

Transmission Flow Theory of Knowledge (B)

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Abstract— In this paper, we propose a methodology for quantifying the flow of knowledge based on simple rules of flow that govern the flow of current, heat or fluids. Knowledge being radically different from any of these established down to earth concepts starts to display that the approach based on conduction theory soon become ineffective, if not futile to be *very precise* in the quantification the flow of knowledge. However, the inroads the these discipline carved out over many decades offer a rough mapping of potentials, resistances, path impedances, work-done and energies transferred. At the outset, knowledge does not abide by universal law of conservation of energy nor by the basic laws of fluid mechanics, instead knowledge needs its own laws and precepts to quantify its flow, rate of flow, and energies transferred one knowledge centric object (KCO) to another.

The conceptual framework evolved in this paper, together with the tools of characterization of KCOs in any given discipline offers the explanation that the knowledge potential acquired by anyone depends on the differences of knowledge potentials, the duration of interaction, and the resistance to flow of knowledge between the participants. Concepts developed here are generic and they can be used most disciplines and in most places. The paper also identifies the makeup of the “source” and the “receptor” KCOs and addresses the process of knowledge transfer wherein the constitution of the KCOs is altered and adjusted by the “work done” during the knowledge energy transfer. By adapting and enhancing equations from heat- current- or fluid- flow laws of physics, electrical engineering or fluid mechanics, we propose the knowledge flow be similarly quantified. Though simple and direct, this approach is coarse and approximate. It yields values for knowledge entities that happen at a subconscious level for human minds and for animate objects and at data- and knowledge levels in intelligent communication systems and machines.

Keywords— *Signal Flow Analysis, Knowledge Flow, Social Aspects of Communication, Knowledge Centric Noun objects, Action Driven Verb Functions, Convolutional Behavior*

I. INTRODUCTION

Four papers are proposed in this Journal. Part A deals with the simplest theory to quantify knowledge as we measure the current, fluid-flow,

heat, magnetic fields, etc.; Part B deals with flow of knowledge as we would quantify current and voltage signals in transmission media and filters with their own characteristics in electrical communication theory; Part C deals with the flow of knowledge based on the *quantum* theory where the individual quantum of knowledge can interact with the medium it is traversing, and finally Part D deals with the inspirational basis for the transfer of knowledge without any media but between transmitters and receptors with matching characteristics. Part D discusses that knowledge does not need a medium at all, and it can traverse infinitely large distances and cross most frontiers of time. Impressions of physical space are instilled into the minds of animate objects since inception. Physical space is artificially created as arrays of computer memories by specifying the X, Y, Z, and t coordinates. Estimation of distances (to create the notion of space) is an inborn skill and evident as infants grab things. Mental space is acquired soon after to deal with others, need-gratifying objects, environment, and boundaries of psychological self. The environment, others and the self soon start to exert influence on the reactions and responses from children and adults and as a link between self and environment is by action (or verb function) such as an infant crying/or trying to communicate because of some outstanding need. The relation of objects within the environment, others within the society with respect one's own self starts to play a part in dealing with the physical space, reality and relationships.

Most species deal with modules of sophisticated knowledge and acquire it to make life easier. Like nature itself, knowledge exists in all textures, sizes and forms. Human senses that operate in real and physical space offer a very tiny glance of a much more intricate and sophisticated universe of knowledge that can be sensed by perception and resolved by programming/mathematical tools. To deal with reality and its use in the knowledge era, the structure of knowledge needs careful adjustment, alignment and association, especially if it is to be deployed in computational environment.

The recent changes in the Internet age are catalyzed by gating functions in the silicon chips and wave mechanics of photons in the optical fibers. This unprecedented synergy in silicon-based computation with glass-based communication has elated the human thought to new levels of intellectual activity and scientific exploration. The mental processes still hold an

almost mystical execution of neural programs to mould concepts, knowledge and wisdom with learning, behavior and adaptation.

Even though thought processes are associated with neural space, the computational processes are associated with physical and Pentium space. These intermediate linkages bridge reality and physical spaces with the human psyche dealing with objects, their actions, interactions and their effects. Human beings have learned to cross these spaces readily by mind control, a "flick of will" or a "twinkle in the eye," a gesture of the face, etc... Such fine processes are hard, if not impossible to program in the software of social machines. However, the connectivity of the mind with the machine can be established by controlling the noun-objects, their verb function, their convolutions and timings. These four entities make up the computational space as the mind would alter them in the psychological space to accomplish any social function or process. The social machine would alter the status of the noun-objects and their entropies accordingly. Thus the machine in a limited sense track, can follow and duplicate the mental and psychological processes of a human mind.

II. THE COMPLEXITY OF KNOWLEDGE SPACE

Knowledge space is staggeringly more complex than physical space. The order of complexity becomes at least fourfold since every noun-object (n), verb-function (v) and their combination ($*$) is unique, further-more all three depend on the X , Y , Z , t , coordinates in society and culture. Hence, it is necessary to limit the size of *kuantum* (i.e., a quantum of knowledge) to "sensible" size and to be practical. Initially, it can be limited to most useful noun objects (such as a human being) and verb functions (such as what is the action). Two examples follow. In a down-to-earth format, a *kuantum* of knowledge can be stated as (food (n), eat (v), restaurant (x, y, z), date and time (t)). At the other extreme, a cosmic *kuantum* can be stated as (space-ship A (n), explore (v), coordinates-Planet B (x, y, z), cosmic calendar date and time (t)). The need to be practical and limit the programming complexity, it becomes a necessity to deal with kuantized knowledge within the realm of computation. Even so, the content of the knowledge so gathered (i.e., the food eaten in the restaurant or the data collected by the space ship) is not communicated. The flow of the entirety of knowledge needs more numerous smaller *kuanta* (kco's) to be complete by the global *kuanta* of knowledge (or KCO).

However, there are two sides to this process. *First*, a given noun-object NO_1 initiates an action or verb-function VF_1 in a certain fashion or convolution $*_1$ generating a *kuantum* of knowledge ($NO_1, *_1, VF_1$). *Second*, this *kuantum* is directed towards another noun-object (including one's own self) or NO_2 that responds with an action or verb-function VF_2 in a certain fashion or convolution $*_2$ thus

generating a response or reflective *kuantum* ($NO_2, *_2, VF_2$). Numerous *kuanta* of knowledge (ranging from a few to many millions or billions) make up a minor *module* of knowledge kco or a major KCO, thus altering the status, kenergy and kentropy of NO_1 and of NO_2 . Knowledge energies are thus altered in the knowledge domain via a "medium" of words and language over specific durations of time. The movements of *kuanta* start to assume highly unique wave patterns of their own thus generating a "signature of interactive behaviorism" between NO_1 and NO_2 .

