Behavioral Aspects of Organizational Learning and Adaptation

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In this paper, I seek to understand the behavioral basis of higher organizational learning and adaption as a teleological dynamic equilibrium process to decipher the underlying psycho-physiological aspects of individual cognitive learning related to organizational adaption. Dynamics of cognitive learning has some differential paths within the neural circuitry which follows certain patterns that leads to individual as well as organized evolution in course of a learning process. I undertake a comparative analysis of human cognitive and behavioral changes and the active mechanisms underlying animal behavior and learning processes to understand the differential patterns of these adaptive changes in these two species. Cognitive behavioral learning processes have certain economic perspectives which help an individual to attain efficiency in workplace adaptation and in learning which however, the individual when being part of an alliance, ember positive influence on the society or organization as a whole. Comparatively, in primates, I review some empirical evidences drawn from chronological studies about cognitive behavioral learning process and adaptation as well as the presence of the capacity of making attributions about mental states, which exists in rudimentary form in chimpanzees and apes. Following this, I apply the outcomes of the findings on different aspects of human cognitive and adaptive behavioral learning-induced evolutionary changes and how human beings are able to exploit the presence of these additive advantages under cluster settings.

Keywords: Animal behavior, cognitive economics, motivational energy, neural adaptation, neuroscience, Organizational learning, organizational adaptation, teleological process

1. Introduction

System: "An ordered arrangement of physical or abstract entities."

- D.J. McFarland

Organizational adaption is attributable to changes in both its adaptive environmental externalities and its guided functional derivatives. Organizations change because human intentions, desires and goals change. Following synchronized change in actions these changes are almost invariably brought about by some conjugated pleiotropic innovations in learning, information acquisition, its perceptual understanding supplementary to its application, and its continual rational adaption owing to interoceptive conditioning in response to the interactions among the external environment and the internal milieu. Most, if not all of these changes, are induced by *learning*- whether observational, or in the course of logical training. Human learning in consequence and by itself is self-motivating; as human actions are driven by

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Any remaining errors are mine.

heteromorphic polar motive forces deliberated for innovation and skill acquisition. Contrarily in animals, learning is observational, isotropic, non-polar and non-motivated, without a need for correction of errors and encouragement for success. This is the reason why the intention of one who finds through evolution that, there is petite or no innovation in nest building by birds which is although, its innate behavior (a bird may build her nest but will never reinforce that with concrete bricks, slabs or mortars) tend to be adaptive through evolution in its innate behavior to its natural habitat. This analogously may be referred to the agents under the frames of organizational settings, where, a better understanding of *why* and *how* organizations change would require an inquisitive mind to search for some deeper sympathetic considerations of the underlying behavioral, psychoanalytical and socio-physiological aspects of changes in human cognitive system. A further stride into superior understanding would require explicating the principles of neurological basis of homeostatic changes in the human physiological environment brought about by interactions of the external milieu with the internal environment, of what enduring changes do learning bring on (through innovations in evolution of neuropeptides, or simply, by training of memory). As such, and in this title, understanding the dynamics of human behavioral actions still remain one of the most fundamentally intriguing and rewardingly motivational subject matter of analysis among behavioral neuropsychologists, economic theorists and social scientists to this day. The interests have grown in leaps and bounds as new *theories of mind* and about *origin of behavior* have been brought up-front. Several aspects of human behavior and behavioral learning based on teleological principles have been explained by Cayla (2008) with special reference to the process allied to the dimensions of organizational adaptations relative to changes in human behavioral learning.

In this paper, I investigate these causal transitions that human beings undergo in their intellectual conceptions and try to understand the behavioral foundations of cognitive changes on account of learning process. Learning process is distinct from random change. It is an organized and ordered change in the human cognitive system. Evolution of behavior of a learning system is a path dependency process which brings about some permanent changes in the cognitive system. This induces changes in human intellectual comprehensions and cognitive perceptions. Questions that are of central in importance to the understanding of behavioral adaptiveness as well as of factors that determines the characteristics of human behavior, have been extended to the sub-domain of primates, non-primate vertebrates and invertebrates in order to decode the comparative nature and specific forms of animal behavioral patterns as well as to understand human intelligence in evolution by comparing it with that of other species (Lorenz 1950). Previously and in particular, social transmission of acquired behavior in vertebrates has been defined by Galef (1975) while Keverne (1992) underlined primate social relationships, their determinants and consequences. Unfortunately, man has no immediate cognitive neighbors who possess functionally equivalent conditional states of cognitive equilibrium, since, the ability to respond to second-order relations are lacking in non-primates. However, the capacity of making attributions about mental states, which exists in rudimentary form in chimpanzees and apes, do not directly qualify this primate specie as our cognitive neighbor, albeit in evolutionary sense, this may mean so to some extent. Thus, measuring the efficiency of intellectual equipment of a species relates to the ability to respond to representations of various items and there exists no formal methods by which to interrogate a nonverbal organism, say, a bird or a cat. Animals in effect, lack the ability to respond to relations between relations and relative associations between items and objects. However, several aspects of observational learning skills have been identified in primates through the growing use of training programs to teach language to primates (chimpanzee, apes) with some success, and in non-primates(rats, pigeons etc), with no success. Developments in cognitive neuroscience and the neural mechanisms underlying evolution in communication, social interaction and behavioral learning have come a long way since Veblen's introduction of teleological principles underlying evolutionary process.

Thornstein Veblen (1898)stressed on teleological process of learning; the importance of human intentions in evolution as his well-marked teleological principles which represents intentional goal oriented learning process, a move away from the strict Darwinian analogy. Garrouste's (2007) however considers both dynamic equilibrium and evolution as complementary in his concept of dynamic equilibrium where, $\Delta \frac{ds}{dt} = \vec{e}$ the dynamic process, which is individualistic behavioral learning process aimed at evolutionary adaptation. Veblen's teleological principles were based on a system's evaluation of the relation between its intentions and its behavior where, intentions may be expressed as goals. It is important to connote that certain actions are required for perceptions which are determined by the specific nature of goals. Hence, goals are required for actions and so also, actions must be performed to achieve those goals. So, actions and goals tend to be complementary in this sense. Evolutionary adaptations are primarily driven by the need for change although change is a constituent of continued evolutionary process which is self-motivated, and is driven by alterations in human intentions determined by changes in habits of thought. In modern evolutionary analysis, teleological aspects of human behavior that define the magnitude of human actions and intentions in evolution have gained much momentum when defining the origins of behavior (Cayla 2008). I try to relate this concept to the theories behind *why* and *how* organizations change which is an interesting topic for pursuit among theorists and practitioners alike under the realms of New Institutional Economics. Organizations adapt and change from the consequences of functional intentions of human beings which contemporaneously adapt and change. These changes are on account of adoption and acquisition of new process techniques, new information and innovation in human capital (Mac Cormack et al. 2007, Ricceri and Guthrie, 2007).

In business firms and organizations, the primary form of intangible resources (Amit and Schoemaker, 1993) include structural resources which are knowledge owned and embedded, human resources which are work driven employee knowledge, experience and skills, and positional resources that include image, brand and its other relational externalities. Since human capital forms the core part of any organization, be it of business, society, institute, group or union, any changes in individual and collective behavioral processes exert forces of change on the part of the organization to adapt. As do businesses and products which evolve from the need for change in response to changes in preferential consumer requirement patterns and desire specifications, continual learning about changing environmental externalities fills the gap between equilibrium and evolutionary process of organizational adaptation. Learning is an organized change and the results of learning lead to a process of permanent changes in behavior as an outcome of environmental interactions affecting both individual and organization behavior. David Cayla (2008) in his paper enumerated the dynamics of cognitive learning patterns of organizations which preliminary aim at two non-trivial aspects; one is goal oriented- that is, what organizations should do, and the other focusing on fitness and adaption or process oriented-which is, how they do? Since learning is a dynamic process, it follows some determined trajectory based on rules which modifies its outcome. Under stable agent behavior, learning is determined by rules that do not change, and which lead to results that can be predestined. Hence, it is possible to foresee the outcome of learning processes which has some bordered rationality inside ex ante determined trajectory under stable agent behavior, without changing the rules of the moving process.

