The Relationship between Spiral Dynamics and the Gell-Mann Curve

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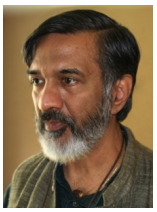

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I had a very enlightening conversation with scientist Dr. S. Naranan who works in the area of cosmic energy and particle physics, but also bends his considerable intellect towards linguistics. He is part of a duo – Balasubramanian and Naranan, highly respected researchers who have published several papers on linguistics. The two papers in the journal *Quantitative Linguistics* discuss complexities of language and entropy. I was intrigued by the discussions and wondered if we could map Spiral Dynamics (SD) on to the basic principles enunciated by them. This discussion helped me get a greater insight into the systems equivalents of the V-memes. The Gell-Mann formulations on the idea of effective complexity are compelling since he discusses “complex adaptive systems” at great length in his papers and presentations. It was very tempting to speculate on the usefulness of trying to map SD on to the Gell-Mann curve. Sharing my understanding, that is as yet very tentative and formative, may be helpful to readers of *Integral Leadership Review* and the SD community.

In the paper “Entropy, Information and Complexity” *(V.K.Balasubramaniam and S.Naranan; A Handbook of Quantitative Linguistics; Edited by R. Kohler, G. Altmann and R.G. Piotrowski; 2005; Chapter 61 pages 878 to 891; Walter de Gruyter, Berlin.New York),* there is a description of the Gell-Mann curve. This looks at the relationship between entropy and system complexity. The following is an excerpt of the discussion of entropy as well as of the well-known empirical formulation by Gell-Mann (I quote from their paper):

Introduction

The concept of entropy was introduced in the study of thermodynamics and statistical mechanics almost a century-and-a-half ago. Even in the early stages, its possible relationship with information was vaguely recognized. In his mathematical theory of communication, Shannon… postulated entropy to be related to the quantity of information involved in the process of communication. Through coding processes in binary notation, entropy could be generalized to systems that were partly random and partly ordered; such systems have associated other useful entropies with them. A higher order entropy called Gell-Mann entropy, seems to be a common feature of several complex adaptive systems, such as language discourses and DNA sequences of biological organisms.

Early applications of entropy in physical systems were for statistical mechanical systems in equilibrium; isolated systems with no exchange of energy or matter with the environment. These systems obey the second law of thermodynamics with entropy never decreasing but tending to increase to a maximum value. When these conditions are relaxed, we get open or dissipative systems that show order on larger scales (macroscopic order). This is seen in phenomena such as Benard thermal convection (which shows ordered cellular structure) and Belusov-Zhabatinsky reactions (which display many regular geometric features). The emergence of orderly behaviour at the edge of chaos in several phenomena is typical of non-linear dynamics where the usual increase of entropy and disorder is replaced by a decrease of entropy and emergence of larger-scale order under some conditions.

The connection between physical entropy and information-entropy is probably much more than just an analogy, though all the ramifications of this connection are not yet clear. Future studies will hopefully clarify this deep and challenging philosophical question.

Gell-Mann’s Characterization of Complexity

Gell-Mann, Bennett and others have noted one aspect of complex systems that is of great interest. These systems, sometimes called complex adaptive systems, are neither fully ordered like a crystal, where the constituent atoms or ions are arranged in a regular crystal lattice, nor fully random like the molecules in a gas at equilibrium. In a crystal, if one knows how to characterize a unit cell, a large crystal, which is ~10^9 times bigger along the rectangular coordinate axes *x, y, z,* can be easily described as a repetitive unit having 10^9 units cells along each axis. There is no size-dependent difficulty in describing a system with a larger number of constituents or orderly structures. In the same manner, for a gas at equilibrium, each cm^3 volume with a huge number of molecules is like any another cm^3 volume. In some sense, there is no great addition or increased informational requirements describing the larger volume in terms of the unit cell chosen. But for many practical systems of interest, like language discourses of DNA sequences, the increase of information with size needed to describe a large collection is quite unlike that of a crystal or a gas in terms of a coarse unit cell of macroscopic (not molecular) dimensions.

A simple prokaryotic cell (cell without a nucleus) may have ~4000 genes, while a human being has ~40.000 genes in each cell. The number of different cell types and variety of different organisms on the evolutionary scale increases as the number of genes increases. These types of systems, which scale up in observed complex behaviour are, according to Gell-Mann, of high *effective complexity* and have been described qualitatively by behaviour sketched in Figure 61.2. While crystals and gases at low and high entropy ends have near zero complexity, systems that have both part orderly and part random behaviour have a higher effective complexity, or *Gell-Mann* complexity.