Time plays a significant role. The earlier three types of *kuanta* for NO , $*$, and VF , all vary with time since a time freeze of anyone will alter the other two. It appears that the *kuantum* of knowledge¹ (*kok*) has a life of its own depending on the triadic interdependence of any of NO , $*$ or VF on the other two. In a sense, these three entities act as organisms with a molecular formula for compounds such as bicarbonates, nitrates, chlorates, or other organic molecules of carbon, oxygen and/or hydrogen group, or of an acid with free hydrogen atoms to react with a base with free a hydro-oxyl pair. The propagation of these types of *kuanta* in any medium of language is structured and tightly coupled thus generating a module of knowledge in each sentence that makes sense in the mental space.

A. Physical Space And Mental Space

1) The Physical Space (M, L, T , and μ)

The basis of most scientific measurements is founded on the real properties of physical entities, i.e., mass (M), length (L), time (T) and the nature of the object which is related, one way or another, with its character of other objects. The most fundamental of the objects (as it was conceived earlier) is the outer space with its own electromagnetic/electrostatic properties, i.e., μ_0 and ϵ_0 , related by the velocity of light held firmly fixed the Michelson-Morley experiment [2] and attested by the writings of Einstein [3].

The length can, however can be measured in various coordinated systems ($xyz, r\theta\psi, r\theta h$, etc). In the rectangular systems, two (x, y) and three dimensions (x, y, z) offer representations of planar or cubic spaces. Essentially, $M, (x, y, z, \text{coordinate space}), \text{time and } \mu_0$ designate a reasonable physical system for single point representations. Yet again, objects are not points and force whereby action takes place, are not lines. Mass being represented as inertia and force being represented as torques offers a little reprieve for reality of the

¹ The symbol *kok* denote a kuantum of a microscopic body of knowledge (*bok*) and symbol *KoK* denote a kuantum of a macroscopic body of knowledge (*BoK*). We are still at a loss to identify one universal kuantum of knowledge (unless it is written as $(vf*no$ or $no*vf$) for all bodies of knowledge.

objects undergoing events and actions that twists and turn knowledge centric objects (*kco*) in the real world under the influence of verb functions from one *kco* or the other in real life. Newtonian representations become ineffective in social space, but when coordinated with mental space the two representations blend space in mind as numbers in mathematics.

2) *The Mental Space (Who, What, When, Where, Why and How)*

Mental space is firmly stood on the answers to seven fundamental questions of the existence of (almost) all objects; why, who, what, how, where, when and how long. The mental space is filled with rationality that ties the answers to these six

questions in an orderly coherent, consistent, and cogent fashion. In tying the answers to be relatively insensitive to the effects of time and social setting, we submit that the computational space to track the mental space to contain the answers to (at least) three most variable answers to who?, what?, and how?. The answers to the other three questions, when, where and why modify the answers to former questions but in a more rational and predictable way.

For example, the answer to the question why is generally found by tracking what is being done to the motivation and the deficit need of the doer. Similarly, where and when are frequently resolved by (*x, y, z, t*) coordinates of the doer.

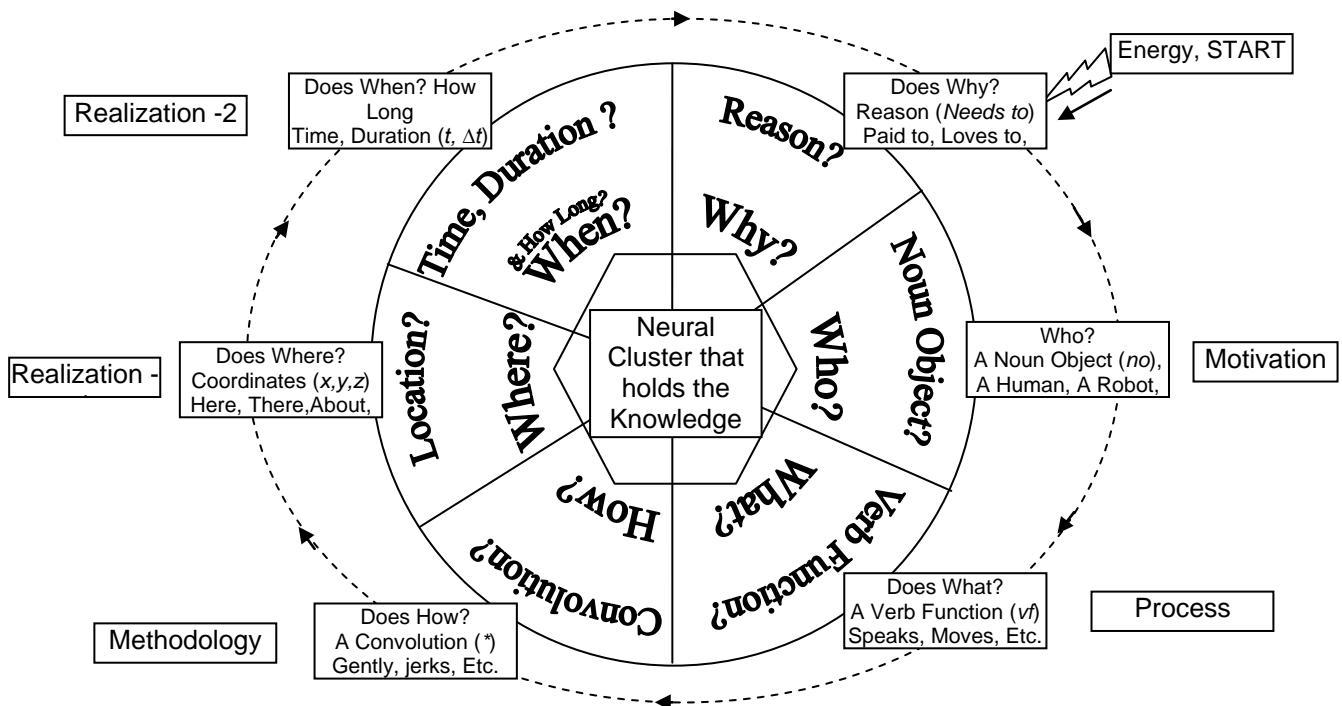


Fig.1 A suggested portrait of the mental coordinate system of a knowledge element *kel* that presents a mental imagery by completing a circular path by answering the (seven) basic questions about anything that has happened, happening or will happen.