It is worth noting that organizations thrive to adapt continuously to external conditions as well emphasize on internal hierarchical decisions for change. Hence, organizations persistently tend to balance the learning process between equilibrium and evolution. My goal in this paper is to engage in these topics for a theoretical discourse and to discuss several facets related to the behavioral aspects of organizational learning and adaptation and hence, understand the employee-management behavior cycle in terms of organizational evolution. This paper is structured into three centralized sections followed by a conclusion. In the first section, I provide a background review of settings to be based on informative analysis to understand why and how organizations change matted on the backdrop of teleological principles. In continuum under this section, I envisage the neuro-behavioral theory of organizational evolution with a deeper understanding of the processes that underlie evolutionary behavior of the learning systems. Following this, I underline the conceptual dynamicity of organizational adaptation through a model conception to understand agent behavior heterogeneity in organization structures from simple mathematical point of view. Then, I perform a deductive analysis of the economic implications of comparative learning methods in agents to interpret the adaptive changes in human intelligence and its applications under organizational settings. In introspection, I provide explanations on what organizations can learn and the effect of learning on genes as well as the expositions of agent adaptation processes by theoretical understanding of the interactions between teleological learning process, the environment and genes. I also try to delineate how organizations can associate and extract meaningful representational information from animal behavior, since, learning from animals on how they compose sequences and interpret those causality exemplifying schemas may provide some original observational schemas which would be probable to apply under organizational surroundings. During this discourse, even if in theory, I find strong evidences that some familiar yet relevant form of organizational structures exists in both primates and invertebrates on ethological context. In significance, I provide a short description of my communication to narrate all my findings followed by a concluding remark and scope for further research on these subjects.

2. Background Review

To gain an overall understanding of the depth and breadth of this subject matter which is- organizational adaptation through learning, it may require going beyond the established routes of entangling the comparative aspects of cognitive learning and social behavior in human beings and the animal kingdom. This paper is based on purely multidimensional evaluation of a single process-*learning*, as well as its investigational form of implications as a basis for comparative analysis of the principles underlying cognitive and behavioral learning process modifications in both human and primates with some special reference to job holders or, agents. It has been established that some form of primordial social organization skills exists in non-human primates and other animals from time immemorial (Lorenz 1950) which has undergone little alterations. For example, the mechanism by which bees encode about the location and quantity of a food (honey) relative to its hive in its dance which a second bee decode. This is an example of general representation capacity of non-primate species that recognize representations of various conditions. Evidence of pro-social behavior in primates have been elucidated which is an interesting topic among social ethnologists and animal psychologists. Several methods are being adopted to interrogate a nonverbal organism by employing social cues. Chimpanzees and apes have been able to acquire words and learn by social cues based on repetitive practice on composite instructions where they able to recognize representations of their own behavior or behavior which they have observed in others. They do this by composing causality exemplifying schema on their own. However since they do not possess any instinctive language learning abilities similar to humans, their processing time in learning instructions, comprehension and production using social cues is awfully time intense. Contrarily in humans, it has been assumed that syntax for learning language is built into the nervous system from antiquity, as well as the capacity to reason something special (Dulany, 1962). It has also been observed that although nest building activity by birds is a complex task which is their innate behavior, they lack problem solving and discrimination capacities. Human beings on the other end possess high degree of transitive reasoning processing strategies on account of higher memory capacity utilization. One may refer to Griffin (1976) and Beer (1992) for classic representations of these phenomena within the domain of cognitive ethology.

A. Evolutionary Process and its Impact on Agent Behavior:

There are numerous factors that determine agent behavior in the evolutionary process of learning to achieve goals. With heterogenic agent behavior, path trajectory of a learning process depends on rules set by routines (Feldman 2000). As long as rules tend to remain unchanged under bounded rationality, specified actions are required to achieve goals. However, a system's behavior as well as the learning process may be affected by the environment in which goals determine actions of a moving process, which in turn, determine a system's behavior. Thus, goals modify a determined trajectory of a moving process under dynamic equilibrium. Systems as such, learn to understand the reality of the environment to reach its goals. However, rules change in an evolutionary process brought about by the interaction of a system with the environment, so as do goals whilst in the interim, affect agent's behavioral causality which is a function of time. To consider pragmatically, there is a definite interrelationship between intention and behavior which relates actions to the effective behavior of a system. To consider analogically, goals in animals related to the obtaining of food, care of the body and offspring(s), repulsion of a predator, their nesting behavior and their mating behavior are all considered to be their innate behavior which have tended to remain little affected as a consequence of evolutionary process. However, it is difficult to ascertain whether tool-using behavior in non-human animals is a purely innate behavior or evidence of learning and intelligence (Goodall 1970). If that is the case of a result of learning, then one may conclude that evolution have a net positive effect on agent(s) behavior as a corollary to adaptation which is a state of homeostasis, explicitly to quote, only when homeostatic environment is reached, adaptation is possible.

B. Neurophysiologic Basis of Behavioral Actions: Cognitive System

Behavior may be expressed as a series of movements and postures on account of continuous stream of effector events (Bently & Konishi, 1978). Behavior actions are as such collection of reactive patterns which are triggered by a specific external and/or internal stimulus. Then, to consider in terms of neurobiological basis, all sorts of agent behavioral actions are motor in nature modulated by sensory feedbacks to the central patterns. Patterns imply order. This is similar to understanding the basis of neural patterns at the cellular level for control of behavior. The neurobehavioral basis of patterns of movement is composed of postures, rhythmically repeated movements or an episodic movement which is founded on the theory of central pattern generation as a general feature of all rhythmical behaviors where invariant repetitions of patterns lead to specific activation of response systems. As such, two interdependent systems may be identified; one is representative (pattern generation) and the other-functional (neural).Behavioral system thus may be classified into two diverse components- Cognitive science and neuroscience. While the first is based on reasoning, logic application (mind-in-motion) and artificial intelligence development equally applicable in computer sciences, the later represents a more functionally applied form of the former. While analyzing human behavioral system, it is uniformly important to understand the underlying control (both biosynthetic and analytic) theory that links the former with the later. Since all actions are motor actions, determinants of the sequence of motor patterns and factors that precipitates activation of a motor pattern depends on the mechanisms that analyze sensory inputs (see textbox 1. in the appendix).

During the 1970's, D.J. McFarland and others have analyzed several aspects of the neurobiological regulatory systems to understand the constancy (homeostatic) of the internal environment and to establish behavioral links in homeostatic mechanisms. In his seminal paper, McFarland (1970) shaped the mathematical analogy of motivational systems, a concept envisioned from motivational energy theory of Hinde (1960). R.A. Hinde's (1960) energy models of motivation laid the modern foundation of behavioral energetic where he introduced motivational state and the biopotential energy concept. The background was to understand transfer function determination of sensory receptors, where it is essential to take into consideration the energy-transfer models of a system. The brain is considered to be the most active functional unit of a human body or an animal. It is the origin of the central pattern system that analyzes sensory inputs and directs motor actions. Human beings as well as animals expend substantial amount of energy for both motor actions and to obtain information. For human beings, this is in the form of motivational energy. Within the brain, there undergoes massive amount of energy transformation, dissipation and conservation of potential energy and it is vaguely difficult to map such total energy content of a fully developed human brain, let aside energy mapping and energy transductions. This is the subject matter of behavioral neuroenergetics which may be provisioned in the future course of research related to total brain energy mapping in human and primate species to decipher comparative neural energy expenditures in these two species. To be content with the present context of cognitive neuroeconomics, I may quote that motivation is required to obtain information and it is different from stimulus. Then if behavior is considered a function of time based on trials in learning abilities, it might be probable to quantify predictions (without precision) about potential behavior and physiology of a system based on what the system has learned. These energy models of *information acquirement* is based on Brillouin's (1962) negentropy (negative entropy)principle of information which he derived from the Second Law of Thermodynamics ($entropy \uparrow energy \downarrow$) where entropy is a measure of the availability for work of the order within a given system. In the generalization of Carnot's principle, work required to obtain information and the price paid in increase of entropy $>$ information which is gained. To provide an alternate definition of the term entropy as a measure of disorder of a system or randomness, a completely random dispersion of elements corresponds to maximum entropy, or minimum information. McFarland has drawn an example of temperature regulatory system of camels related to water conservation to show the relational characteristics between entropy and energy. In camels, energy dissipation occurs during water conservation. Conservation of water through the reduction of water loss through evaporation results in reduced heat loss and thus, body temperature rises. This means, camels are adapted to arid desert conditions to minimize sweating. Their fine woolly hide insulates the body, reducing heat gain. The camel can also allow its body temperature to rise to 41 °C (106 °F) before sweating at all due to presence of unique protein chaperones which do not unfold under heat stress. This reduces the temperature difference between the camel and its environment and thereby reduces heat gain and water loss by as much as two-thirds. It tolerates extreme dehydration and can lose up to 25–30 percent of its body weight—twice what would be fatal for most mammals. Owing to the peculiar nature of their red blood cell membranes which are viscous that permits swelling which prevent their RBCs from bursting under osmotic stress is the reason why they are less dehydrated. Also, camels are able to store large amounts of fat forming humps. In times of crisis, they expend this fat in the form of heat energy which is dissipated universally over their body. On account of their thick skin coat, they do not sweat and hence their body temperature rises, conserving water while using heat as a function of entropy. This is an example of physiological type of motivation- induced adaptation for survival in animals. Comparatively, if I define the concept of motivation as *'a continual psychological process that drives an individual or an agent to accomplish goal oriented actions in achieving individual potential to fulfill their existential needs and',* then, motivational energy is the force of power of a stimulus that transforms the embedded potential energy in the agent into useful and intentional energy.