Balasubrahmanyan / Naranan (*Quantitative Linguistics and Complex Systems Studies; Journal of Quantitative Linguistics; Vol 3 No*

3;1996, p. 177) have quantified this concept. They treat Gell-Mann complexity as an entropy characterizing system with a lot of information organized according to regularity (i.e., order introduced by rules), as well as randomness. In language, order is represented by syntax, context, and coherence, whereas, randomness is reflected in the freedom of choice of words (especially c-words). Shannon entropy deals with the whole message as a macroscopic whole without taking into account the organizational features that make up the message. Gell-Mann complexity is a parameter that separates complex adaptive systems, with a lot of inner organization, hierarchical components, etc., from simple systems with only the same repetitive constituents present in large numbers. The major advantage of this separation is that several systems of great practical use, such as language discourses, DNA sequences, bibliographic listings of scientific literature, and many other evolutionary schemes fall into this category and their detailed characteristics can be explored from a unified systems point of view.

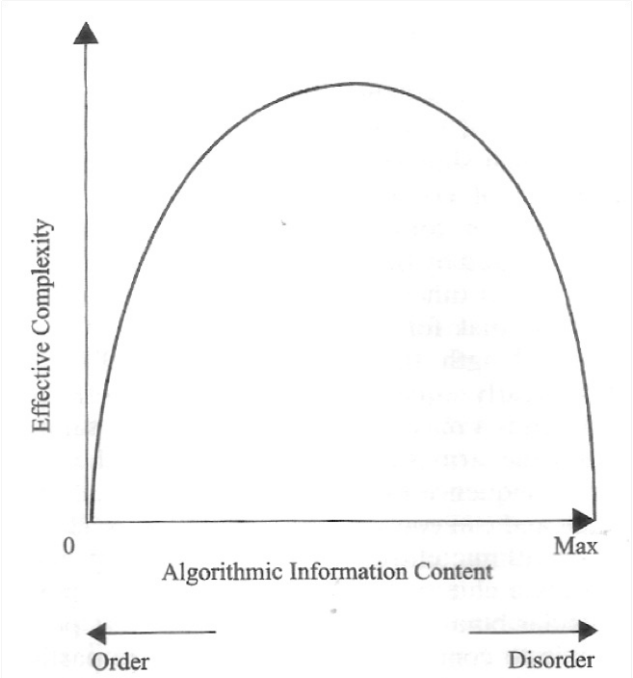

Fig. 61.2: A schematic showing that "effective complexity" of a system is maximum at an intermediate value of "algorithmic information content", between extreme values of 0 (for ordered system) and 1 (for totally disordered system).

Figure 1: Gell-Mann Figure 61.2

Balasubramaniam and Naranan also look at the way words are disturbed in usage. They apply some of the ways in which entropy is understood by examining characteristic patterns of natural languages.

I was curious to see if the various levels of the Spiral Dynamics fit into the curve, so I had a detailed discussion with Dr. S. Naranan. One of the key ideas that Dr. Naranan emphasized was that the world as we know it is an outcome of "regularities and accidents". "Frozen accidents" determine the path of evolution. A frozen accident is therefore something that folds itself on top of the underlying bed of highly ordered events and creates a new phenomenon. Every level of complexity therefore has intended and unintended consequences.

I explained the basics of SD to him. I then proposed the following logic and took the liberty of seeing each V-meme as a sytemic level:

> One, the difference between self expressive – Red, Orange, and Yellow, and self-sacrificing Purple, Blue, and Green can be compared with high entropy/ disorder and low entropy/order creating systems.
>
> Two, the nature order/disorder of a system would be reflected in the number and degrees of freedom of the repetitive elements that compose the system. In human groups these can also be seen as "cultures". We can look at cultures as the nourishing ground that enlivens certain types of behaviours. I am suggesting that the "Standard Normal Person (SNP)" in a "Purple System" would have a smaller range of personal choices to act from than a person in a "Red System". Further, the SNP of a "Blue System" would have more choices than if she were in the "Purple System" but less than the "Red System". These elements and the way they interact would be subjected to a "grammar" that characterizes the behaviour of the people who create that culture through their interactions. This would therefore also be reflected in the language they use. A Clan language would therefore use words that are more uniform and have less idiosyncratic meanings, than an Arena.
>
> Three, the "include and transcend" principle would mean that for higher-level systems V-memes in the spiral would correspond to greater complexity. They would have more regularities, i.e., motifs and models in dealing with the environment, be more capable of spotting ineffectiveness in deploying of these motifs and models, as well as making improvements in them as a whole system. "Bhoomaan" is a term used in the Upanishads. It means both "sustaining and greater than". It has a sense that is similar to include and transcend, but in a counterpoint sense of being more foundational and therefore capable of sustaining. Blue Systems, for example, can sustain Clans and Arenas that have a

coherent ground.