In Table 1 the knowledge generated ΔK by each of the noun objects NO_i or no_i , verb functions VF_j or vf_j and their convolutions $*_j$ are presented. Knowledge and need gratification become linked every time any noun object does anything at any place and at any time. The association between (noun) objects (who), verb functions (what) and their convolutions (how) get associated with needs (why) in the mind of infants and adults alike. Such mental associations can be reworked in computer systems like telephone numbers are worked into switching systems that provide channels of communications in networks. A scientific model becomes essential and mathematical relationships become necessary to optimize the chain of need(s), action(s), response(s) to gratify such needs. More than that, in a social setting, the socially acceptable norms play a part and culturally variable factors make the programming of social machines more

demanding than the programming of plain old scientific computers based on already optimized mathematical algorithms.

In an attempt to establish a scientific model for the machine and to offer valid results, the correlation between reality of the physical world and the machine symbols is necessary. A series of such correlations are presented in Table 1. Noun-objects, convolutions, verb functions and timing instants and durations are manipulated in the social processor units (*SPUs*) of the machine like data, numbers and strings are manipulated in central processor units (*CPUs*).

B. *Reality And Its Mental Portrait*

Objects (*no*'s), actions (*vf*'s), their interplay (***'s) and timing connect the physical space with the mental space. The human mind retains a trail of what happened (*vf*'s) to and from what objects (*no*'s), how

what happened did happen, and the way (*) it happened, the instant of time (t) and the duration over which it happened (Δt). A snapshot relating the four (no , *, vf , t and Δt) entities is thus rendered in the mental space. If the duration can be derived or deemed unimportant, reality is portrayed as a four-dimensional object in mind.

A series of these real events occurs routinely, and the mind participates by interjecting more actions and/or follows events in the physical space. The mental space in the memory elements of the machine is updated accordingly. Three spaces (physical, mental, and social) participate in the overall process, and fourth overlapping space mapped in the computer memory, emulates the change via social programming in tracking these changes in the time dimension. A representation of these four hyper-dimensional spaces is shown in Fig. 2.

The methodologies from existing (physical, mathematical, social and computational) sciences offer sufficient ground space to construct a more comprehensive science of knowledge that crisscrosses all these disciplines. Numerous strides have been documented. The physical and mathematical sciences have the most rapid pace of expansion. Computational science being more recent has a shorter course with notable contributions from Knuth [4] and Aho [5]. Social sciences though much older have their origin in philosophy, humanities and religion. However, human needs and their structures, though as old as the species itself, have a scientific methodology based on the classical work of Freud [6], Jung [7] and Maslow [8]. The seven layer need pyramid eluded by Ahamed [9] incorporates the most recent trend of the Internet age humans searching the worldwide knowledge banks (Level-6) and to attempting to unify (Level-7) whatever they find into the mainstream of activities.

In an optimizing and predictive mode, the social machines alter the parameters of physical, mental and social spaces to make the discrete time transitions optimal and energy efficient. Although the programming can be different for the numerous social settings, these new generations of machines can offer solutions based on the universality of values and ethics around the globe. Such solutions are generally not unique for a particular entity in a particular social and cultural setting for a particular problem at hand, thus offering the final optimizations and creativity to the individual. For example, a computer offers a string of numbers for pi that is normally nine digits long working in single precision mode and a string of seventeen digits for researchers operating the computer in a double precision mode, and so on.

III. THE TRANSMISSION ASPECTS OF KNOWLEDGE

We present a theory akin to the transmission theory of electric signals in physical and electromagnetic domains. Some of the EE tools from transmission theory can be borrowed to

explain the nascent-flow properties of knowledge. Some of the techniques from wave propagation theory are borrowed to explain the (x, y, z, t) properties of knowledge flow. They can isolate the resistive and distortive properties of the social medium, especially when the media has a storage (memory) and discharge (suddenly release) properties. For example a knowledge bank can keep certain news items stored for a length of time and then suddenly publicize the item hiding critical information or in a distorted perspective.

In addition, out-flow of knowledge energy from a source does not deplete its energy nor it is dissipated; instead, it is continually changed (distorted, enhanced, or transformed) into new knowledge forms. In a sense, it exhibits some wave properties of electromagnetic propagation waves wherein the electric and magnetization vectors become time and space dependent. In the knowledge domain, the composition and constitution of noun-objects, the verb-functions, and their convolutional structure all get modified and transformed depending on the location (x, y, z, t) in the social media as a "wave of knowledge" passes by. This phenomenon is also prevalent as sound waves travel through air and aqueous media, or as light is refracted/reflected at the boundaries of air and glass, water and glass, etc. Properties of social spaces and the time dependence start to gain significance but the mathematics and relationships become obscure due to the complex structure of knowledge *kuanta* composed of *nos*, *vfs* and *s.

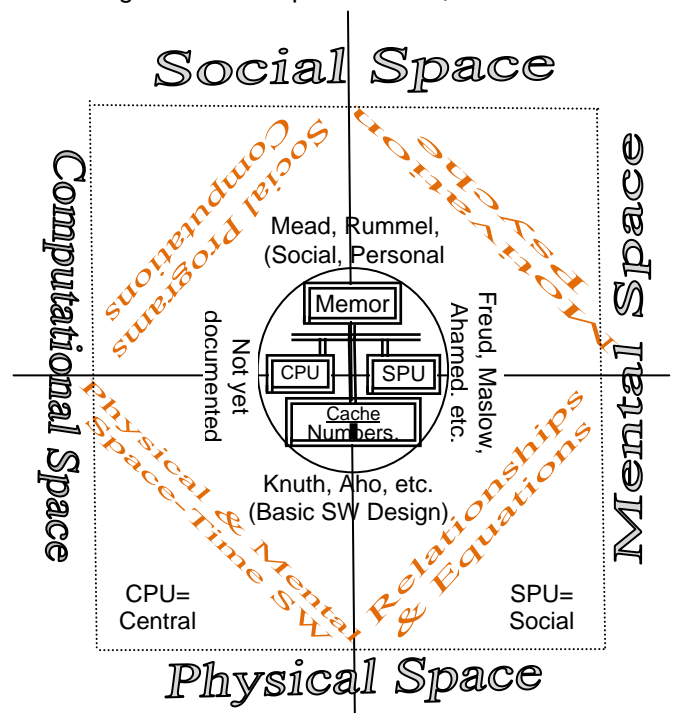


Fig. 2 Depiction and interconnectivity of the dynamic distances in the physical, mental and social spaces by programmable steps in a social machine to track, design, predict, and optimize social processes. Solution of most energy efficient (or least painful) solution to social problems is also feasible. In the design mode when a global problem in a given social setting, is posed, the machine blends the solutions of many cultures and lists the pros and cons of each

solutions and blends them optimally to find the “best” solution if one or more “objective function(s)” are defined.