C. *Simplifying Teleological Process:*

Teleological learning process is primarily based on the notion of innovation where human rationality and designs of inquest can achieve their definitive purpose of discovering and identifying universal truths. It is thus an intentional, goal oriented learning process. Teleological process still remains a questionable status under foundations of epistemological principles. Any change set to take place in an organization must be based on the notion of goal defined by some definite process. This is to say that there should be some definite benefit of adopting a process to know beforehand what its outcomes could be like, even under most probabilistic terms of sense. However, the indemnity of favorable outcomes cannot be certain, since, it is practically difficult to define precisely general equilibrium in nature. As Laplace once stated that if one has all the complete data about present system, it would be possible to predict the entire future. Nevertheless, a process should help determine and achieve goals if goals fail to define some ultimate process, conversely, goals should help modify a process if that learning process fails to determine or achieve goals. David Cayla (2008) in his inspiring paper states the lack of either one of the above complementary forces of change (goal and process) in both under equilibrium conception and under adaptation, and where, there subsists either goal without process (former) or process without goals (in the later). In this title, I provide a simple model to fill this gap between both teleological learning process and ateleological processes to interpret on the basis of agent behavior that how one may possibly determine the directional component or trajectory of the other. In the course, what I have attempted is to interpret the correct representation of the underlying principles of teleology, albeit, in terms of adaptive economics.

Systems behavior (h) is affected by environment (E_i) with both endogenous and exogenous factors being at occupation. A system's evaluation of the relation between its intentions and its behavior is determined by the stability of representations and perceptions that determines the behavior of the cognitive system. This stability of representations and perceptions are brought about by some permanent changes induced by learning (l) where rules ($R_{t+1)}$ stay in equilibrium ($\Delta\vec{e}$) as long as the cognitive system (C) is unchanged. If the rules ($R_{t+1)}$ are changed contemporaneously, under unbounded rationality$\overleftrightarrow{|B|}$, it would be difficult to ascertain the outcomes (δ) of a learning process. That is to say, that a system which is in dynamic process where rules that direct a process do not change but is ex ante determined, it is compatible with the notion of intention where learning system is limited inside a certain path. Here, the changes in agent behavior are stable which has a definite trajectory, i.e. $\vec{v}$. Teleological process on the contrary is a dynamic equilibrium process which shifts away from the notion of stability of the rules which are determined endogenously. A teleological process may express some diverse moves in an unknown environment where actions determine path trajectory$\overrightarrow{(v)}$ of a learning process with heterogenic agent behavior and are affected by the changes in system's intentions. This is evident from the point of view that changes in agent's behavior determine evolutionary processes which are governed by bounded rationality under classical dynamic equilibrium. Reciprocally, environmental factors also impact agent's behavior during the course of the evolutionary process. To quote without difficulty, teleological process rests on some unbounded rationality principle. This is the reason behind how differential perceptions impact actions of different people under similar circumstances encircling same objectives, similar environment and comparable cognitive limitations. Civically, this is the reason why two communities may act differently in the face of a same disturbance in their environment. And this is the reason why cultures differ enormously across the world under the realms of biocultural evolution which stems from the fact that how they 'train their young?' Uncertainty of the knowledge creation process thus renders it more difficult in understanding the finalities of learning process under unstable rules. But again, it is difficult to predetermine the actions $\widetilde{(A)}$of heterogenic agents ($\overleftrightarrow{h}_{i,j..n}$) when they do not follow dynamic equilibrium. Hence, it is important to integrate agents' subjective dimensions under teleological process. To achieve goals, one needs to perform certain actions, and these actions follow certain procedures or process. However, the path dynamicity of the process trajectory may change in course of evolution to achieve a specific goal. Thus in organizations, conscientious managerial decisions are often bounded by specific strategies related to a specific goal where managerial behavior tends to be an adaptive process that occurs in response to a change in the environment (goals). If the goals (actions) change, it must be followed by some degree of homogenous change in actions (but not goals). So, change in actions induces changes in reactions, since, action is needed for perception which is required to achieve goal. But the question remain, in order to avoid chaos in evolutionary process, what specific actions may be required to achieve specific goals under stable (unstable) environment with homogenous (heterogeneous) agents within (un)bounded rationality, or, contained by irrational boundaries? I may posit here that for the later query, teleological process play some dominant role whilst for the former, it may be possibly conceived that the classical dynamic equilibrium process may apply. There remains subjective argument of whether change in actions help attain similar goals with dissimilar reactions. Learning as such, is a basis for the process of change in organizational behavior, and where, system of innovation in learning induces innovations in organizational behavior. Organizational adaption then is both a dynamic equilibrium process as well as teleological process where its trajectory when founded on a cognitive system of unbounded learning process, is difficult to predict. This is because the finalities of a learning process under teleological principles are difficult to determine. However, under stable agent behavior with bounded rationality, which is a dynamic equilibrium process (guided process), path trajectories may be fixed and where outcomes may be discernible. Under decentralized process of learning in an organization, a team often adapts its collective behavior when it is confronted by new rules that come from the management. Adaptive behavior of the team is then particularly oriented to the new rules as specified with new goals that demand differential actions dissimilar from the prior rules laid down by the management. This may encourage one to undertake a time-dependent study of organizational behavior of how they continuously change and evolve through both adaptive process and guided process by analyzing the nature of routines to implement in order to follow rules. These events account for the important role of changes in collective intentions of the team in the way organizations adapt to a change in their environment. Hence, leadership development is essential which sets routines to be implemented and rules to be followed to achieve goals and actions to be performed by teams in order to reach targets.

3. The Model

In this section, I lay down the basic framework for a simple model of a more complex structure of order to test the qualitative aspects of the explanatory factors of behavioral process related to organizational adaptation. To understand *how* organizations change and *why* they need to adapt, this model simplifies both the teleological aspects of Cayla's (2008) presentation as well the trajectory of the behavioral and the neuroeconomics of learning process under equilibrium. This model thus both subjectively and objectively, correlates to the functions of human elements in industry and under organizational structures. Since understanding organizational behavior is to understand the business goals and philosophies of top executives in a particular organization, the reason behind differential personalities and business organizational dispositions of any individual company or unit is due to differences in reflections of its top management. However, by keeping aside individual dispositions at the bay, the top management de-differentiates their personal traits and grounds on some common goals that sets organizational growth trajectory. This is because in an organizational unit, the rules are laid down by the top management executives who provide vision, and the rules are set to be followed by their immediate subordinates down to each individual team members to reach the same. For if, there are chaos in the top management, this would leave the agents with none but, unconstrained, unfocussed and non-directional perturbations. For that reason, understanding corporate organizational objectives is equivalent to perceiving the top management's vision which is, by far, as important as understanding the dynamics of employee behavior under cluster settings. Herein per se, I present a simple mathematical model to construe some practical issues related to organizational adaptation through learning.

Before presenting the model, I set forward some subtle queries related to behavioral adaption process of learning that may be mathematically deduced, and which I have discussed in subsection A under section II. Under organizational setup, Cardona et. al., (2003) have stressed on two types of learning; *calculative learning* and *evaluative learning*. In this paper, we shall mostly deal with the later, i.e. the organizational implications of evaluative learning. Answers to these queries will help me to fill some of the missing information on the subject. These are, but not limited to;

- How agent's behavior is modified, why and when?
- What factors determine trajectory of a learning process?
- Does trajectory modify the outcome of a learning process?
- How change in rules impact agent behavior and the trajectory?
- When do rules need to change and why do they need to change?

Responses to these queries are directly related to any organizational setting wherein, one may be able to theoretically offer certain propositions in relation to organizational behavior heterogeneity and adaptation. The equation that I propose from the variables described in the above section stands as;

$$\frac{\vec{v}}{s} = \lambda E_i \left[C \left\{ \left| A \right| (l + h) \left| B \right|_j \right\} \right] i_k \left(R_{t+1} \right) \Delta \vec{e} \qquad (1)$$

Where, the variables are defined as, $\vec{v}$ for trajectory, s for outcome, λ signifying bounded constraints, E_i denotes evolutionary process, C indicates the system, $|A|$ signifying actions, l and h subsequently implies the learning process and homogenous agent behavior (which is a function of time), $|B|_j$ containing the bounded rationality, and R_{t+1} stands for rules which are time (in)variant. I place a constant i_k followed by the equilibrium of the system $\Delta\vec{e}$. The equation holds well when all other things remaining constant. The variable λ is trivial and removing it when solving will not modify the overall equation, but it has important implications in the later part. One can solve for all the implied variables to derive equation functions, but I content here with three major variables which would likely resolve the above postulates. First, I need to prove whether change in trajectory $\vec{v}$ would induce changes in homogenous agent's behavior which is, (h) and, under what conditions the trajectory would change.

