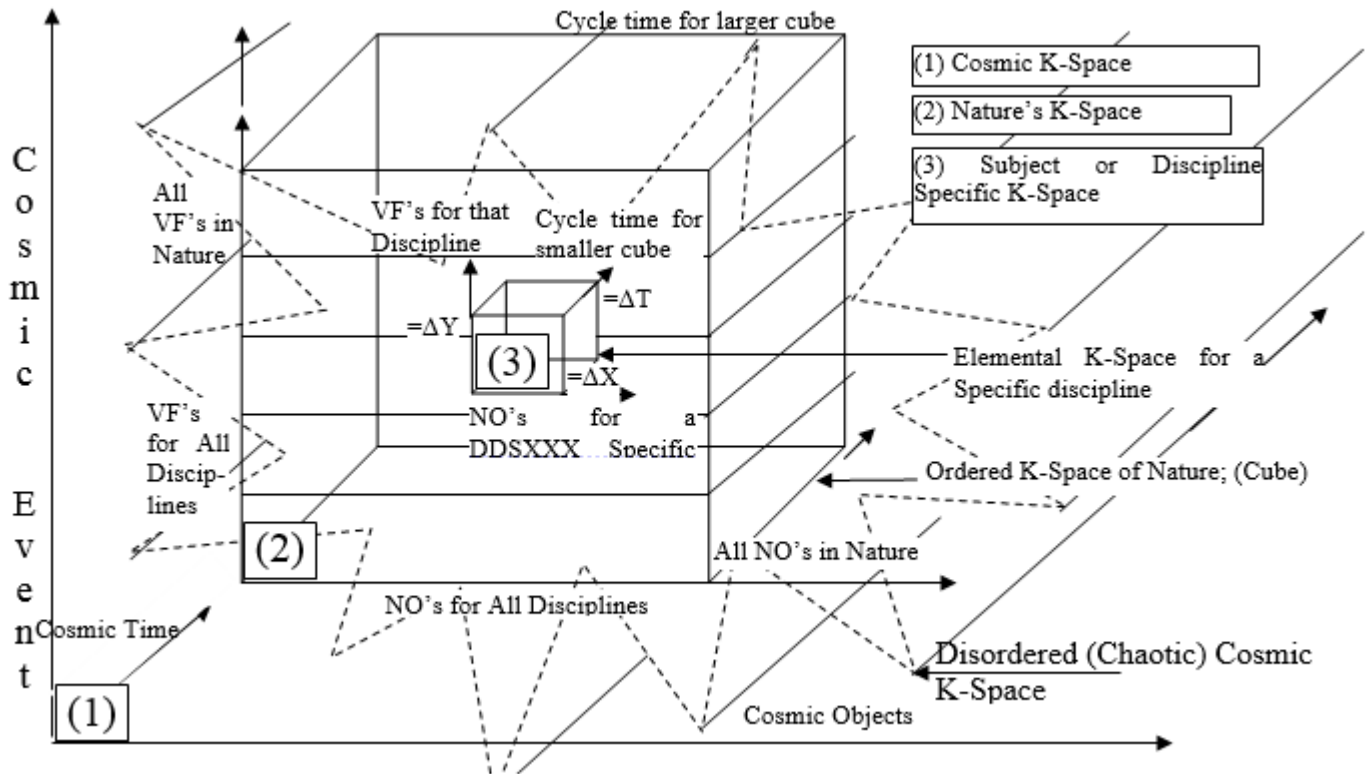
The 3-dimensional knowledge object "*knowbula*" is an envelope of all knowledge loops during an given interval of time and depicted in Figure 20. *Knowbula* can be microscopic as a small computer program or it could be macroscopic to encompass all human knowledge. The time span can also microscopic or span eons back. However, to be realistic, the size of *knowbula*, is selected to suit a particular segment of knowledge that is of current interest and the time span that is operative for and during the investigation for the topic(s) of study. Typically lasting for 24 hours for stock mark daily fluctuations, or a decade for trend analysis, the window of time is moderated by accessing the appropriate knowledge bases on the Web.

In the knowledge space, the convolution of verb functions with appropriate noun objects leads to their modification, enhancement, or their restructuring to suit a particular need of a society, a corporation or any larger entity that engulfs this particular set of noun objects.

This fuzzy object (Figure 20) is the knowledge in numerous forms that surround the K-node along the knowledge trail or the K-loop (Figures 1 through 4). It has been referred as (I  $\leftrightarrow$  K) in [1]. In this paper the knowledge around the K-node has at least four characteristics as indicated by the four ports in the K-node shown in Figures 11.1 and 11.2 of Ref [1] In the present context, *knowbula* can be treated as a fuzzy mathematical entity that can be processed and its entropy can be modified by the execution of knowledge operation codes (kpoc's) in the KPU's of knowledge machines. If it is frozen in time, *knowbula* is the matrix shown in Figure 3.2 of Ref. [1].



**Figure 18. Two step degeneration of universal space and time in (a) to an ordered elemental cube of  $(\Delta X, \Delta Y, \Delta T)$  in (c), to facilitate the processing of knowledge. In this tightly enclosed ordered k-space of the subject matter classification of the noun objects (NO's), i.e.  $\Delta X$ , their associated verb functions (VF's), i.e.,  $\Delta Y$ , and an increment of time  $\Delta T$ . The processing of knowledge can be relaxed or tightened by the user. Processing over a larger cube brings objects and functions from neighboring disciplines and makes the search for new objects and processing more generic. This element of time represents the cycle time of the elemental cube of knowledge that is constantly being altered by human understanding and time. Order, knowledge and time facilitate the isolation of this elemental cube (c) from the more complex and universal K-space in nature (b).**



**Figure 19.** The superposition of the three knowledge spaces to derives an ordered knowledge space (3) from an overall cosmic Knowledge space (1) in the (XYT) dimensions.

*Knowbula's* constant change reflects the profile of knowledge of every size group of noun objects and verb functions, particularly those that are important to the society. *Knowbula* is essentially a 3D envelope of all the knowledge loops that are and have been active in any environment during a finite interval of time (such as a four year presidential term, rise and fall of the Roman empire, or the campus life of a college student, etc.).

The envelope has X, Y, and T dimensions because of the time required to traverse these k-loops active during any finite interval of time. In practical situations, these various knowledge loops can be any function or social program such as writing of the US Constitution, Lincoln's Abolishment of Slavery, Gandhi's pursuit of non-violence, Kofi Annan's Middle East peace efforts, or even a Ph.D. student's dissertation project, etc.