Table 1 Six Basic Questions (who (W_1), what (W_2), when (W_3), where (W_4), why (W_5), how (H)) and Knowledge Generated (ΔK)

	Effect of Convolution(s) and the Gratification of the Deficit Need (WHY the action WHAT took place)	
WHY(W_5)/ REASONS	Any deficit need of the Source Object(s)	Element of Knowledge; $(\Delta K)_1 = (NO_1 *_{1} VF_1)_{t1}$ VF_j or vf_j in turn gratify the deficit need of NO_i or no_i
WHO (W_1)/ OBJECT(S)	NO_1 or no_1 ; NO_2 or no_2 ; NO_3 or no_3 ; NO_i or no_i ;	Element of Knowledge; $(\Delta K)_2 = (NO_2 *_{2} VF_2)_{t2}$ VF_j or vf_j in turn gratify the deficit need of NO_i or no_i
WHAT(W_2)/ VERB(S)	VF_1 or vf_1 ; VF_2 or vf_2 ; VF_3 or vf_3 ; VF_j or vf_j ;	Element of Knowledge; $(\Delta K)_3 = (NO_3 *_{3} VF_3)_{t3}$ VF_j or vf_j in turn gratify the deficit need of NO_i or no_i
HOW(H)/ CONVULVU- TIONS (*)	* ₁ * ₂ * ₃ * _j	Element of Knowledge; $(\Delta K)_i = (NO_i *_{j} VF_k)_{ti}$ VF_j or vf_j in turn gratify the deficit need of NO_i or no_i
WHERE(W_4)/ LOCATION(S)	Location (x, y, z) Coordinates of Object(s)	At the exact physical location(s) coordinates of NO_1 or no_1 ; NO_2 or no_2 ; NO_3 or no_3 ; NO_i or no_i
WHEN(W_3)/ TIME 't'	Time 't' coordinates of the Object(s)	At the exact time coordinates of NO_1 or no_1 ; NO_2 or no_2 ; NO_3 or no_3 ; NO_i or no_i

However, there are two sides to this process. First, a given noun-object no_1 initiates an action or verb-function vf_1 in a certain fashion or convolution $*_1$ generating a *kuantum* of knowledge ($no_1, *_1, vf_1$). Second, this *kuantum* is directed towards another noun-object (including one's own self) or no_2 that responds with an action or verb-function vf_2 in a certain fashion or convolution $*_2$ thus generating a response or reflective *kuantum* ($no_2, *_2, vf_2$). Numerous *kuanta* of knowledge (ranging from a few to many millions or billions) make up a module of knowledge thus altering the status, kenergy and kentropy of no_1 and of no_2 . Knowledge energies are thus altered in the knowledge domain via a “medium” of words and language over time. The movements of *kuanta* start to assume highly unique wave patterns of their own thus generating a “signature of interactive behaviorism” between no_1 and no_2 .

A. Signal Flow In Conventional Circuits

In this section, the flow of knowledge is based on the flow of electrical signals. Currents, distributions of voltage, power, and energies in

electrical systems and circuits are well documented in electrical engineering and physics. Knowledge flow refers to the flow of information and knowledge, distributions of knowledge potential, knowledge power and kenergy, in social systems and media. Knowledge science is not as highly evolved. Limited parallelism exists in the two systems and the concept of series elements and shunt elements can be imported from electrical systems into social systems and the flow of knowledge can be estimated.

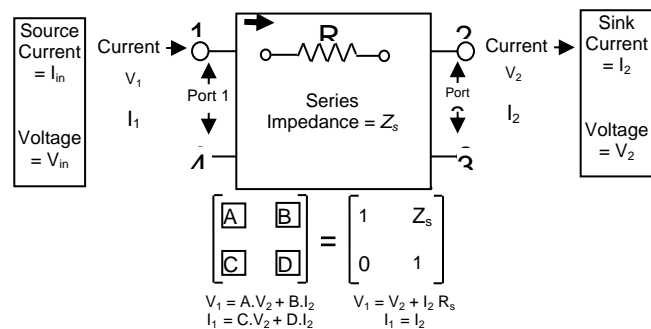
Whereas analysis of electrical circuits (such as transmission lines, passive filters², ladder-circuits, dividers, etc.) is based on fixed parameter values, the analysis of knowledge flows should include the variations of these parameters based on (x, y, z, t) coordinates. Even though the analysis is

² Active circuit analysis also assumes fixed transistor parameters. However, when circuit components such as varactors (voltage dependent variable capacitors, [11]), or saturated inductors (with non linear B-H characteristics, [12]) are present, these circuits can exhibit different but computable change in behavioral characteristics of systems.

complicated, it is programmable based on the updating of the resistive, inductive and capacitive coefficients are based on location (household, society, culture, place, nation) and time (past, current or future) coordinates. The worldwide knowledge banks do indeed portray the moods and their variations in most social environments.

1) *Signal Flow Elements in Simple: Series Elements for Signal Flow*

Two basic types of elements exist; the series and shunt elements. In the simplest of cases, the equations for signal flow can be derived by voltage-current equations embedded in Kirchhoff laws. The basic equations for the two port electrical network for series impedances can be written as:



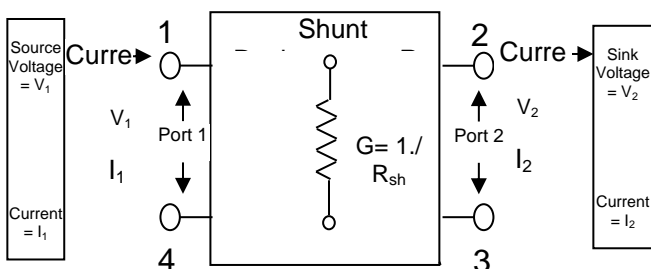
The arrow indicates variable character of the elements due to high currents

Fig. 3. Series resistive element for flow of Signal from Port 1 between terminals (1 and 4) to Port 2 between terminals (2 and 3).