Definition 1 *Trajectory will only tend to change when rules change which may induce change in agent's behavior where ($\vec{v} \propto R \propto h$) that is, agent's behavior will change proportionately to the change in trajectory that is the effect of proportionate change in rules, where $\vec{v} = R > 0$ or R< 0 so that any change in rules will be absorbed. Under stable conditions, the agents have no preferences.*

This definition leads us to:

Lemma 1 *Let 'h' be the agent behavior and ($\vec{v}$) a function of trajectory and where 'l' be the learning process. We need to solve for agent's behavior from (1) where we need to prove that;*

$$h = (\vec{v}) * \text{ or, } h = \vec{v} \propto l \qquad (2)$$

Proof. See Appendix ‖

To consider empirically what may induce changes in the learning process and how it may modify agent behavior independent of the outcomes to bring on changes in the trajectory, it is important to emphasize the role of actions performed by agents which modify trajectory. Actions performed by agents may be positive or non-neutral whereas, the same may be said of outcomes.

Proposition 1 *Agents behavior to hold good with the learning process that may be modified by outcome, which may again be, positive or non-neutral. To propose that agent's behavioral change may induce equivocal changes in the learning process 'l' where, outcome is non extensive and may be difficult to determine.*

(i) Under constraint, if $h < 0$, then agents actions are one of the following; $|A| \ncong 0$, may be $|A| < 0$, $|A| > 0$ $or\ may\ be\ stationary$.

(ii) Under constraint, if $h > 0$, then agents actions are $|A| \geq 0$, or even may be $|A| > 0$ but, may not be$|A| < 0$.

Let us consider an organization under teleological process of adaptation which is a fast moving, dynamic and headed by some strong, motivated management experts who have some positive vision to move the organization up the corporate value chain. To achieve efficiency in organizational operations, directional disciplines are imposed with rules laid down by these top executives. Now, consider an environment where the company faces some constraints in its businesses related to a downturn, market hyper-competitiveness or cost pressure or, the combination of all of the above three. Again, consider the same company when it has procured a large contract from another partner firm or government, other things remaining constant. Now, the company needs to reorient itself for a new equilibrium where there are new goals or new targets to meet, and new challenges to overcome with unknown externalities. As a consequence, the CEO with the help of Board of Directors (BoD) and top executives will lay down new sets of rules based on new routines to be followed. Now, there are three options left for the agents (employees). They should follow the new rules with positive actions, cede to the imposed constraint or do nothing (where,$|A| = 0$). Hence, under such constraints of new rules, their behavior (h)must change which will reflect in their actions$|A| \geq 0$, and which must be positive ≥ 1 for the organization to sustain, since, the rules (*R*) are now changed. Thereafter, they will have to adapt to these new equilibrium which would call for new knowledge acquisition, technology adoption and innovation in the learning process. As such, there will be some inadvertent change in the learning process. In the first case, the goals remain unchanged, only firm specific changes are required to meet the same target(s). However, in the second case, goals and targets both change. To be noted here, one may find similar constraints in both these cases where, they call for changes in agent behavior(h) and purposefully in their actions$|A|$.

Proof. Under bounded constraints, agent's behavior needs to change, but it is also the last to undergo such adaptation. I need to evaluate what if the rules (R) change by reducing the equation (1) and solving for R.

$$-\frac{v}{s} = E_i\left[C\left\{|A|(l+h)|B|_j\right\}\right] i_k\left(R_{t+1}\right)\Delta\vec{e} \qquad (3)$$

Opening commonalities of the groups (parenthesis), one derives

$$\frac{v}{s} = E_i C\,|A|(l+h)|B|_j\, i_k R_{t+1}\vec{e} \qquad (4)$$

Where,

$$\vec{v} = sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}l + sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}h \qquad (5)$$

Where, outcome will tend to modify the system's adaptation with the environment as a product of actions under dynamic equilibrium that will define the path trajectory, and where again, agent's behavior may change or remain bounded. Then, rules will be defined by,

$$v = R_{t+1}\left(sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}l + sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}h\right) \qquad (6)$$

Where, R_{t+1} is a function of the cumulative proportionate measure of the dependent variable trajectory divide by the sum of all the variables; which signify rules will moderate all other variables and will tend to determine $\vec{v}$

$$\frac{R_{t+1}\left(sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}l + sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}h\right)}{sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}l + sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}h} = \frac{v}{sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}l + sE_i C|A||B|_j\, i_k R_{t+1}\vec{e}h} \qquad (7)$$

Hence, rules will impact the trajectory determined by other externalities under equilibrium where outcome is a product of all other entities. Thus, if rules change, the trajectory will also tend to change which will be influenced by the product of outcome and all other determinants (actions, behavior, learning etc.). Reducing the equation, I derive

$$R_{t+1} = v / sE_i C\,|A||B|_j\, i_k\vec{e}\,(l+h) \qquad (8)$$

For further Proof, See Appendix ‖

Also, rules will remain stable as long as the trajectory remains unaffected, determined by outcome, learning process and agent behavior. If however, the agent behavior turns negative indefinite $h < 0$ with infertile actions$|A| \leq 0$, then the particular management will try in its best effort to impose further limiting constraints on the agents (hh/λ^2)to streamline their actions through training, counseling, reorientation programs and forewarnings, following which, for incumbent agents who continue with their poor performance and marginal productivity, and who do not meet these criteria even after appropriate reconditioning, possibility of layoffs may be in the line. Good managers who know how to manage themselves usually provide context of values within which agents can manage themselves and thus thrive to neutralize the effects of imposed constraints.

Let us then examine the effect of limiting constraints imposed by the management on the agents would likely modify rules as well as the trajectory. The equation I may write after adjusting for ($\vec{v} = v$),

$$R_{t+1} = v/s(h/\lambda^2) \qquad (9)$$

Initial first derivation of λ^2 is

$$s\lambda^2 R_{t+1} = vh \quad (9.1)$$

$$\frac{s\lambda^2 R_{t+1}}{sR_{t+1}} = \frac{vh}{sR_{t+1}} \quad (9.2)$$

Where,

$$\lambda^2 = \frac{vh}{sR_{t+1}} \quad (9.3)$$

Initially,$\lambda^2 = \frac{vh}{sR_{t+1}}$, where, the degree of imposed constrained will be equal to the product of the trajectory and agent behavior influenced by outcome and rules where outcome and rules will modify both trajectory and agent behavior following $R_{t+1} = v/s(\frac{h}{\lambda^2})$, where, rules will be directed by the product of the ratio of v/s on the degree of agent responsiveness to the imposed constraints. Herein now, the rules are bound to be changed since the agents will have to bear the combined impact of all the other modifiers (9.7).

From the first equation (1), the generalized constraint λ is common for all the variables where it implies conditional restrictions related to environmental externalities, system's constraints, and the management imposed constraints, et cetera following in (9) where I have increased the exponential power of λ^1 by$\lambda^{1+1=2}$. The rationality behind this is the synthetic constraints being imposed by the management on the part of the agents. However, $\lambda^3$is not desirable since it may amend to commanding nature of organizational practice and may awfully turn the corporate ambience into dictatorial administration which may induce definite negative $(-h)$ behavioral changes in agents with positive intentions for turnover. This is an interesting pursuit in order to understand the employee-management behavior cycle in an organizational setup. It is noteworthy to mention here that the degree of synthetic constraintλ^2 imposed on the agents however, will be adjusted as a new equilibrium, where any such diminution in λ on the part of the agents is undesirable, since, λ^2 cannot further reduce to λ which may compromise operational efficiency.