On one hand, wisdom and worthy knowledge is derived from traversing these K-loops. On the other hand, instances (such as the Spanish Inquest, British slave trade, Clinton's Impeachment exercise, Bush's Iraq war, Blair-Bush's poodle dog drama during the invasion of Iraq, etc.), these knowledge loops offer pain and suffering through the society. Recorded as knowledge loops, they get preserved as indignations of humanity. In a true sense, the evolution of negative knowledge also involves its integration over the forgotten millennia. Major civilizations have left their imprint on the pages of time and some have left their blood ridden footprints in time. The earlier knowledge-methodologies were frail and error prone. In the modern days, numerous digital techniques are developed. These are application specific and provide the intellectual highways to traverse and integrate the many disciplines and events into one coherent pyramid of knowledge.

## **XVI. HINDSIGHT AND FORESIGHT**

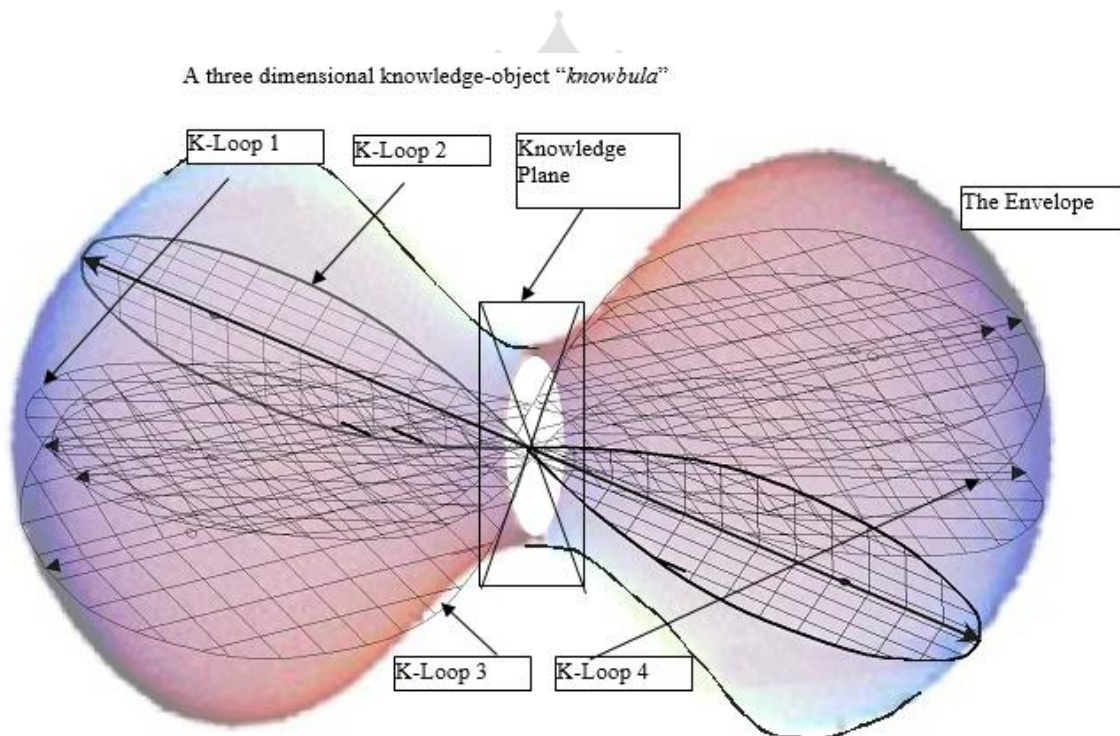
A survey of knowledge offers a rich hindsight. A scan of current knowledge methodologies also offers substantial and predictive foresight. In this section, we blend the survey the old and scan the knowledge domains to build a platform in a horizontal XY plane and the conceptual coherence along the vertical axis.

### **16.1 Brief Survey of Human Struggle**

Every significant struggle within a society has a telltale *knowbula* that freezes their achievement in time. It is thus appropriate to envision a cube containing a *knowbula* with its own knowledge plane and a knowledge space (see Figures 14 - 17). This *knowbula*-cube configuration that scans the history is shown in Figure 21. The *knowbula* does not entirely fill the knowledge space since only a few the NO's and VF's are deployed in traversing the K-loop. For example, when Pharaohs were building the pyramids, mathematics and language were both sufficiently developed, yet the architects did not leave behind any significant information<sup>viii</sup> or strategies in building their structures. As another example, when the first steam engine was put together by Thomas Newcomen

(1792), the thermal efficiency or the heat loss were not calculated till much later in another time window. Other significant examples exist even today as the effectiveness, benefit/cost ratios of most major social reforms are neither computed nor monitored. Tremendous inefficiencies, corruption and losses still continue.

In hindsight, if decades and even centuries are aligned on a vertical line and many hundreds of *knowbula* are spread on a horizontal plane, then a heap of human activity results. In arranging each *knowbula* in its own time slot creates this three dimensional structure. Since there has been no mastermind in arranging the continuity of knowledge over the many civilizations and centuries, the newly created 3-D structure is a heap haphazardly thrown on the horizontal plane. Such a haphazard collection of these *knowbula* with the time axis along the vertical axis is shown in Figure 22.



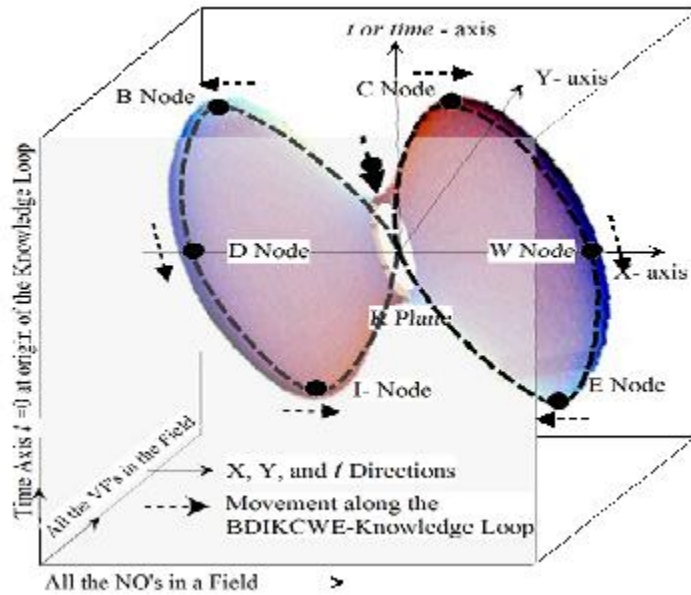
**Figure 20. This 3-Dimensional Knowledge Object “knowbula” is the envelope of all knowledge loops during an given interval of time.**

## 16.2 Scan of Modern Methodologies

Current methodologies are based on extensive computing systems and AI techniques. During the last few decade pattern recognition, expert systems, intelligent agents and systems, etc., have facilitated processing and network technologies have facilitated (almost) instantaneous communications. By coordinated deployment, the structure, shape, and entropy of knowledge can be molded, shaped, and manipulated. On the positive side, social reform and progress accumulate and on the negative side, deception, corruption, and social depletion accrue. Human beings remain firmly in control to drive the society up or down. In the current knowledge environment machines only accelerate the process.