2) *Signal Flow Elements in Inductive and Capacitive Elements for Signal Flow*

In context to the signal flow in electrical systems, inductive and capacitive elements can occur in series, parallel, or any combination thereof. Depicted in Fig. 3 and 4, these elements can bring about serious effect for the flow of signals. Fortunately, the nature of these elements has been studied by physicists, electrical engineers, and mathematicians. Since they respond to the rate change if current and voltage, they can give rise to "resonance" in circuits and systems. In the knowledge domain, such elements can be responsive to rate of change of knowledge rather than the amount of knowledge in a complex KCOs.

3) *Signal Flow Elements in Simple: Shunt Elements for Signal Flow*



The basic equations for the two port electrical network for shunt impedance shown in Fig. 4 can be written as:

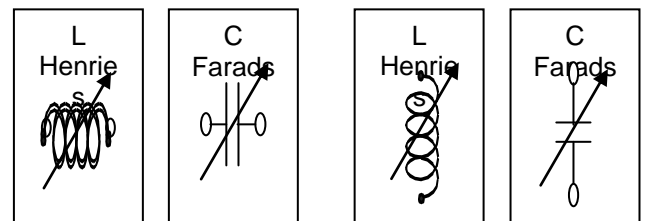
$$\begin{bmatrix} A & B \\ C & D \end{bmatrix} = \begin{bmatrix} 1 & 0 \\ G & 1 \end{bmatrix}$$

$$\begin{aligned} V_1 &= A.V_2 + B.I_2 & V_1 &= V_2 \\ I_1 &= C.V_2 + D.I_2 & I_1 &= V_2 G + I_2 \end{aligned}$$

The arrow indicates variable character of the elements due to high currents

Fig. 4 Shunt resistive element for flow of Signal from Port 1 between terminals (1 and 4) to Port 2 between terminals (2 and 3)

Electrical elements influence the flow of power and alter relations between voltages and currents. The exact relations and equivalent impedances are documented in most textbooks in Electrical Engineering and Signal Flow Theory [10] and for this reason, we go to the next section and determine their equivalencies for the flow of information and knowledge in social media.



(a) Series Reactive Elements

(b) Shunt Reactive Elements

The arrow indicates variable character of the elements due high magnetic or electric intensities. Such non-linearity's are sometimes exploited to alter nature the overall circuit response in cases such as voltage regulators or frequency dividers or even lightning arresters

IV. FEEDBACK AND STABILITY OF KCO'S

This social media can attenuate all three (*v*'s, *n*'s and *s) components of knowledge. Typically found in non receptive audiences and sleepy class rooms, the social media does not dissect the knowledge enough to find its beginning or the end. Any output from the resistive media would be at a lower power level (*Knowls*, a suggested unit for the knowledge power). The effect of this type of media would be loss of information and knowledge from the source. For example, if a high resolution image is projected on a low resolution screen, or seen through a translucent glass, objects, and their relationships become dim, dull and fuzzy. Such images and bodies of knowledge (*BoKs*) are soon forgotten if they are not reinforced, restored, replenished, or in some cases reincarnated structures, monuments, books, and religions fall victims in the passages of time.

These social elements (e.g., campaign staff, news editors, special-interest groups, etc.) can willingly and wantonly distort the relationships between nouns (n 's), verbs (v 's) and their convolutions ($*$'s) at any instant of time. They affect the most crucial features by altering the convolutions ($*$), combinations and sequencing of verbs between the nouns. Though it appears as a slip of the pen, the damage to the original *BoK* is done. When conditions are at their worst, these elements in resonance with the timings of v 's can cause a short circuit (series resonance) and completely choke (parallel resonance) the flow of (significant and trustworthy) knowledge and information.

For example, Mao's blockage of distribution of Scriptures [13], Bush's blockage of Guantanamo-prison coverage [14], the News blackout during Middle-East Conflict [15], Nixon's refusal to release of the White House tapes [16], etc., are examples of radical changes in the knowledge-flow brought about by unworthy elements in the social networks. In the knowledge domain, the abuse of power corrupts the pristine knowledge space. Truth gets replaced by deception, love by arrogance and virtue by hate. Conversely, truth can be reinforced by desirable social agents that make "truthful" information to accompany the original flow of beneficial knowledge.

The properties of the media dictate the amount, and distortion of knowledge through that particular social media, or the flow of current and power for the signal-flow through active electrical circuits. In addition, these elements project the media characteristics on the v 's and n 's and can completely decouple the convolution processes. The effect is too common in practice. For example, any biased news and TV media under dictatorial rule, the political and advertising campaigns, the

sales pitch of shady salespersons, the word of hypocrites, etc. carries such the proof of attenuation, distortion and dispersion of knowledge further and further from its pristine nature encompassing truth and nothing but the truth. A dangerous situation in the society is portrayed under these conditions.

One additional complexity for the knowledge flow is the presence of active elements (equivalent of transistors and operational amplifiers [17] embedded in electrical circuits) in the social media. These elements readjust their characteristics based on the knowledge (signal) that is flowing through the elements. To some extent, they resemble the intelligent agents in AI programs to monitor and control environments [18]. In the real world, such elements distort the truth in knowledge and bring in bias in society. For example, the casualties of allied force in war are brought to the headlines, and the casualties of other side are quietly ignored, the victories of war are exaggerated by the media for the sole purpose of gaining popularity. The cruelties of the allied forces are pushed to last page; the failures of the Federal policies (against drugs and Marijuana) are quietly forgotten soon, etc. It needs to be investigated if willful contamination of pristine knowledge by social media and elements to deceptive and corrupt knowledge should carry the same penalties as the charges for financial corruption by officials and employees.

A. Conventional Power, Energy And Entropy

In this section, we extend the analogy between signal flow and knowledge flow by using the ABCD matrix (for signal flow) and A-I matrix (for the knowledge flow). Consider the case of signal flow. The process can be identified by the Fig. 5.