So, for the new incoming agents the, equation (1) is to hold again. Per se, after the rules are set and the incumbent agents adjust toλ^2, any competent management should motivate the team by leading through inspiration and persuasion rather than by command. Now, isolating the variables by exponentiation of both sides by the reciprocal of the variable's exponent, one derives (9.6) through (9.4).

$$\lambda = \frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}} \quad (9.4)$$

Thereof,

$$\lambda = -\frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}} \quad (9.5)$$

Where, $\in$ *contains the set variables of* λ

$$\lambda = \in \left\{ \frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}}, -\frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}} \right\} \quad (9.6)$$

Combining (9.3) through (9.6), one may represent the equation as;

$$\lambda^2 = \frac{vh}{sR_{t+1}}, \lambda = \frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}} \; and, \; \lambda = -\frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}}$$

Where, $\lambda = \in \left\{ \frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}}, -\frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}} \right\}$ (9.7)

Substituting for λ^2, one derive

$$R_{t+1} = v/s[\left(\frac{h}{\left(-\frac{v^{\frac{1}{2}} h^{\frac{1}{2}}}{s^{\frac{1}{2}} R^{\frac{1}{2}}} \right)^2} \right)^1] \quad (9.8)$$

Where, $R_{t+1} = v/s \left(\frac{h}{\frac{vh}{sR_{t+1}}} \right)$,

$R_{t+1} = v/s \left(\frac{hsR_{t+1}}{vh} \right)$ and $R_{t+1} = R_{t+1}$. (9.9)

But following $R_{t+1} = \frac{vsR_{t+1}}{sv}$ (steps not shown), there will be no such behavioral externalities left for the agents and thereafter, trajectory will be the product function of change in agent behavior and outcomes based on new precepts with new equilibrium attained as homeostasis is established in the remaining agent(s) behavior. Hence, a new set of corporate discipline will be in place. This justifies why business organizations inter-temporarily '*eject'* some of their employees for nonperformance, just to save the countenance of other remaining employees and the institution itself, where, the course of one incumbent threatens the aims and progress of all. Even a jackass knows well that non-performance may inevitably lead to retrenchment. Hence, organizational structure should not make an effort to try to continuously adapt itself to the idiosyncrasies of job holders whose incumbency is insolently transient relative to the long run of continuity of the organization. It is on the part of the agents who are often required to reorient their behavioral dispositions to adapt to the organizational routines. Although determining the consequences of agent actions *ex post* is difficult, but still, the management should be aware of the need to adapt to other idiosyncrasies, i.e., attrition and voluntary renouncing of employment. There seems to be many factors, but one primary cause behind attrition may be attributed to employee over-performance and their underrepresentation by the management. Sustained undervaluation of over-performing employees may induce negative changes in agent behavior $h < 0$ and may result in asymptotic agent underperformance$|A| < 0$ (where, $|A| \propto \Delta h \approx \overset{\geq}{\underset{\leq}{=}} 0$) that may invite countercyclical layoffs, which again, satisfies equation 8. Insofar since$|A| \prec h \in S$ and in such, let $x \in |A|$ while $y \in h$ are in relation ρ, then, I may write $x\rho y$ that is, $x\rho y \Leftrightarrow (x, y) \in \rho \subset |A| \times h$. Hence, it is the responsibility of the management to maintain such balancing act of understanding agent behavioral externalities sandwiched between performance appraisals and performance breakdown to preserve vibrancy of organizational ambience. It shall be valued herein that human agents are able to draw inspirations from uncountable sources of stimuli (which is of *prime nature*), i.e. from rational behavior and achievements of their immediate neighbors, reading, historical events, from grief or sorrow, happiness or even from motion pictures. If the agents are suitably motivated through constructive communications, encouragement, and inspirations, they may accomplish wonders. Here lies the importance of Hinde's (1960) motivational energy concept wherein, inspirations drawn from stimuli may motivate agents profoundly, and where the management's ability to motivate it's agents to reach organizational goals should be well accounted for. This is also the reason for which organizations tend to hire experienced agents who have extensive history of transactions with the environment on account of prior social exposures wherein, consequences of errors in agent's responses are minimized. While for the novices, greenhorn and tenderfoots, organizations undertake extensive training programs incorporating into the agents' own behavior repertoires the learned adaptive behavior of more experienced agents through less cumbersome processes. However otherwise, the individual agents would then have to be required to discover by themselves the existence of novel distribution of important elements in the environment, which can be a protracted process (H.B. Maynard).

Proposition 2 *Agent's behavior must change when there is no favorable outcome with a well determined trajectory, i.e., when* $\vec{v} > s$ *. But even if the outcome is discounted, there must take place a concurrent change in the learning process.*

Proof. Let us consider learning as a stationary process where, $\xi_i = \iota$ and $\epsilon_i = orthogonalized\ variates$, then, we will be able to derive Gram-Schmidt's orthonormalization of a variate say, z_i where, $\Delta^c z_i = \xi_i$ ($\Delta^c =$ difference operator and $\xi_i = stationary\ process$). To prove that agent behavior may change bounded by stationarity of the learning process, I have modified the equation somewhat to suit the objectives. The equation may be written as;

$$z_i \equiv l \quad (10)$$

Let us substitute $z_i$by v/s to be able to prove that trajectory is a function of learning and outcome.

Again, substituting z_i by (1),

$$E_i\left[C\left\{\left|A\right|(l+h)\left|B\right|_j\right\}\right]i_k\left(R_{t+1}\right)\vec{e},$$

The equation reads as;

$$v/sE_i\left[C\left\{\left|A\right|(l+h)\left|B\right|_j\right\}\right]i_k\left(R_{t+1}\right)\vec{e}=l \quad (11)$$

Solving for l, we get,

$$v/\text{s}E_iC|A|h|B|_ji_kR_{t+1}\vec{e}=l \quad (12)$$

Where,

$$\frac{vE_iC\left|A\right|h\left|B\right|_j i_k R_{t+1}\vec{e}}{s}=l \quad (13)$$

To quote, learning will be modified by all other variates and indirectly modified by outcome which will further determine the path trajectory and rationality of agent behavior. This may be obtained by solving for v(not shown). Here, learning may not directly determine the outcome if rules that lead to learning are not structured then, learning may not lead to favorable outcome. Whereof learning is assigned to be some non-stationary process, under circumstances of generality, l will be affected by l itself as well as by all other variables. Thus to infer that learning process should *never* remain stationary but will bring innovations in learning by self-evaluation, where, by solving for $\vec{v},$ one derives $l \equiv l \propto \Delta l$. Perhaps, this is the most universal part of our theory and holds true even in the practical and day to day lives of every individual person on earth, among animals, as well for organizations. On examining the gene specific effects of learning on agent behavior however, it would be interesting to presume that how learning influence gene activation and gene expression or whether do learning suppress an agent's innate behavior or help express it. A probable assumption may be that more intense learning reflect less of an individual's innate behavior in the course of more gene activation, memory development and vice versa.

So, learning positively influences adaptive behavior although, there are certain behaviors that are not changed by the learning process, an example being the case of behavior in 'Drosophila mutant'. To draw a simple analogy to posit that human actions in the form of agent behavior tend to be rationally adaptive (due to learning) than most of her peer neighbors (primates), since, human beings are able to spend most of their time doing some work, or at any rate, something in particular (Elton 1927) in contrast to animals: I quote a phrase from Berry's paper (1989) what Elton characterized animal behavior as,

> *--'Animals spend an unexpectedly large amount of their time doing nothing at all, or at any rate nothing in particular...[They] are not always struggling for existence.'*

In what retrospect Elton meant that animals seldom do useful work, in a sense, stimulates one about thinking the notion of 'animal capital' in congruence with human capital. From the dawn of the civilization, man and woman domesticated wild animals and used their *physical energy reserves* for her various purposes. But the facts that animals can reason and learn have opened a new chapter in understanding their behavior and interaction with the environment. Classic work by Romanes (1881) who studied comparative psychology in his book '*Animal Intelligence'*, and recent accounts by Griffin, *'The Question of animal awareness'* (1976) and on animal thinking (1984) provide excellent insights into the minds of animals of whether they have intentional states. Fodor (1975) theory of evolutionary origin for the representational system also provides excellent analytical discourse of referential opacity, existential generalization and intentionality states. The fact that the human brain excels at finding patterns even among random data represents the reflective acts as the principle objects of our reasoning, since; it is the inherent nature of human to believe by reasoning, by throwing out questions on propositional attitudes, and applications of decision, strategy, evaluation and rule use. It is of interest to recognize from the behavioral ethologists' viewpoint whether animals possess similar kinds of concealed awareness or attitudes, and when if appropriately stimulated or motivated, do they be able to show such representations of reasoning, conation and discrimination? If cognition is depended on language, and here I am speaking about animal consciousness, then reversing of what Elton (1927) meant would lead to a deeper understanding of mental experiences in animals (Griffin 1976). I shall now illustrate a simple scenario to exemplify the role that evaluative learning plays in modifying biological elements of agent's behavioral environment.