The insidious movement of the society (see Figure 21) along the knowledge loop constantly alters the entropy of knowledge and the exact location of the BDIKCWE nodes. In most instances, it is not necessary to track knowledge to such a level of fine detail. However, in some instances (such as wars, space-mission, emergency room procedures, etc.) the shape and configuration of the K-loop can be monitored and adjusted with very small increments of time. For this reason, 'knowbula' can only be 3-D object since there is no (noun) object that is immune to time and there is no (verb) function that is absolutely still.

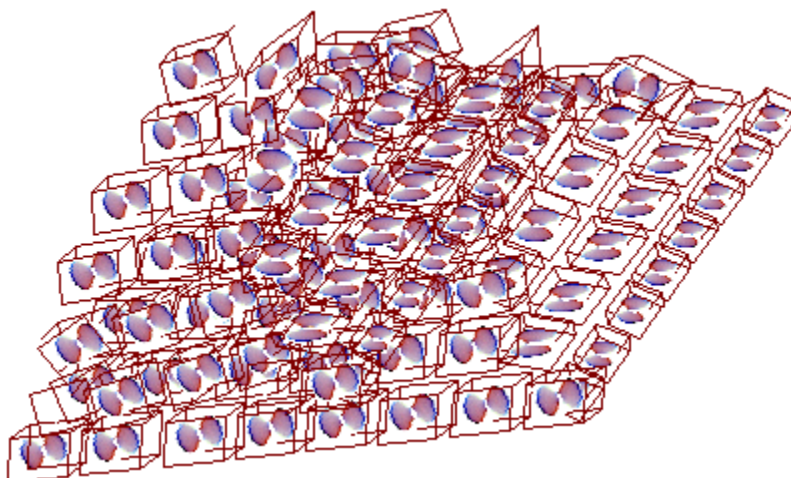




**Figure 21** The insidious movement of the society along the knowledge loop constantly alters the entropy of knowledge and the exact location of the BDIKCWE nodes.

In order to facilitate the representation, the XY, (noun objects, verb functions) plane is oriented to be perpendicular to the plane of the paper, and the time axis is along the vertical line. The representation permits the partitioning of the K-space such that the passage of time falls along the Y axis and the human and machine activities to be in a horizontal plane. Positive struggles of humans (such as Newton's classical mechanics, Einstein's Relativity, Poynting's P-vectors, etc.) and the machines that were invented move the *knowbula* up. Negative struggles of human (such as the Vietnam war, the search for nonexistent WMD (weapons of mass destruction), and flagrant ignoring of global warming, etc.) move the *knowbula* down.





**Figure 22 The Shape of a Broken Knowledge Object (KCO). The Dewey Decimal System and the Library of Congress have classified the subject material in the numerous disciplines around the globe. When knowbulas are not organized in the K-space, the K-cubes appear as heaps rather than as architectures or pyramids.**

### **6.3 Structured and Predictive Knowledge**

The Dewey Decimal System and the Library of Congress have classified the subject material in the numerous disciplines around the globe. However, knowledge that is the gateway to concepts still lies as an ill organized heap of individual *knowbulas* trapped in cubes of noun objects, verb functions and time. The convolution between VF's and NO's (see Section 1.1) leads to inventions that push the society forward. The methodology for organizing any heap to a pyramid is an achievement of the Pharaohs and Mayan cultures. The base is wide and the peak is high. In the knowledge domain, the base is the subject matters for the subjects in the DDS and LoC classifications and the peak is the concepts that unifies the knowledge distributed in the knowledge bases on the Internet. The reinforcements for the knowledge pyramid are the forward and backward pointers between the noun objects, verb functions, their convolutions, and underlying concepts that makes various disciplines distinctive segments of global wisdom.

When a number of the *knowbula* cubes are organized by the knowledge sciences of the 21st century, the disorderly heap of knowledge from the K-loops in the cubes (Figure 21), assumes the form of knowledge pyramid. Such a pyramid is shown in Figure 23. The pyramid is also a virtual entity but totally reinforced with forward and backward point in all the three X, Y, and T dimensions. Any knowledge processing machine (KM) will have the capability to navigate in, out and penetrate the K-pyramid as a spacecraft can navigate itself through cosmic space.

Two aspects that are crucial in Figure 23 are: (i) that the vertical axis of the pyramid represents the path between the K-node and the C-node of the greater knowledge that encompasses the current discipline, and (ii) that the X and Y axes at any horizontal plane through the pyramid contains all the NO's and VF's of the current discipline. In order to hop between one K-pyramid to the next, and from discipline to the adjoining/sister discipline, the wisdom from the W-node plays a crucial role. It affirms the parallelism between many adjoining disciplines and then draws upon them to find a common thread of underlying wisdom if any. Human beings are far more adept at this type of K-pyramid hopping and the role of human beings in wisdom machines [1] becomes essential to monitor the machines. In this Figure 23, the focus of wisdom lies just beyond the highest block of coherent concepts.