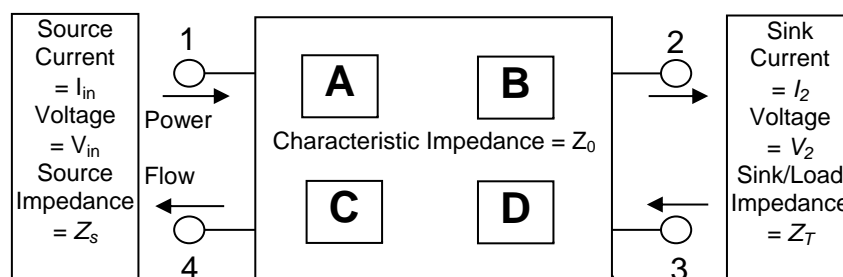


Fig. 6 Representation of a two port electrical network to transfer signals and power from any source with source impedance of Z_s to any sink/load with its own impedance of Z_T through a medium of characteristic impedance Z_0 .

The ABCD matrices are generally held constant during simulations, even though they vary slightly from transmission event to the next. When averaged over numerous events and over many network configurations, the received signal shapes are satisfactory enough to yield very low bit error rates.

B. Flow Of Electrical Signals And Power

Fig. 5 depicts a simple electrical signal path for the flow of *signals* that are embedded in the (magnitudes, wave shapes and harmonic phase relations between) voltages and currents as they flow from the transmitter (at the left) to the receptor (at the right). In the absence of noise and random events that alter the three characteristic [ABCD]

matrices for the path, the propagation distortion(s) and delay is totally deterministic.

The methodologies are completely algebraic, and almost every variation of the signal can be traced, computed and predicted [19]. In most practical applications, the transmission systems cannot be completely shielded from the effects of random events that may interfere with the preservation of signal through the medium. In these situations, the mean and variance of the random events (such as noise, lightning, and even component variations) are computed and the margin of error is reduced to tolerable levels. Generally, digital systems offer much desired robustness for the entire system and are used extensively in almost all signals, their preservations, measurement, and monitoring.

In most knowledge systems, the public media for the transmission of information/knowledge is highly variable and random. The usual techniques of coding, measuring and monitoring the S/N ratios, equalization, etc. will assume a very different flavor. For this reason, a self-learning error correction methodology becomes attractive. Largely, human-beings adopt this practice. For example, when a criminal suspect is identified, the police will

concentrate on the prior clues left behind by the criminal and try to identify such clues. In the same vein, when a type of cover up has been used in the social media (such as hiding the evidence of corruption, bank records, Swedish bank accounts, etc.) then the humanist machines will over sample events to find out repetitions of clues for similar actions, misrepresentations or even slander. Suspicious activity deserves a greater investigation by human beings and machines alike. In computer science, embedding and priming intelligent agents (IAs) [20] serves the same purpose. Such agents learn from the prior behavior of the system and act predicatively to rectify the impending disasters when initial clues are detected.

When information/knowledge passes through a corrupt medium, the receptor system would attempt to rectify the nature of the “verb functions” or v 's, the nature of the “noun objects” or n 's, and/or the nature of the “convolutions” or $*$'s in the body of knowledge or BoK received at the receptor. Such precautionary safeguards are quite human and definitely transferable in the knowledge-ware of humanist machines.

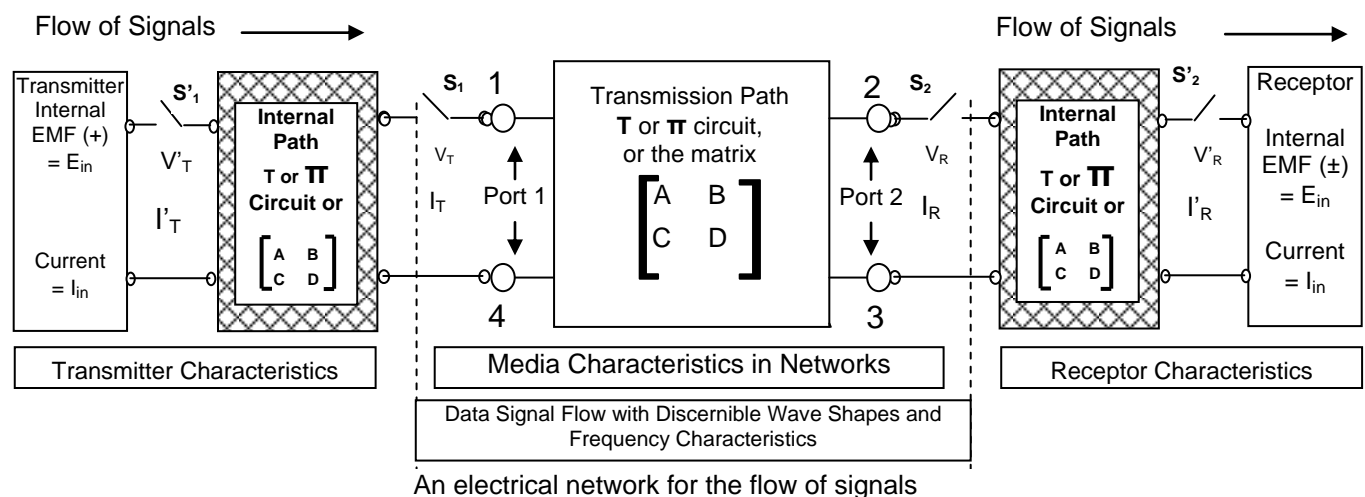


Fig. 7 Flow-path for information bearing signals through wired media. For the wired paths the T or π approximations are generally used. For the wireless, the field analysis techniques are generally used. For fiber optic medium both solutions yield convergent results. The computation of signal wave shapes and power transferred from transmitter to the receptor provide accurate (enough) results to predict the robustness of the signal transmission. Probability of errors does exist but it is sufficiently low. Most back-bone and global network communication systems have statistical bit error rates as low as one bit in 10^5 bits received through metallic media systems and as low as one bit in 10^8 or 10^9 bits received through fiber optic media systems.

V. KNOWLEDGE DISTORTIONS IN SOCIAL MEDIA

Society exists because of the capacity to communicate. The deformation of signals communicated is typical of most communication systems. This fact is inevitable. The audio-visual face to face media has been pretty much replaced by electrical pathways, electromagnetic, wireless and fiber optic media since the days of Marconi, Bell and Tesla. Social media and social elements are forever present making social networking carry dual implications; first the physical media brings its own

delay and distortion characteristics and second the human elements have their delay, distortion, decay and disordering characteristics. These impairments cause misrepresentation, inaccuracy and twisting of the original information present in any body of knowledge. The magnitude, phase and ordering error introduced can be extremely serious about the extent of making of the received information almost chaotic.