I also attempted to describe each level with systemic descriptors as well as the metaphors that we (users of the Existential Universe Mapper [EUM] developed by Ashok Malhotra – *http://intgralleadershipreview.com/4977-feature-article-leadership-in-indian-corporations-through-the-sdi-lens*) use to refer to the levels. I am assuming that a person familiar with Spiral Dynamics integral (SDi) would understand these terms without much explanation. Our classification is derived from Ashok's early work with the Gravesian approach and his own research. It broadly corresponds with SD but has a few differences. The main difference lies in our looking at the EUM as a range of "notes in chord" and not as discrete descriptors. Therefore, any person or a whole system is a unique set of "V-meme propensities". Also, the evolutionary directionality and a consequent idea of one level being "better than" another is something we stay away from. With this preamble, let me give you our parallels.

Purple – Clan – *Congealed Monoclonal systems*

Red – Arena – *Multivalent chaotic systems*

Blue – Clockwork – *Closed hierarchical systems*

Orange – Network – *Purposive interlinked systems*

Green – Ecological – *Complex symbiotic systems*

Yellow – Integral – *Coherent self-designing systems*

Cultures that can be described from the outside with fewer independent variables would be less disordered. For example, a Purple-Clan, would require a fairly simple description of its "Standard Normal Person" (SNP) as well as a few rules that define this person's choices (degrees of freedom), i.e., the algorithm that would describe the set of behaviours that the substratum would support. Thus we can compare the system types to cells and organisms.

The Red-Arena would have as many SNP as there are weapon/ technology skill types, and each of them would be making choices based largely on their internal needs and drives. The algorithm to describe such a system would have many variables. Blue-Clockwork systems would have a more complex SNP, as well as greater range of choices, but a much less elaborate algorithm that describes it than an Arena. This system is therefore less ordered than a Clan, but also be of higher Effective complexity than both the Purple-Clan and the Red-Arena. Orange-Network Systems would have nodes that characterize the SNP, and since each of these nodes would act in consonance with a set of other nodes that they are linked with, we can postulate that their disorder will be less than the Arena, but the system will be a ground for the less "Effective Complexity System" like the Clockwork, which in turn houses the Clan (be more "bhoomaan"). As we approach Yellow-Integral systems, we will reach closer and closer to the apex of the curve (See Figure 1). Thus, we reach an optimum for organizing a group of people with various technological capabilities, but with a growing depth of interdependence.

In my discussions with Dr. Naranan it emerged that we could map these systems on to the Gell-Mann curve as follows:

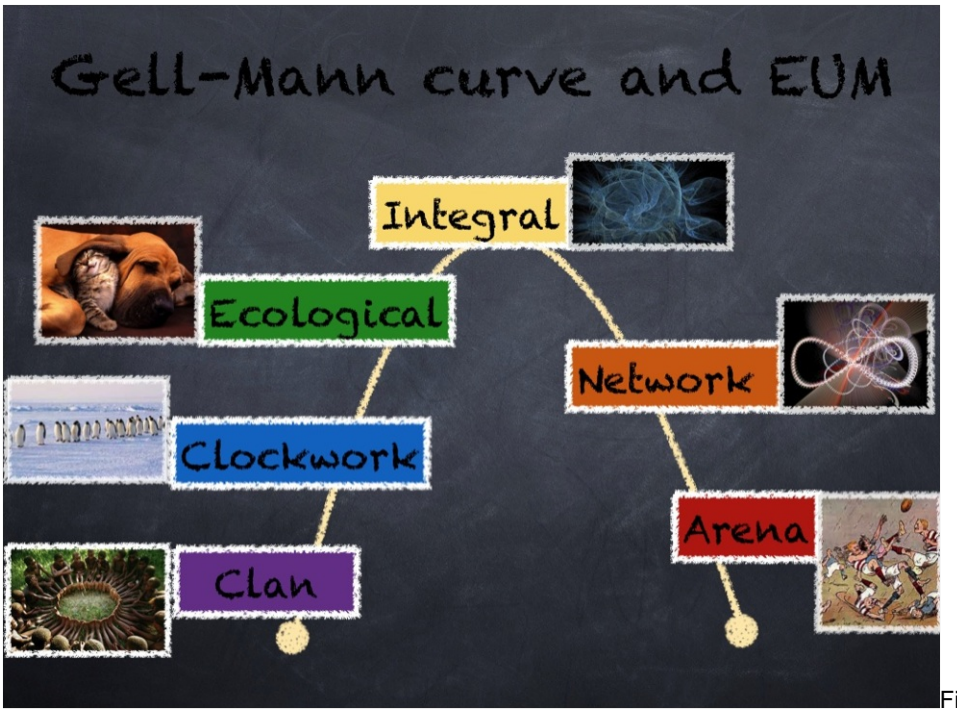

Figure 2: Gell-Mann Curve and EUM

This mapping opened some interesting possibilities for me. Firstly, that Green-Ecological ought to be a stable platform and a viable stage in human development. Perhaps our "high entropy" habits of orange along with the "mean green" and "boomeritis" tendencies are blinding us to understanding a world that is a stable, mutually supportive, and sustainable platform for the emergence of "tier two" systems. Perhaps this type of system is as hard to create and sustain as the movement to Blue-Closed systems.

I was also left wondering to what extent the political and economic structures of the "Dharmic Civilization" are "Green-Ecological" Systems. They certainly seem so to me. I have argued in my paper (*http://integralleadershipreview.com/339-exploring-what-is-indian-a-parable-and-a-discussion*) that what we see today in India is an uneasy and tense relationship between traditional ideas of

Dharma and modern ideas of structure and control. In its present form it is held within communities and is guarded, therefore, looking like “Purple-Clan”. The work of Rajiv Malhotra, Ashish Nandy, and Sudhir Kakkar would also suggest that a focus on balance and stability has been a strong foundation of the Dharmic Cultures. This would imply a pull to the “order/ low entropy” end of the Gell-Mann curve (Malhotra; Kakkar). Looked at from the Western perspective, this would seem like a “purple shift”. Thus, the tendency to pathologise the Eastern community based socio-political and socio-economic systems would kick in.

Similarly, looking at the Western from Eastern eyes would tend to have a “red shift”! Would the Dharmic Cultures be able to create stable “Green-Ecological systems”? Would green in these cultures be less prone to “mean green”? Many of the older Buddhist systems established in the reign of Ashoka reflect an ecological anchor of social coherence where the spiritual “Integral-Yellow” had a great space for movement and action.

> Beloved-of-the-Gods, King Piyadasi, speaks thus: There is no gift like the gift of the Dhamma, (no acquaintance like) acquaintance with Dhamma, (no distribution like) distribution of Dhamma, and (no kinship like) kinship through Dhamma. And it consists of this: proper behavior towards servants and employees, respect for mother and father, generosity to friends, companions, relations, Brahmanas and ascetics, and not killing living beings. Therefore a father, a son, a brother, a master, a friend, a companion or a neighbor should say: “This is good, this should be done.” One benefits in this world and gains great merit in the next by giving the gift of the Dhamma.
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> (http://www.cs.colostate.edu/~malaiya/ashoka.htm)

Another question that arises is: is it important to differentiate the systems beyond Yellow-Integral before we discover a stable Green-Ecological? All these systems will occupy a narrow band at the apex of the curve. The “transcend and include” principle implies that the functional aspects of *self-expression – self-preservation* and *community – reciprocal altruism* start converging with each other and therefore achieve a *self-system simultaneity* in thought, feeling, and action. The warm and cool colours are two sides of the same coin at this level.

Perhaps the pull towards a stable collective will be higher in cultures where individuation is not given a high value, like many Asian cultures that value belonging more than they value individuation. Perhaps, the worlds beyond this level will be sub-systems that behave in “Integral” ways with other subsystems while individuals within these sub-systems continue to evolve through the first tier states. This is a feature that can be seen in large “Joint Families” in India that still manage many businesses. Individuals respond to “outsiders’ within a fairly rigid and well understood range of responses that they are certain will fall within the responses that every other member of the family will own up to as their own. However, within these families, a fair amount of latitude is given for individual differences. The more gifted help support and lead the less gifted share the benefits that accrue from the belonging to the larger family equitably.

If systems tend to grow and evolve so that they move closer and closer to the apex of the Gell-Mann curve, then human evolution will also move towards the Yellow stage where there is an optimal balance between complexity and entropy. The apex of the curve also signifies a greater sustainability, “a quality that is not purchased at the expense of the future-quality of human life and of the environment”. (Gell-Mann)

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About the Author

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