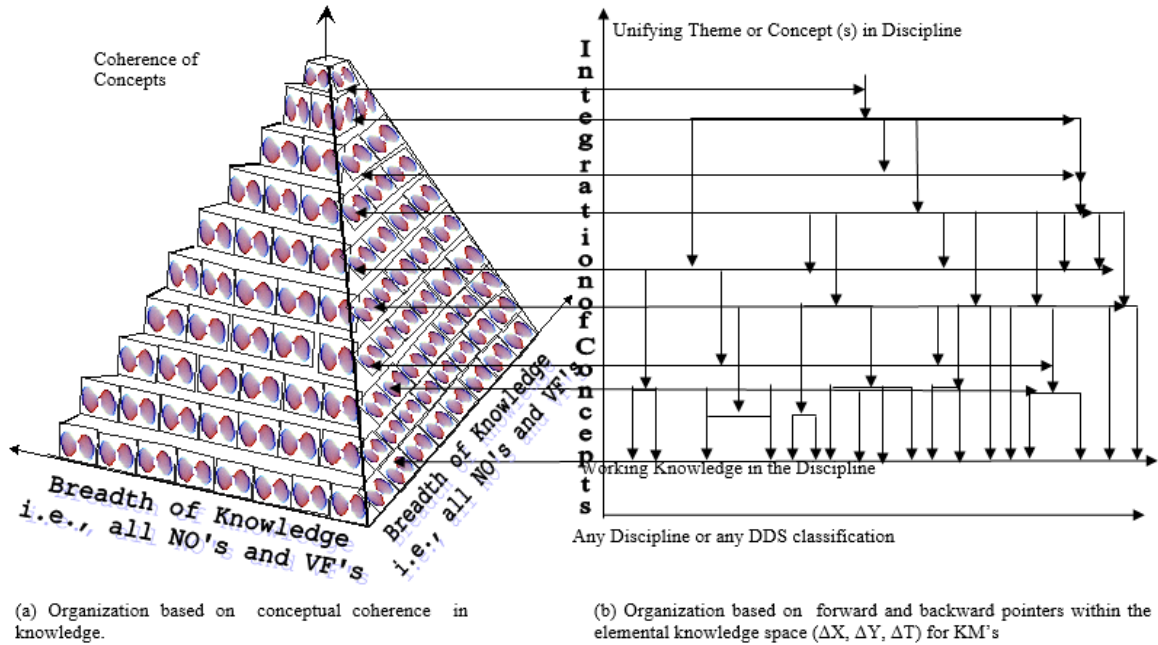
## **XVII. KNOWLEDGE, FREEDOM AND CREATIVITY**

Well founded scientific knowledge and intellectual freedom provide a good basis for creativity. In the context of the K-loops embedded in *knowbulas* in a structured pyramid of concepts (Figure 23), the entry and exit points at the K-node (see Figure 3) play an important role in the future direction of traverse along the K-loop. When a *knowbula* is enclosed in an elemental cube of knowledge, the maneuverability along the path of traverse of the loop can influence the creative deviation of the current loop from the earlier predecessor paths.

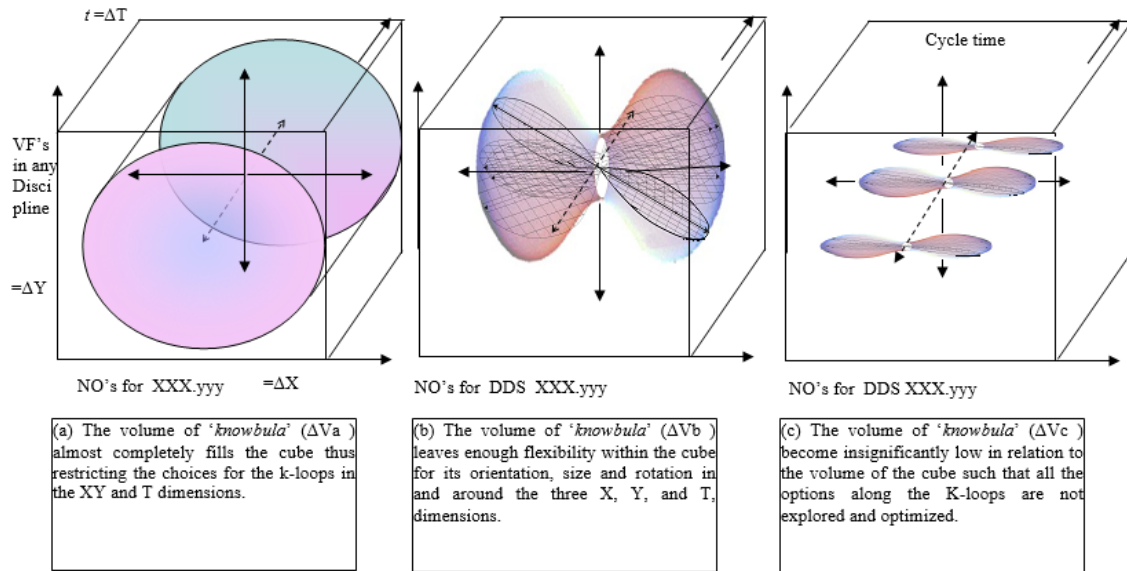
Human ingenuity attempts to alter the pathways between nodes in the K-loop so as to be optimal and most direct. In essence, creativity results and inventions are made. The size and shape of *knowbula* that fits the elementary cube of knowledge offers three possibilities; (a) the *knowbula* is such a tight fit that no movement or adaptation is feasible, (b) the *knowbula* is good fit that restrains violent swings in the orientation and structure of *knowbula* but offers some room for negotiations with the environment to find a more optimal fit within the cube (innovations and inventions result), and (c) the *knowbula* becomes a line joining the computational/mechanical intelligence of a machine and the natural intelligence of a human being, (see Figure 3), i.e., the volume of *knowbula* collapses to zero. In this last case, there no flexibility for changing the NO's and/or VF's and there is neither intelligence nor creativity. These three cases are depicted in Figure 24.

### **17.1 *Knowbula* Almost Fills the Cube of Knowledge**

This condition occurs when all the noun functions (NO's) and their associated verb function (VF's) in a given window of time are completely deployed in the K-loop. The freedom to readjust the shape and structure of the loop for even minor adjustments are not possible. Under such conditions, the knowledge plane at the K-node is the entire XY plane and shown in Figure 24a. The typical shape of the loop that is generally close to a Lemniscates (see Section 4) assume the shape of Cassini's Oval. In the limiting case, the volume and shape of the Lemniscates approaches those of the cube of knowledge itself. The cube of knowledge can be artificially compressed by dictators, oppressors and military occupation of a country, a society, a civilization. Historically, Mao, Stalin, Hitler, Israel's occupation of Palestine have stolen freedom and creativity from people and driving them into a state of apathy and slavery. When the access to the noun objects (such as books and libraries) is denied and verb functions (such as research and development) are made illegal, *knowbulas* assume the shape of hardened clay.



**Figure 23 The Shape of a reconstructed Knowledge Object (KCO).** The movement from the universal knowledge level to a universal concept level is based on the unique human tendency that the most cost structures have sense of order and elegance, even though it may be initially overlooked. However, if knowledge is based on scientific principles, then concept unifies such principles into a tight circle that is the focus of a broader wisdom.



**Figure 24 Knowledge, Freedom and Creativity: The Effect of Size, Shape, Orientation of 'knowbula' in exploring and inventing new objects in the knowledge domain.**

In this window, scientific creativity comes to stop; societies and nations stagnate. Artistic and literary talent is likely to survive in isolated packets that are unaffected by science, economics and technology that usually bring about an profusion of new NO's and VF's. Closed societies and dictatorships of the past offer excellent conditions for the knowledge loop to get trapped in its own self generated wisdom (W) and values (E). Human spirit is born free but becomes enslaved by the brutal force of dictators and their single minded self glory.