Pristine information has distinctive parameters. These parameters of knowledge have structure and order like the voltages and currents in electrical

systems that can be measured, adjusted and calibrated. Knowledge has a theme, foundation and a set of equations that govern its flow and its' potential. Specific body of knowledge rests on a structural relation between a key-group of knowledge centric objects (KCOs) and the current forces in the society to alter such KCOs and the structural relationships between them. Such an activity can cause incremental changes in knowledge, however, localized they may be. To track the changes we can fall back on the communication of v 's, n 's, and $*$'s, through a social media characterized by its own nine-element A-I matrix written out as follows:

$$\begin{bmatrix} \mathbf{A} & \mathbf{B} & \mathbf{C} \\ \mathbf{D} & \mathbf{E} & \mathbf{F} \\ \mathbf{G} & \mathbf{H} & \mathbf{I} \end{bmatrix}$$

When an S_1 (machine, organization, society, government, etc.), with a socio-metric potential injects a body of knowledge BOK_1 at the input of the medium to be transmitted to another individual or a structure S_2 , then the

retracted body of knowledge is BOK_2 is generated at the output. However, degradations and distortions may occur much like the degradations and distortions that occur during signal transmission. In the algebraic methodology [21] that relates input and output electrical signals, the relation between the two bodies of knowledge can be written as,

$$BOK_1 = \text{Social Media Characteristics From 1 to 2} \text{ times } BOK_2$$

The "times" operation should be considered as a convolution rather than the matrix multiplication. The exact laws for this socio-metric convolution still need to be derived. In the simplest of cases, if the only non-zero elements in the [A-I] square matrix A, E and I are each 1.0; then the numerical multiplication is applied for "times" and all the v 's, $*$'s and n 's get translated from BOK_1 to BOK_2 . The active verbs (v 's), operations ($*$) and the embedded noun objects (n 's) are related by a matrix equation.

$$\left\{ \begin{array}{l} \left[\begin{array}{l} \Sigma v's \\ \Pi (*'s) \\ \Sigma n's \end{array} \right]_{kco-1} \\ \left[\begin{array}{l} \mathbf{A} \quad \mathbf{B} \quad \mathbf{C} \\ \mathbf{D} \quad \mathbf{E} \quad \mathbf{F} \\ \mathbf{G} \quad \mathbf{H} \quad \mathbf{I} \end{array} \right]_{1-2} \\ \left[\begin{array}{l} \Sigma v's' \\ \Pi (*'s)' \\ \Sigma n's' \end{array} \right]_{kco-2} \end{array} \right\} dt$$

Case 1. Generic and instantaneous snap-shot for knowledge flow from $kco1$ to $kco2$ over an infinitesimally small interval dt .

$$\left\{ \begin{array}{l} \left[\begin{array}{l} \Sigma v's' \\ \Pi (*'s)' \\ \Sigma n's' \end{array} \right]_{kco-1} \\ \left[\begin{array}{l} \mathbf{A}' \quad \mathbf{B}' \quad \mathbf{C}' \\ \mathbf{D}' \quad \mathbf{E}' \quad \mathbf{F}' \\ \mathbf{G}' \quad \mathbf{H}' \quad \mathbf{I}' \end{array} \right]_{1-2} \\ \left[\begin{array}{l} \Sigma v's' \\ \Pi (*'s)' \\ \Sigma n's' \end{array} \right]_{kco-2} \end{array} \right\} \begin{array}{l} \text{finite} \\ \text{duration} \\ \Delta t \text{ or } \Delta T \end{array}$$

$\Delta t = \int_t^{t+\Delta t} dt$ or $\Delta T = \int_t^{t+\Delta T} dt$

Case 2 Integrated representation of the matrix representation in Case 1 over a discrete interval of time from t' to $t'+\Delta t'$ or from t' to $t'+\Delta T'$.

The science of knowledge processing is still in infancy compared to the science of signal processing. It becomes a challenge to accurately evaluate the parameter [A-I] in the knowledge domain, even though the [ABCD] can be computer very accurately by measuring the properties [R, L, G and C] for wired media or the μ and ϵ for wireless media. However, we fall back on the intuitions of Bell, Edison, Marconi, or Tesla as they were evaluating the wired and wireless media during the late nineteenth century for communication of voice encoded as electrical signals and wave shapes.

Cascading of numerous segments of transmission media has evolved from rigorous mathematical discipline that preserves the attenuation and dispersion properties caused by individual segments in a media chain that may have significantly different characteristics. The methodology for cascading is quite generic, and it can be used in a large of variety of applications. In essence, if the methodologies can be transixed in the knowledge domain, much of deception and misrepresentation of information and knowledge can be (and will be) removed. Social values will be quite accurately safeguarded by machines. We present these methodologies in the last two section of this Appendix.

For signal processing and the power flow calculations, cascading is a process of multiplying the individual [ABCD] matrices of each segment to get one overall composite [ABCD] matrix for the complete flow-path. In general, the composite matrix for the entire path carries the effect of each individual segment due to the multiplication rule for generated composite matrix. This identity is accurate for the wired media. In the knowledge domain, when the channel of communication is strictly confined (e.g., the White House media office, or corporate public office, a university spokesperson, etc.) then the *BoK* at the termination can be strictly monitored by appropriate personnel.

When there is no control on the media (typical news agencies, community centers, gossip engines and junk broadcast services, etc.) severe distortions and dispersion of the original *BoK* can be expected. For example, the reporter's bias is embedded in the report however well-disguised it may be. Al Jazera's reporting of recent settlements can be quite different from FOX or CNN media reporting (if any) of the same incidents and activities in the occupied regions. Perhaps the dumbest logic circuits can outperform better than biased intelligent human systems. Preservation of truth and accuracy based on logical deductions will be a desirable machine feature.

VI. FLOW OF INFORMATION AND KNOWLEDGE

Fig. 7 depicts a transmission path for the flow of knowledge through social media. Typically, the well-intentioned media (e.g., universities, welfare and charitable organizations, churches, etc.) promotes and amplifies the social and ethical values that have a lasting impact on society. Neutral media promotes facts in perspective. Biased media generally promotes the self-interest groups (SIGs) that fund the media. Such activities do leave a smelly trail behind or a smoking gun, both of these can be covered up by the same biased media. Even for humanist machines, the compensation and correction of bias and corruption in the media would need considerable knowledge-ware intelligence and effort.