SCENARIO 1. *Let us consider a scenario involving three different generations (0th, 1st and 2nd generations) of agent behavior and analyze how learning will affect gene expression and agent performance in the first and second generations respectively. Consider in the zeroth generation, agents are tenderfoots, in the 1st generation, they are learners whilst in the second generation they are proficiently expert.*

Definition 2 *Continued higher learning will induce gene activation and expression in agents in the first generation which will reflect less of the agent's inherent behavior while more of adaptive behavior, and vice versa, as a consequence of "zeroth" generation impact, where, it is assumed that agents are tenderfoots in the "zeroth" generation .*

This definition leads us to:

Lemma 2 *Let (l^2) be defined as learning where 'ω' is the gene expression factor, S_t and S_e be social transmission and social exposure factors and let h_i, h_a be defined as innate (inherent) and adaptive behavior respectively. Then, we need to solve for ω to prove that learning (l^2) induces gene expression in the first generation where,*

$$l^2 = \omega\left(\frac{h_i}{h_a}\right) / (s_e + s_t) \qquad (14)$$

Proof. From (14), it is possible to derive the learning-gene expression cycle of agents and to further prove that *(i)* gene expression will be more determined by learning and less by innate behavior and, *(ii)* learning induces gene expression in the first generation. By solving for ω to derive the notion that $\omega \propto 1/h_i$ (in the first generation), as it continues;

$$\omega = \frac{h_a l^2 \left(s_e + s_t\right)}{h_i} \qquad (14.1)$$

For further Proof, See Appendix ‖

Therefore, in the first generation, gene expressions will be directed relative to the adaptive behavior influenced by learning and where, ω is inversely correlated to the expression of innate behavior in the agents. Hence, there will be less of expressions in individual's innate behavior when compared to more expressions of an agent's adaptive behavior acquired through learning, as also, the gene expressions will be influenced by both social exposure and social transmission which will have a propensity to determine the outcomes of the second generation.

Proposition 3 *It is important to prove the relationship holdings between learning and gene expression effects and whether in the "2nd" generation, that is, for proficient agents, how the equation holds provided that the genetic effects in the first generation is inversely related to innate behavior as an effect of learning. It may hold here that in the second generation of agents, innate behavior acquired from the previous experiences of the first generation will be expressed which will further aid in better learning and exposition of acquired behavior. This is the reason for which I represent this as the 'agent learning-gene expression-behavior cycle'.*

Proof. From (14.1) in the first generation, ω is inversely related to h_i as outcome of learning. Now in the second generation, it is important to exemplify how first generation effects would impact agent behavior in the second generation and establish the cyclical behavior of learning, gene expression and behavioral representation in agents. As illustrated by solving for h_i , innate behavior will be expressed as further aid in better learning and exposition of acquired behavior in the second generation but if,

$$h_i\omega = h_a l^2 S_e + h_a l^2 s_t \qquad (14.2)$$

Then,

$$h_i = \frac{h_a l^2 \left(S_e + s_t\right)}{\omega} \qquad (14.3)$$

Wherein, in (14.3), although h_i directly relates to the expression of acquired-adaptive behavior of the agent, it seems a problem of inverse relation to gene effect. Here, let h_a=h_b.This particularity may be attributed to the fact that in the second generation, the role of gene effect on innate behavioral expression is less exposited than the effect of innate behavior which will help express more of an agent's acquired behavior and further aid in learning. Thus, there will be some effect of acquired changes in an agent's innate behavior permanently through learning. This is proved by (14.7) where, it satisfies the *proposition 3*. But again, we require l=h_i or h_i(x) =l so, (14.3) will not satisfy. Hence, I modify the equation (14.3) slightly as;

$$\int(x) = \frac{\left(\left(l^2\right)^x \left(S_e + S_t\right)\right)}{x\left[h_i\left(S_e + S_t\right)\right]} \qquad (14.4)$$

$$\int(\omega h_b) = \frac{l^{2\omega h_b}\left(S_e + S_t\right)}{\omega h_b h_i\left(S_e + S_t\right)} \qquad (14.5)$$

And,

$$\int(\omega h_b) = \frac{l^{2\omega h_b}}{\omega h_b h_i} \qquad (14.6)$$

Now using linear rational polynomial function and solving for l^2,

$$(\omega h_b) = \frac{l^{2\omega h_b}}{\omega h_b h_i} \qquad (14.7)$$

we get,

$$l = w^{\frac{1}{\omega h_b}} h_b^{\frac{1}{\omega h_b}} h_i^{\frac{1}{2\omega h_b}}$$

Where,

$$x = \left(w^{\frac{1}{\omega h_b}} h_b^{\frac{1}{\omega h_b}}\right)$$

or,

$x = \left(wh_b\right)^{\frac{1}{\omega h_b}}$ and thus, we derive

$$l = h_i^{\frac{1}{2\omega h_b}}(x) \qquad (14.8)$$

However, the gene effect may modify acquired behavior and learning to some extent in the second generation and the agents will tend to adapt to the new equilibrium with more memory development in their third generation due to the positive effect of learning on innate behavior. Here, *(x)* is significant because, learning will impact all the variables from 3rd generation onwards resulting in gene expression. It should be noted that that all the derivations satisfy equation (1), the primary equation of the model. Recent evidence suggests the fact that neuroplastic mechanisms required for memory consolidation process is a gene expression dependent process through expression of specific immediate-early genes (IEGs) which have differential stimulus thresholds for transcriptional induction (Abraham et al., 1993). One class of IEG, *Arc* plays a critical role in synaptic plasticity through interactions with other structural proteins such as calcium calmodulin- dependent Kinnase II (CaMK II). CaMK II is a dendritic protein required for long tem memory formation. *Arc* RNA expression is regulated by patterned stimulation that induces long term potentiation. M. Dragunow (1996) also established the role of immediate-early transcription factors in learning and memory. It is thus evident that stimulus induced by learning or behavioral training induce gene expression leading to memory development.

4. Organizational applicability of the Model

I have outlined the exploratory behavioral issues confronting agents under organizational surrounding by developing a simple model. The above outlined model specifications although have certain limitations since it does not incorporate all the events that take place in an organization, neither it is feasible to design a comprehensive model containing all the events that designate a general equilibrium in nature. The real implications that can be drawn lie in understanding the heterocyclic behavior of agent actions with recuperative response analysis of the management in lieu of such actions. When agents are part of an organization, they are bounded by certain internalities of the work processes related to the organization's goals. Agents then measure the total marginal efficiency of being in that job of what collateral benefits that they can draw upon, i.e. psychological or cognitive benefits. Here, they are out in the open to both social transmission and social exposure which impact their behavioral learning. It is also true that social exposure modifies their acquired behavior while the social transmission of this acquired behavior induces alterations (mutations) in those agents' genotype. Then invariably, they may contend that what is the *real* value of a *job* to them on the context of extra-pecuniary benefits? To answer this question, it is important to assess the applicability of the above model on organizations or corporate firms; I would like to relate the above dispositions primarily on to two general principles of organizational design and management. Since organizations are goal oriented, their incumbent agents are hence as much oriented toward the same ideology as their patrons. This is to signify the importance of strategic developments in a firm's bottom-line as well as to understand the behavioral dynamics of top-line managers or executives. In terms of executives, this refers to the 'value of an employee', whilst, in terms of agents (employees), this is but just a 'value of a job'.

However, it also important in terms of agents who needs to learn new things to bring on innovation in their thought process (and not stagnate) in terms of their performance integration methodologies and to enhance their strategic capabilities under uncertain environment and hypercompetitive market forces. Any sustained stagflation in agent learning initiatives may induce idiosyncratic innovational inactivity and may invite countercyclical agent voyages where agents may love their organization without loving its system! Firms as a consequence, shall try to sustain in their initiatives to design, innovate and impart new learning processes for their agents encircling people skills development programs and technology adaptations that might help maintain organizational development through mutual growth, and thus, leverage their agency skills for leadership development. The 'real' value of a job is then beyond some pecuniary benefits of what agents might have learned in terms of their knowledge, skills and adroitness during the course of their job tenure which they can leverage in the long run. Hence the life-cycle of the raw recruits begins with learning and retaining new skills taught to them following which, they ought to move up the value chain, that is, become experience and proficient. I have led some stress on the model for learning targeted toward agents which improvably bring in permanent changes in their behavior. Physiologically, two inferences can be drawn;

- Continual higher evaluative learning and training induces more gene expression and transmission of genetic factors

- Discontinuous, unstable or learning stagflation causes less gene expression and less transmission of genetic factors, and hence, less adaptive capacity on the part of the agents on account of inequity in knowledge acquisition

That is, social exposure and social transmission are important in learning in individuals' as much as adaptive transmission of the newly acquired behavior. This would ensure positive agent actions in terms of their performance metrics with an increased rate of adaptation measured as employee productivity as a ratio of progress / effort, expected optimal to be ≥1, which is a function of agent sustainability factor. I may hitherto invite a question thereof; is it a management responsibility (the agent sustainability factor)? Following Berry's (1989) definition of employee productivity, I may derive;

$$E_p = \frac{P}{W} \geq 1$$

Where, $E_p$is employee productivity measured in terms of the ratio of progress (P) to effort (W). Organizations would then be able to cut down on employee (agent) emigration or migration and likewise enhance agent adaptability to the environment. However, besides agents, there should be enough stress to bring in innovation in management learning process since managements also qualify as agents of their organizations. The benefits of such protracted knowledge development through continous learning increase a firm's resource base. This is usually achieved in the form of removing communication gap between strategic manager and the bottom-line through building common platforms for resource sharing and strengthening interdepartmental communication channels, which may vary, according to the differential patterns of organizations.