### 17.2 Knowbula Loosely Fits the Cube of Knowledge

The loose fit of *knowbula* offers the possibility to stretch the K-loops (within the *knowbula*) creatively and make inventions to suit the application, situation, and the particular phase of social adaptation. In a sense, this is a self perpetuating syndrome. The convolution of NO's and VF's during any interval of time give rise to new NO's and VF's for the next interval. However, the prevalent freedom for the convolutions of VF's and NO's can set the yield the three (TVB, DAH, and SET) full-fledged orientations of

wisdom. Social progress and social regression follows the attitudes and deeds of the leaders.

When the freedom for extensive convolutions is taken to a extreme, the human reaction is purely economic; the maximization of derived utility becomes most appealing. At one extreme when the society seeks freedom but becomes tolerant of dishonesty, individuals lean toward stealing rather than earning, deceiving rather than convincing, especially if facts are distorted to suit the purpose, and war becomes easier than negotiating for the egoistic. These conditions are amplified many times over even today due to self-centered reasoning of politicians, executives, and state officials let alone pressure tactics of thugs and criminals. Science, economics and technology become weapons of mass deception in the hands of fraudulent and conniving. When deception becomes a tactical commodity in perpetuating self interest, the know-not pay the price without ever knowing it. At the other extreme, when freedom is derived from integrity, the society stands to gain. Data faking, mass deception and fear mongering in the hands of the media interest will gradually come to a stop. It appears that once the tides of society have started in the downward path, the social resistance becomes more deeply ingrained for any reversal to occur. The expenditure of energy for this social reversal become far greater than the social energy for reversing the trend from a upward social track to a downward social track.

This directional friction effect occurs in nature when the fear (of smoke) of destruction strikes a bee colony. Bees abandon the hive after gorging themselves on the honey after smoke arouses a sense of forest fire. Many months of slow and painstaking work of collecting the honey. In a similar vein, humans in threatening situations, tend to slide towards DAH, much more easily than continue to protect the hard earned goals of wisdom, ethics and values based on TVB.

### 17.3 *Knowbula* Becomes Insignificant in Cube of Knowledge

This condition prevailed at the dawn of human civilization. It exists after major calamities in nature and the history of human achievement is all but lost. There is no residual scientific knowledge to support the human intuition and imagination, and there is little systematic creativity to grow and extend scientific findings. However, human creativity and values survive in pockets and civilization finds a new beginning. On an individual basis, this condition can occur as the frame of mind of an infant as it is learning to cope with its environment.

Total conceptual freedom in the absence of all scientific methodology is to provide the feathers of flight for an arctic tern without the genetic navigational capability. Reinventing the wheel would be an essential exercise. Learning the entire social and ethical framework would be a necessary step. However, the path towards a new civilization can become more direct without the dark ages of prolonged ignorance and witchcraft.

Even though an experiment with the entire human race is impractical, a set of machines may be forced to operate in a knowledge vacuum. If enough AI rules (analysis, learning and adaptation) are primed, such machine may invent new NO's and VF's, yet unknown to the human species. In another practical applications, if a group of untrained Einsteins were to dabble with the mysteries of cellular biology, perhaps the theory of relativistic social sciences would evolve. In a more realistic setting, if a raw human intellectual was confined to mind and self, and trace a K-loop without any recourse to any local or WWW knowledge bases, then the psyche of Hitler becomes as likely as the spirituality of Gandhi.

When breakthrough approaches are sought, partial isolation from society becomes a necessity. History provides many examples when many (Buddha, Christ, Moses, Rumi, Schweitzer, and even some of the recent sufi's) had sought retreat in their lives. In the knowledge society (where total isolation is impossible), this condition is achieved by balancing the size and shape the individual *knowbula* in relation to the volume of the



cube of knowledge, (i.e.,  $\Delta X \times \Delta Y \times \Delta T$ ). This delicate balance is self achieved equilibrium condition that maximizes the achievement of personal goal in any social setting. It holds the promise of being a stable equilibrium state that the machines can help human beings and nations to achieve.

### **XVIII. KNOWLEDGE AND MONEY**

Knowledge and money are both resources. Spent appropriately, both offer rewards. When the velocity of money is zero, the economic activity comes to a halt. Severe recessions follow. Conversely, when the velocity is too high economic activity becomes rampant and severe inflation follows. The Federal Reserve Commission monitors the economic activity by controlling the availability of funds to the public by controlling the prime lending rates. A healthy economy prevails for a long term to make the conditions suitable for constituents of a nation to enjoy a stable pattern of life in a stable society.

When the velocity of knowledge tends to zero, an intellectual freeze occurs and massive ignorance to deal with critical social issues takes over. A state of apathy prevails. Many strains of intellectual starvation follow. Fortunately, human memory retains low level knowledge to maintain subsistence living. Conversely, when the velocity of knowledge become too high, two effects are evident: first, the media carries junk information of no intellectual value, and second, if the information is mostly educational, then the economy cannot offer employment to match the level of education and understanding of the populous. Many strains of local and national social unrests follow. Between the two extremes (intellectual starvation and junky information highways) of social fears, the media opportunism fills the information highways with palatable cocktail of gossip-level information. A vast majority of public consumes the zero value information as entertainment.

Unfortunately, there is no centralized commission to regulate the velocity of knowledge that can instill social content with intellectual growth and also curtail the flow of tainted information on the knowledge highways around the nation. This status quo suits the

leaders just fine to cover up their own inadequacies. Mass media thus perpetuates the self-interest of many and the seeds of mass deception gets planted in those who monitor the velocity of flow of knowledge. The result is apathy and lethargy thus paralyzing the social/intellectual growth of a nation.

In this section, we propose a mathematical strategy that permits the moderation of the flow of knowledge that neither starves the mind with too little knowledge nor corrupts the mind with massive infusions of deception and tainted knowledge. Two following strategies are proposed.

(a) Monitoring the size of *knowbula* in relation to the relevant elemental cube of knowledge over a finite interval reveals the balance between no knowledge and a glut of junk knowledge. Irrelevant information, bias and gossip are systematically filtered out the media information, and

(b) Matching the rate and relevance of information feedback from intelligent knowledge bases so as keep the curiosity and creativity of the user at a level consistent with the interest and intellectual profile of the user. This strategy needs smart designs of intelligent knowledge bases to be predictive and adaptive. Inappropriate responses only annoy the user. Some of the design considerations for intelligent educational systems are presented in [1]. Much as a lending institution performs a credit check on the borrowers, the knowledge banks should keep an intellectual profile of every user. Much as an Intelligent Medical Network [1] keeps a medical profile for the patient, the knowledge providers should keep an intellectual profile of the users and dynamically update it from time to time. Much as a corporation keeps the employee profile in human resources database, a Central Knowledge Agency (CKA) should keep a profile of those who can alter the destiny of a nation or the genes of the futuristic knowledge.