In many cases even the most powerful humans turn vulnerable and the downward spiral of cover-ups (e.g., Nixon's White House tapes and transcripts (early 1970s that lead to his resignation before impeachment as a President of the United States), Clinton's Monica Lewinsky affair (1998), etc.) continues. Machines do persevere and the machine knowledge thus generated is likely to get more preserved than the human voice that can be suppressed. The role of (unbiased) social machines does become more persuasive.

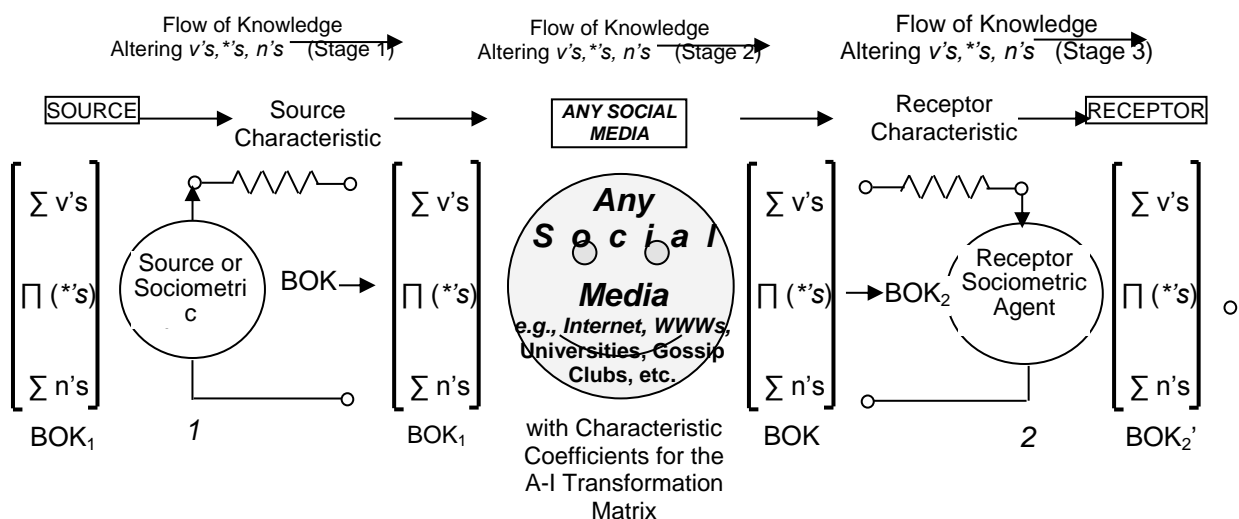


Fig. 8 Flow path for information through social media. For regimented paths (such as the military and corporate management), the chain of command ascertains accuracy and freedom from errors. When the social values and

ethics tolerate deception and misrepresentations, the social media can (and does) introduce self-beneficial omissions and falsifications. This practice is too common to be ignored. Numerous news agencies and news agencies carry incomplete or biased information tending to favor personal gains and self interest. For example, the source socio-metric agency can well be a dating agency that only emphasizes its success stories without indicating average rate of failures or disgruntled couples. As another example, the State Department briefing agencies always tends to present the war stories (however false they might be) of the current President.

However, machines being slaves of humans can be programmed, to play an exactly opposite adversarial role. The role of well-secured ethical and unbiased knowledge-ware (KW) in machine does offer hope. After all, the teaching of Buddha inscribed in Asoka-pillars have carried the same message for centuries. Computer memories are more transitory by design than human values inscribed in Scriptures.

The DDS and LoC offer two widely accepted directions in the subject matter classifications. These two frameworks of classification do not specifically address the concerns of individuals and societies in dealing with knowledge ranging from junk and spam knowledge to the most profound aioms of eternal wisdom. For the reason of classifying knowledge for the masses that encounter ordinary lives as ordinary individuals attending to ordinary duties, we classify knowledge in three (1, 2, and 3) directions as we have classified wisdom. *First*, consider the direction of absolute wisdom based on Aristotle's truth, virtue, and beauty (TVB) and label the direction as 1 (one). *Second*, consider the direction of wisdom of the knowledge society based on science, economics, and technology (SET) and label the direction as 2 (two). *Finally*, consider the direction of (negative) wisdom of the evil society based on deception, arrogance, and hate (DAH) and label the direction 3 (three). The volume integral (in directions 1, 2, and 3) of the knowledge base generated should be zero and the surface integral (in dimensions 1 and 2) should be infinite, however curved this surface might be. Most individuals fail to maximize their growth in directions 1 and 2, while minimizing it in direction 3 in their personality.

VII. CONCLUSIONS

The basis for treating knowledge as an energy centric entity is explored in this paper. Knowledge can exist in an abstract state in many forms in human mind, as words on paper, in computer or as irrelevant gossip. These forms of knowledge do not have any significance until the content is processed to suit the situation. Context becomes essential to gain a scientific grasp, and the context is bounded to trap the enclosed knowledge. In this mode, the contextual analysis yields the shape and nature of knowledge centric objects and around these objects. Thus knowledge can be assembled in an orderly and scientific fashion. Content and context both become equally important.

In the long run, stagnant or highly altercating knowledge does not serve beneficial human or social purpose. However, cohesive and flexible knowledge molded around individual and social needs and

circumstances can greatly benefit individuals and society. The laws of fluid knowledge mechanics are thus linked to the flow heat, electricity, signals and binary bits in electrical and electronic circuits. An overall scheme of establishing the basis for flow of knowledge based on knowledge potential difference, the resistance to knowledge and the natures of source and recipient knowledge(s) is thus evolved in this paper. Active circuits with embedded transistors offer a basis for evolving knowledge flow in dynamic and intelligent social networks.

Since knowledge has existed for many eons before science had ever evolved, we fall back upon two sets of axioms or truisms based of human observation and experience about knowledge and its structure; and also upon physics, thermodynamics, electricity and economics to find the final pathways and mechanics for the flow of knowledge. The confluence of many disciplines thus governs the dynamics of knowledge.

The principle of conservation of energy in the knowledge domain should be deployed with appropriate caution and care. Psychological, emotional, physiological and spiritual energies are significantly apportioned, enhanced or depleted by sentiments and feelings. Hence, the routine procedures of energy balancing (from conventional sciences) become inaccurate and get misplaced in dealing with human beings who may initiate "actions" or v 's on themselves or on other noun objects, n 's or KCOs. This delicate balance is time and situation dependent but a close study of prior decision making processes can be embedded in the machines emulating human actions and behavior in knowledge machines.

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