5. Discussion

It is now necessary to consider a formal discussion of several results related to the above discourse on the micro-foundations of agent behavior and to report the applicability of the same that I have proposed. Applying the model of teleological design for learning process to understand purpose-driven organizational adaptation seems plausible in a sense that, organizations are goal oriented, and agents continuously learn new things as well as they require both to adopt new technology and adapt to endogenous and exogenous externalities of organizational evolutionary process. In the process, agents are also exposed to both kinds of exogenous natural and endogenous synthetic constraints as λ^{1+1}. In lieu of that, I have considered both dynamic equilibrium and teleological process in congruence. This is because learning without adaptation is analogous to dispatching a unit to a difficult terrain on the war front without requiring them to undergo practical analogous preconditioning simulations, as also, adaptation is entirely implausible without learning and perception (or observational experience in animals). Adaptation only occurs when a system is required either to survive or to derive certain benefits from such and hence has to undergo full conditioning to attain homeostasis. In the case of an organization, this is brought about by learning under institutional settings where the information gained by expending energy is applied for the benefit of the institution, its regulars and its agents. To elucidate more transparently the true modifiers of the determinants of agent actions and behavior, it seems plausible to denote here that motivation is a common parameter and time dependent. However, stimulus is not synonymous with motivation, but a *prius quam* here. Motivation requires prior stimulus which may be in the form of efficiency wage effects or enticements. It is a well acknowledged fact that incentives motivate agents to perform better. By agent actions, here I mean purposeful work. In terms of agents, it means employment or job. All systems of work are energy systems and thus, human work is energy directed to goals and targets. Agents put in physical and mental energy into producing, maintaining or converting economic resources into useful commodities (Sahlins 1974). To motivate agents for working better, organizations from time to time undertake incentive programs where agents are inspired to make the extra effort necessary for a better performance by the promise of extra reward (Wallman 1980). These may be in the form of provision of personal and social enticements to work. However and under all these circumstances, agents invariably learn to work better by adopting new technology while adapting to the same and in the way, *learning* about them in turn. Thus, my findings can be summarized in the following manner; *First* and foremost, I find that organizations are represented by some choices inculpating from collective behavioral biases of homogenous agents which reflect their trajectory of actions. It is apparent from the above generalization that all representations of agents and their management(s) need to change if the outcome remains indefinitely non-positive with uncompensated non-directional vector biases. *Second*, it is equally substantiated and shown that changes in rules would inevitably lead to changes in learning behavior of employees where it dynamically influences explicit changes in agent's actions in terms of objective skills development. Hence, it would be reasonable for the agents to adapt to such state-lines imposed by change in rules; employees should understand the dynamicity of organizational adaptation in relation to their goals; rules and management decisions to optimize one's efficiency in actions in order to avoid unfavorable consequences of retrenchment. For the organization, it would mean to further understand the dynamics of agents' behavioral flexibilities and the sequences of information inflow into the system, the need for long term changes to be brought in by altering intentional dynamism of objective rules, and knowledge about trajectory and its outcome based on heterogeneity in agent behavioral actions. Use of positive stimulus induced motivation in terms of learning and innovation in the process of learning should be equivocally advocated rather than imposing repetitive constraints on the part of the agents in order to maintain quintessential atmosphere of organizational ambience. In the beginning, I have mentioned that it is possible for organizations to extract meaningful information from representational behavior of animals where, I have drawn up some comparative literatures related to the trial and error based learning models in animals and primates that perceptibly lead to analogous changes in their social behavior. In understanding the fundamental basis of the origin of behavior, it is essential to identify the factors that decide the specific form of behavioral patterns in animals comparative to humans. The motivation stems from the fact that the fundamental basis of differential intelligence among human and the animal kingdom has been ascribed to the former's language learning abilities, a feat not observed in the later. However, animals also communicate among themselves through various ways of representations, as in birds through vocalization of songs and in insects through acoustic communications and organic pheromones. Field observation of wild birds living in nature and also of captive birds living in semi-natural conditions like for example, in song sparrow (*Melospiza melodia*), Chaffinch (*Fringilla coelebs*) and others, experiential proof of existence of individual differences in vocal behavior have been established. Analysis of frequency spectra of bird vocalizations encircling pitch, timbre and rhythm from bird calls and songs have revealed temporal patterning to identify vocal recognition in a single species by its signature tune. An example of vocal mimicry in birds that sing have variants of songs in their repertoire while, their auditory reaction times are faster by ten times than they are in human. This is represented by antiphonal singing in birds which sing duets synchronously in constant time interval that helps to maintain their pair bond in a dense habitat of foliage. This is also an example of organization of bird song where sensory-motor feedback coordination for effector activation patterns is dependent on auditory feedback of vocal motor system which maintains the controlled programming of interval patterns and error corrections.

A major difference between human and animal behavior is the lack of discipline in animals, but they can be trained to attain such discipline to some extent, for example, in dogs who can acquire discipline through extensive training, but not language learning skills. However, it has been assumed that animals do not apply logical rules but their behavior can be sometimes rational without being logical, although this does not establish the relationship between discipline and rationality. Monkeys, chimpanzees, pigeons and rats all appear to be able to draw transitive inferences which children below 5 years of age often fail to do so (Russell 1996). As indicative of rationality in animals, McGonigle & Chambers (1977, 1992) were the first to demonstrate that animals are able to draw transitive inferences (Monkeys are rational!). However, Gergely & Csibra (1996, 1997) provided the evidence that 9-month old infants can interpret the behavior of an abstract computer-animated object as being goal-directed and can infer its novel action in a changed situation as a basis for teleological origin of mentalistic action explanations. But there are certain exceptions, as in children below the age of 5 lacking the working memory capacity for holding in mind the mapping of stimuli to more than three relations simultaneously (Halford 1984). Here, animals appear to outperform children on ability to make transitive inferences and reasoning. This is primarily attributed to the temporal differentiation of relative memory capacity utilizations in toddlers, animals and adult human. Strange to expostulate here in terms of memory utilizations that even house lizards (gecko, family Gekkonidae) exhibit some form of representational memory capacity utilization when exposed to Pavlovian conditioning (personal observance). Besides these, chimpanzees and capuchin monkeys may be taught by the use of experimenter-given cues during object choice tasks to accede to comprehend the associative fashion of information. Interesting inferences can be drawn regarding current task performance based on practice with repetition priming since identifying exact nature of representation through repetition priming is a memory phenomenon. An example of stimulus recognition could be showing a stick to a dog as a representation of its memory of any past incident of pain inflicted upon. Thus, representations underlying the repetition effect are domain-specific. This is to infer that animals like human possess some degree of social and organizational skills that they often call for when under severe organic stress. I may posit here that there are certain evidences of goal oriented behavior found in animals mostly aimed at their survival strategy under severe environmental stress where they inculpate calculated moves organized under rule following behavior and where, the cost of an error may prove fatal. Analogously, this is all about stress debate (agent constraints) where, response of an individual to stress and effect of stress that produces response under higher levels of functional complexity may induce fitness in agents who are able to adapt. Environmental constraints or stress is, however, an important factor that induces competition among agents. The reason behind why and how environmental pressure induced mass extinction of some species may be ascribed to this genetic fitness to counter stress. Thus, in terms of fitness concept, the strength of competition among agents may be influenced by genes which may have positive effects on one fitness component and negative ones on another. To articulate in such continuum, survivors and non-survivors are to be genetically different in order to adapt (Berry 1979). One may then correctly deduce that a phenotypic property of individuals is a product of evolutionary process. Here, I may accord that ‘stress’, in its truest sense, some imposed externalities of constraint, as a form of stimulus under certain circumstances provide motivational energy in an organism or an agent to achieve its necessary goal, either to regulate survival or extract explicit benefits out of its habitat. Before concluding this section however, I would like to take pride to provide some arguments related to the dynamics of adaptation process *itself* by correlating some of my findings based on this paper.