The methodology for migration into well structured of knowledge for the future is depicted in Figure 25. The utopian society will exist at the peak of the bell-shaped curve. Most constituents will gravitate to the peak rather than drift down to the skirt of the bell

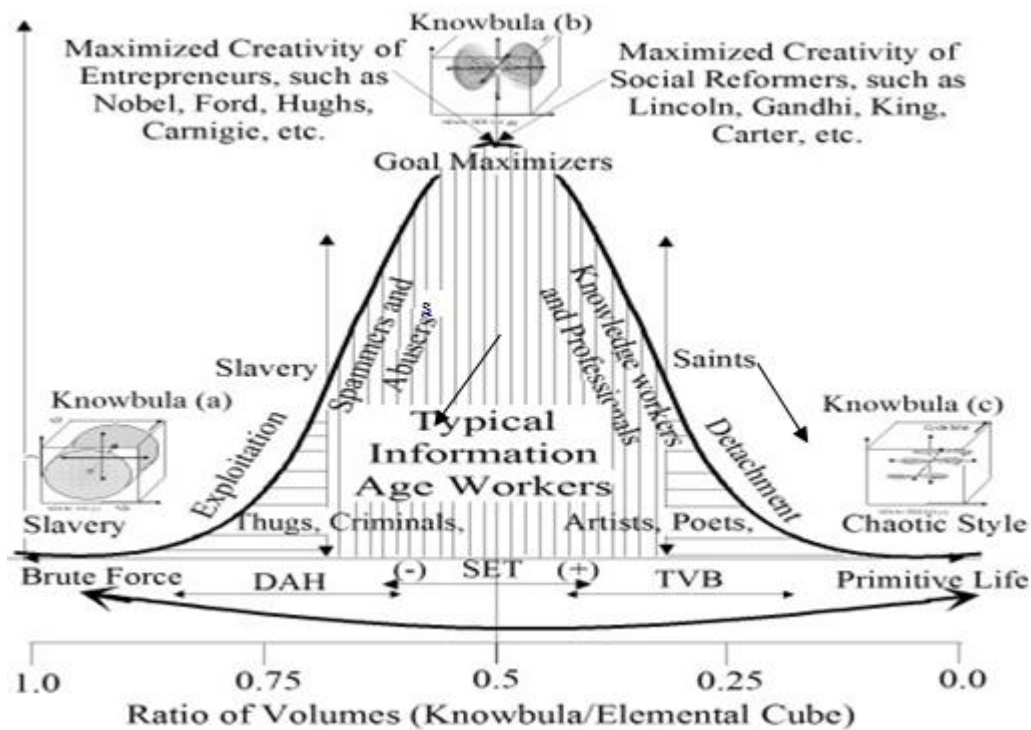
shaped curve. Such an upward mobility in the knowledge space will occur in the pursuit of genuine and beneficial knowledge, concepts and wisdom in an infinite cube of knowledge where both the semi-infinite X and Y axes are primed with all noun objects, verb functions from all of nature as we know it and eternity along the T (time) axis. This ideal goal is perhaps a forbidden zone for scientists, philosophers and poets and brings us back into the confined reality of  $\Delta X \times \Delta Y \times \Delta T$ .

### **IXX. PINNACLE OF MIND AND INFINITY OF THOUGHT**

In the utopian space of infinite objects, their convolutions and eternal time, the continuum exists with strings of thought. Such strings of thought are duly represented as K-loops of human activity. When an infinite number of such strings are huddled in a *knowbula*, a sense of order starts to appear in this superspace. *Knowbula* being a virtual entity needs the human mind to be perceived. Human beings would be lost in this virtual space without computers and knowledge machines to serve as navigation tools. Machines would be impotent without the philosophers and theoreticians to jump between one state of nature to the next state. A state of symbiotic coexistence becomes essential for survival. If nature evolved human beings, then the human beings evolved the mind to conceive nature. We present this stable condition in Figure 26. The stability is assured till nature destroys human species or the human species destroys nature.

The crucial node in the forward path N1-BDI (Ka-Kb) CWE-N1' is knowledge and once more in the return path of Philosophers and mathematicians. Computers and knowledge machines become subservient to mathematicians and philosophers to regain a sense of reality in this rather prolonged excursion of the K-loop. This is synergistic and symbiotic relationship that occurs in the background as society changes its momentum towards from one orientation to the other. The roles of humans (as philosophers and theoreticians) and machines (as computers and knowledge machines) are depicted. The cycle-time of this loop can be centuries long or quite short. The knowledge revolution over the last few decades has hastened the cyclic processes that drive this K-loops in every discipline. The effects on human beings are rampant. The top node has three orientations of 'wisdom'

(TVB, SET, and DAH) embedded in it. The SET mode of wisdom being neutral can work equally well with the TVB mode or the DAH mode. Different flavors of ‘wisdom’ become evident in the political posture of a nation or society. When arranged in the plane of the paper, the impact on the society can be derived as being expansionary or regressive. Thus the present political posture becomes a leading indicator of the social migration. The role of computers, knowledge machines, philosophers, and theoreticians becomes almost subservient to the political posture of the politicians within the society. This posture can reconstruct a deteriorating society or deteriorate a constructive society. Mathematical framework for the outer limit of the machines can get constrained by the national priorities. Such priorities come and go from fragmented windows of time over the cycles of human evolution. On many occasions, human effort gets drowned in a slice of cosmic time.



**Figure 25** The influence of ratio of volumes of knowbula to elemental cube upon the freedom and choice of creativity depending on the TVB, SET, or DAH orientations of wisdom. The ratios depicted as (a), (b), (c) inserts.

## **XX. SOCIAL MIGRATION AND POLITICAL AGENDA**

Long term implications of political pressure on society is evident from every page of history. In the recent past, the defense spending has shifted the types of jobs, tourist revenues have changed peoples' attitudes, lack of medical insurance has prompted better healthier lifestyles, junk foods have made people obese, liberal gun laws increased crime rates, etc. These isolated cause-effect relations have a tell tale story. In essence, a wise national policy breeds a healthy society. The three orientations of wisdom (TVB, SET, and DAH) and their numerous permutations (such as, tvb, set, dah) discussed in [1] bear a long term effect on cohesion, attitudes and preferences of the society. On the positive side, the industrial revolution brought an end to the forced labor, farm mechanization brought relief from famines, the IC engine revolutionized transportation, the Wright Brothers brought about the beginning of the airline industry, and so on. On the negative side, the Chinese society has suffered a stagnation during the monarchy, the British and Portuguese traders had the freedom to traffic slaves, the Spaniards raided the Inca temples, the Southern States practiced cruel slavery, all for countless decades.

When the effects of TVB, SET and DAH orientations are perceived, the political posture does not always stand out. However, when machines perform a detailed analysis of the cause-effect relationships, rather than a coarse guess on the part of humans, the telltale effects will be more definitive and precise.

Policies leaning towards DAH will be investigated in greater detail by knowledge processing machines. Deception in the media and falsified statements of the leaders will be intercepted early before serious damage is done. Combinatorial policies such as (high level) deception (from DAH) with (artificially sweetened) virtue (from TVB) will soon be trapped by machines operating on scientific basis and statistical analysis. Uncorrupted machines will gravitate towards truth because science is based on truth and universality.

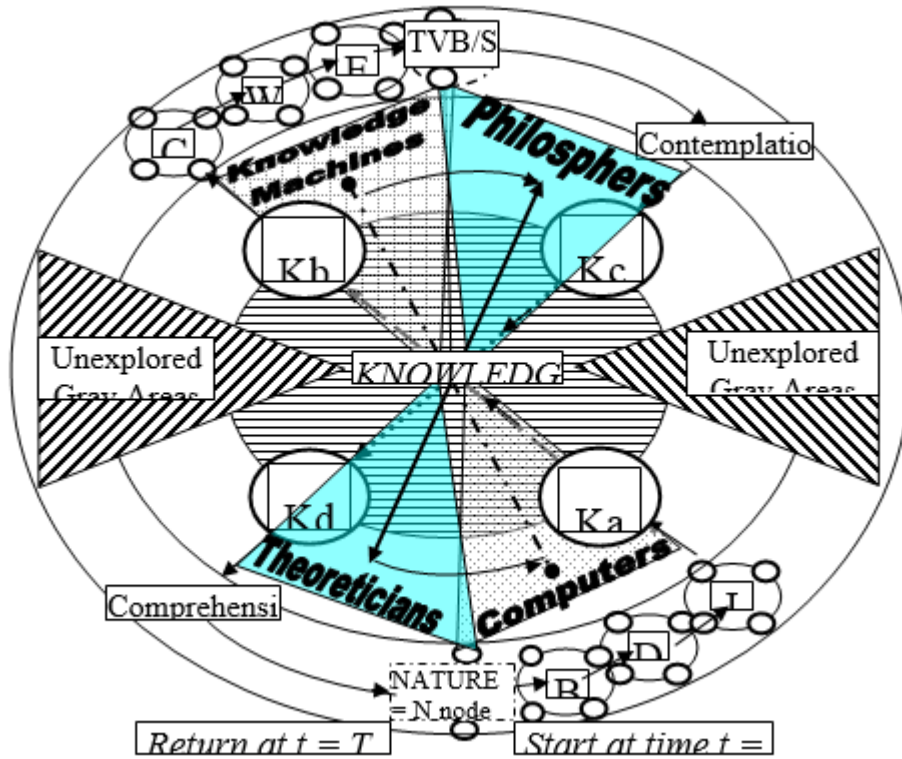


Figure 26 The secondary plane of knowledge with a protracted K-loop ‘N-BDIKCWE (TVB)-N1’, from nature back to nature. This loop incorporates human intervention in the way (TVB) knowledge evolves. Similar loops for the SET or DAH orientations can also be deduced from this Figure. Computers and KM’s remain, but philosophers and theoreticians get replaced by humans of mixed disposition ranging from saints and virtuous to thugs and criminals.

We depict this entire scenario in Figure 27. The SET mode of wisdom shown being neutral can work well with the TVB mode or the DAH mode. Different flavors of ‘wisdom’ become evident in the posture of a nation or society. In Figure 27, two major variations (OKT for Order, Knowledge and Time, and CIT for Chaos, Ignorance and Trauma) of wisdom are shown. The OKT orientation is further divided into three (CWE for Concepts, Wisdom and Ethics, TVB for Truth, Virtue and Beauty, and LCC for Love, Concern and Compassion).

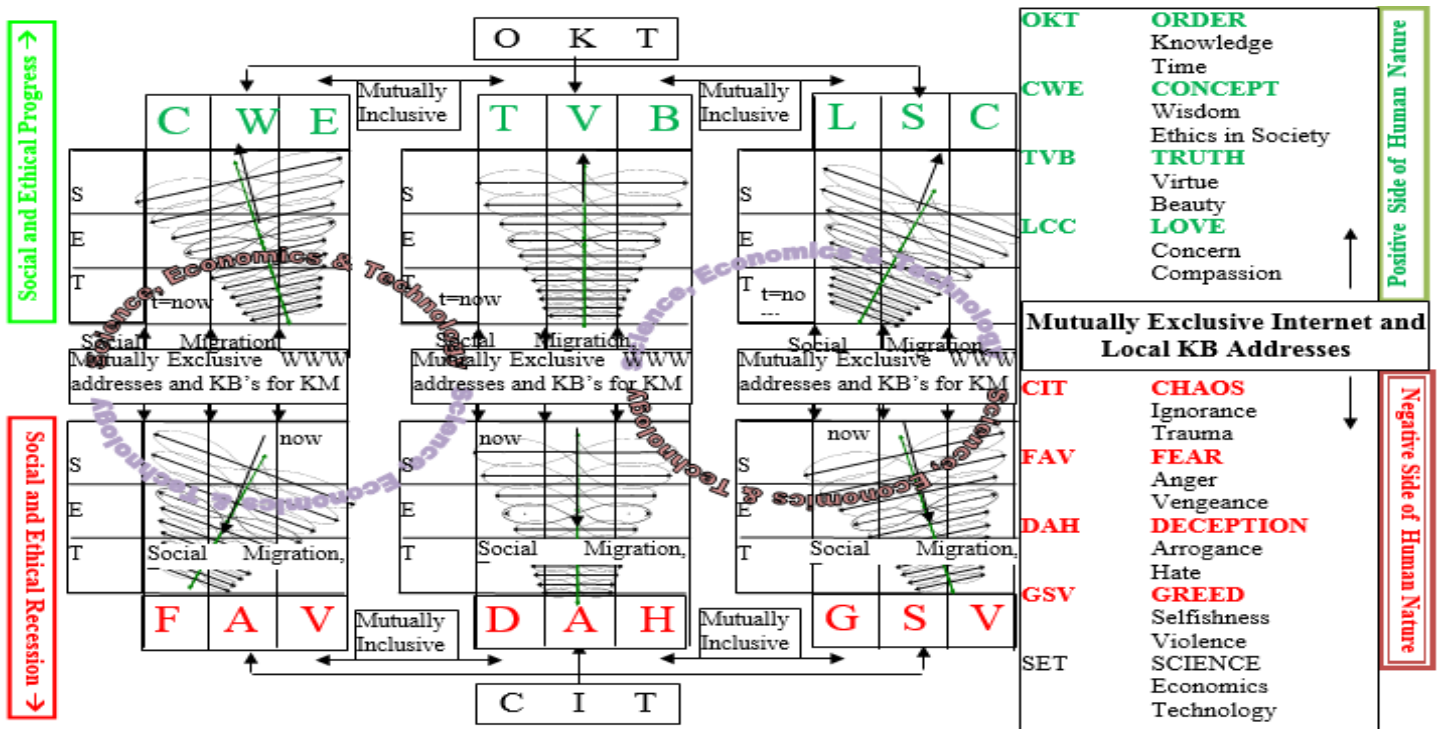


Figure 27 The last node in Figure 28, has three orientations of ‘wisdom’ (TVB, SET, and DAH) embedded in it. The SET mode of wisdom being neutral can work well with the TVB mode or the DAH mode. The social migration up or down is shown by the arrows. In reality, the effects can be incremental and a KM’ can accurately track them. Two time and society dependent rotating circles are shown to indicate the dynamic nature of the TVB and/or the DAH nature of human beings and political leaders influence the SET forces in the Society and vice-versa. The mutual dependence is as ancient as human civilizations and long preceded the age of computer and information revolutions of the 20<sup>th</sup> to 21<sup>st</sup> centuries.



The CIT is also subdivided into three (FAV for Fear, Anger and Vengeance; DAH for Deception, Aggression and Hate; and GSV for Greed, Selfishness and Violence). When these eight variations of wisdom are arranged in the plane of the paper, the impact on the society can be derived as being expansionary (upward movements) or regressive (downward movements). Thus the current political posture becomes a leading indicator of the social migration. The role of computers, knowledge machines, philosophers, and theoreticians becomes almost subservient to the political posture of the politicians within the society. This posture can reconstruct a deteriorating society or deteriorate a constructive society.

The social and economic forces are superposed on beneficial (*tvb*) and/or subversive leadership (*dah*) styles of political leaders. Typical cases from recent history are exemplified to validate the movements in the (American) society. Two rotating and/or oscillating circles shown in Figure 27 indicate that the society is never static but always undergoing natural and fabricated environments of nations and cultures. Such events also occur in the financial, seismic, and weather environments. Predictions can be reasonably accurate in very short run. Knowledge science is also founded on (almost) random events the influences (almost) all aspects of natural environment and human behavior.

A mathematical framework for the outer limit of the machines gets enveloped in the political posture, which can by itself shaped by the machines provided the politicians have the capacity and insight to deploy such machines for social reform rather than for personal gain.

## **XXI. CONCLUSIONS**

This paper is a culmination of the general theory of knowledge, processing of knowledge and a systematic integration of the past and future domains of knowledge. It encompasses numerous disciplines, such as AI, computer science, economics, human behavior, etc. It provides conceptual highways and byways between old and new knowledge domains by building systematic forward and backward pointers to noun

objects (NO's) and verb functions (VF's) that populate the past and current knowledge spaces.

The paper also summarizes the growth and evolution of knowledge. Human beings having been logical and infused with economic behavior in modifying the environment, follow the movement towards deriving knowledge from information, concepts from knowledge, and finally, wisdom from concepts will mould the environment wisely and hopefully in an ethical sense. Knowledge gets visited many times over with a little more wisdom gained each time. In this paper, a mathematical framework of traversing the knowledge loop is delineated and made reentrant. The knowledge thus gets constantly updated and replenished. The factors that make the general populous more creative in any given situation are embedded in constructing *knowbula* as a virtual object that envelopes human and individual effort in learning from the past and realigning for the future. Neither human beings nor machines by themselves can reverse established trends in the knowledge society. Symbiosis and synergy leads to rapid change and quick reversal. Sudden and disruptive changes are relatively few because humans retain the basic powers of (mental) processing, (biological) memory, and genetic intelligence. In the same vein, machines retain quick process data and information capability, massive knowledge banks and memories, and generic algorithms of artificial intelligence. Even superposition and division of tasks can yield to the genesis of wisdom machines. This paper introduces the concept of predictive knowledge that is capable of being artificially creative rather than passively intelligent, thus paving the path to design of creative machines rather than intelligent systems. Intelligent Internet knowledge banks that match the novelty and rate of delivery of knowledge to the users that is just ahead of their immediate needs are also presented in this paper. The quality of knowledge (QoK) is thus personalized to each user or user groups.

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<sup>i</sup> From the laws of grammar in any language, every sentence has some form of noun object (s), one or more verb function(s) and tense (s) involved in its structure. We use this requirement to indicate the incremental three dimensional knowledge space where every sentence will fit as an increment in the (semi-infinite) global space of knowledge.

<sup>ii</sup> The roots of truth, virtue and beauty (TVB) reach beyond humans into nature. Science, economics and technology (SET) are unaffected by emotions, and natural consequences. Finally, deception, arrogance and hate (DAH) engulf the minds and destroy the nature that hosts the societies. Rationality and precision of thought usually drown in deception, arrogance and hate. The Freudian superego, ego and id assume a distorted manifestation in Aristotle's TVB, DAH and SET that lies in between the two.

<sup>iii</sup> Lamniscate (also spelled Lemniscate) of Bernoulli, is written out as  $((x - a)^2 + y^2)((x + a)^2 + y^2) = a^4$  or more generically as Cassini Oval i.e.,  $((x - a)^2 + y^2)((x + a)^2 + y^2) = b^4$  in the Cartesian coordinates.

<sup>iv</sup> In the recent times, richer society does not imply more civilized society. On the contrary, some richer societies are becoming less civil and more violent. This is specially case in US and in Israel; both use greater and greater violence and/or brutality to solve social unrest and justifiable social issues.

<sup>v</sup> The three orientations of wisdom, TVB, SET, and DAH have been introduced. For indicating the numerous dimensions, tvb, set, and dah are used in this section.

<sup>vi</sup> Raiders of the Egyptian Pyramids and their treasures; Spanish Hernando Cortez, Francisco Pizarro, etc., during the plundering of native American heritage and treasures; British Clive during the thievery of gems and diamonds during the occupation of India, etc.

<sup>vii</sup> In reality, such segmentation occurs many times. Eskimos carve out blocks of ices from vast chunks to build their igloos, mathematicians have caved out sequential numbering system from a infinitely large sets of numbers, coding theorists select a subset of binary sequences for error detection and correction.

<sup>viii</sup> As far as we know, the Pharaohs, Aztecs, and early scientists did not have the binary representations (B) and data structures (D) at their disposal, however they had the skills for communicating, storing and retrieving information (I). Their K-loops appeared to be shortened as N-ICWE-N providing them the capacity to learn directly from nature (N) and return to nature to retune their skill sets.