Buoying on this opportunity that I cruise, perhaps I could not resist the temptation to remark about some aspects related to the past explanations of evolution and adaptation put down by Jean Baptist Lamarck and Charles Darwin way back in the nineteenth century, although I am humble enough to put any such objective comments on their theoretical dispositions as such. However on retrospection, and in order to clear my doubts on the paradigm of a dilemma that still haunts the evolutionary biologists and paleontologists to this day, and I believe that my documented deposition may further instigate new lights of debate on these topics. On his golden reflections of 'Natural Selection' eliciting, what was not immoral to quote the phrase '*survival of the fittest'* preceded by Lamarck's hereditable effects of use and disuse in '*Philosophie zoologique',* Charles Darwin's theory had its very own representation of the theory of evolution, where I may say that if Darwin was correct, and indeed that though he was, then, the argument that '*adaptation for survival*' is not a necessary evil! Lamarck in 1801 wrote,

> '. . . *time* and *favorable conditions* are the two principal means which nature has employed in giving existence to all her productions. We know that for her time has no limit, and that consequently she always has it at her disposal.'

Then, it is wrongly residual to say that adaptation is not a necessary ingredient for survival but to rightly cite the phrase that, '*survival of those who are fit to adapt',* and hence, it is the fittest organism or a biological system which can visage the disordered environmental states, since, environment enforces a system to adapt. But then also, its survival and sustenance proves that adaptation has already taken apace and this *adaptive survival* depends on the inherent motivational capacity of the organism which is *stimulus* induced and may have some genetic determinants, and where one requires stimulus for motivation to adapt, would activate specific genes in general. Interactions between genome and the environment and the concept of genetic load (Muller 1950) that underlines the interplay of mutation and adaptation as a consequence of genetic heterogeneity where mutation as basis for variation is then the underlying principle of the operation for natural selection. Genetic variations in agents can be identified by identifying individual heterozygous gene loci. This genetic variation in the way of gene polymorphism imparts individual agents with inclusive fitness, innate immunity against diseases and heterogeneity in behavior. When we speak about the common origin and foundation of behavior in human, we also mean the correlation between habitat and genetic variation. This commonality fades due to individual heterogeneity on account of separation in time and space as well as due to the exposure of each and every individual agent to internalities of heterogeneous resources available at their disposal. Classification of behavior in terms of developmental origin and the ontogeny of behavioral adaptiveness may provide evidences of the sources of behavioral distinctiveness where cellular factors as expression of inherited determinants of individual behavior are related to specific gene expression and activation. This deference may be also derived from the motivational energy concept of Hinde (1960) where, it is important to quantify following learning induced stimulus recognition, of how much energy is required for specific memory related gene expression relative to its temporal factors. For if, genetic fitness is reflected in an organism's biological adaptiveness relative to its environment, then, fitness precedes adaptation, yet as well, fitness is not achievable without adaptation. Thus, if I classify adaptation is as *(i)* genetic, *(ii)* neural or cognitive and *(iii)* physical adaptation, an organism must contain inherited genetic factors as well as the required potential energy to be embedded in its system in order to adapt and survive. Furthermore, neural or cognitive adaptation should take place before physical, but only if the physical state can sustain, and then it is again the fitness factor of Darwin that we consociate upon, where, genetic fitness may determine whether an organism is *fit to adapt*. Here, it seems that fitness to *adapt* comes before *survival*, because, if survival has already been in place, it could not have been without any such adaptations (homeostatic adaptations) at all. The great quandary is that, neither Darwin nor Lamarck was incorrect, but indeed they were complementarily wrong about each others propositions which were reciprocally correct however yet, both were approved in factual senses. But ostensibly, it presents a dilemma similar to the one where it becomes difficult to ascertain whether the hen has laid her egg or hatched out of it first, unless adaptation is called for in to explain the hypothesis. However, one may find some clear indication out of my discourse that Lamarck indeed, posed some serious threats to Darwin's dispositions. Although this is not an appropriate place to counter such arguments, and a detail discussion on this subject is beyond the scope of this paper, still however, I have summarized the relative association of adaptive economics to the theory of the origin of evolutionary adaptation by studying the intricacies of agent behavior model under cluster settings.

6. Conclusion

Several conclusions can be drawn on the basis of the above study. In terms of modern behavioral and cognitive economics, I have outlined the dynamics of employee-management-behavior cycle (Fig.1) under organizational surroundings. The important effects of continuous evaluative learning on the behavioral mutation of agents have also been delineated. The implication, in my mind, is a step forward in understanding the dynamicity of institutional work culture in relation to employee behavior, their periodic adaption to innovation in learning, and acquired fitness. Perhaps, the impact of learning on agent behavioral modifications and a deeper consecutive implication on their physiological dispositions of how learning induces gene expression and memory formation is in greater part, the most significant outcome of this study. Of why and how and what factors predispose agents to stress or constraints of imposed contingencies from the part of the management in an organization has been mathematically underlined. The rationalities of imposed rules and routines that follow teleological process have also been summarized in relation to comparative analysis of similar behavioral reflections in animals. It is to be legibly noted that like human beings, animals also posses some degree of adaptive intellect and organizational skills which they demonstrate under unsympathetic environmental constraints, or by training. To conclude herein, I may posit that although several aspects related to organization behavior and adaption in terms of behavioral basis have been outlined in this paper which may shed some new light on this field of cognitive economics, yet still, much remains to be considered for future research. □

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Appendix

Proof of Lemma 3: if $$\frac{h_i}{h_a} = \omega \frac{\left[S_t + S_e\right]\left(h_i + h_a\right)}{l^2}$$

Then, *l* will contain the sets as

$$l \in \left\{ \frac{h_a^{\frac{1}{2}} \omega^{\frac{1}{2}} \left(h_i + h_a\right)^{\frac{1}{2}} \left(S_t + S_e\right)^{\frac{1}{2}}}{h_i^{\frac{1}{2}}}, -\frac{h_a^{\frac{1}{2}} \omega^{\frac{1}{2}} \left(h_i + h_a\right)^{\frac{1}{2}} \left(S_t + S_e\right)^{\frac{1}{2}}}{h_i^{\frac{1}{2}}}) \right\}$$

Proof:

Let us consider in the second generation a variation of (14.3). Then, I may write as

$$l^2 = \omega, \left[\left(\frac{h_i}{h_a} + \frac{h_a}{h_i}\right)\left(h_a + h_i\right)\right]\left(S_e + S_t\right)$$

Then, by solving for 'l' in the third generation, we obtain:

$$\omega\left(h_i^2 h_a S_e + h_i^2 h_a S_t + h_i^3 S_e + h_i^3 S_t + h_a^3 S_e + h_a^3 S_t + h_a^2 h_i S_e + h_a^2 h_i S_t\right) = h_a h_i l^2$$

And,

$$\omega = \frac{h_a h_i l^2}{h_i^2 h_a S_e + h_i^2 h_a S_t + h_i^3 S_e + h_i^3 S_t + h_a^3 S_e + h_a^3 S_t + h_a^2 h_i S_e + h_a^2 h_i S_t}$$

Hence, from third generation onwards, gene expression will be the result of both innate and acquired behavior as well as learning and if, in an another variant of the same expression,

$$l^2 = \omega\left(h_i^2 + h_a^2\right)\left(h_a + h_i\right)\left(S_e + S_t\right)$$

Solving for 'ω', one will obtain,

$$\omega = \frac{l^2}{h_i^2 h_a S_e + h_i^2 h_a S_t + h_i^3 S_e + h_i^3 S_t + h_a^3 S_e + h_a^3 S_t + h_a^2 h_i S_e + h_a^2 h_i S_t}$$

That is, from the 3rd generation onwards, gene expression will be determined by learning as well. This endorse the fact that how continual learning will effect agent behavior and help develop memory proteins and add to the biochemical repertoire of agents. This also proves equation (14.8).

Textbox 1.

General Description of Neurophysiology of Behavior

I will briefly revisit some of the basic technical facts related to how learning induces physiological, genetic or biochemical changes in the human body. It is imperative to note that the process of learning, whether observational or practical, brings in some innovative changes in the human physiological system. There are many intracellular and intercellular factors that relate learning to these enduring changes as effect. There occurs a myriad of biochemical reactions in response to learning. Learning is but gaining new information, experiences or in crude sense, one of the sources of stimulus as input for sensory analysis, whether repetitive or one time event. The question then, remains about the particular nature of stimulus and the threshold of the intensity or *power* of stimulus that is fed into the central cognition system. On molecular level, any stimuli (stimulus) of a certain threshold excite sensory neurons, for example, visual stimuli activate human sensory neurons and help educe motor actions. To understand sensory information analysis and origin of motor patterns at the cellular level, interganglionic impulse conduction/modulation and signal transduction mechanisms need to be understood, as also, the role of sensory feedback in motor pattern generation. Previous experiments with isolated squid and leech neurons have shown the selective excitation-inhibition of ganglionic neurons with intracellular current injection to identify the origin of motor patterns. Since actions are motor responses of basic patterns of coordination generated by central neurons, it is essential to understand the biochemical basis of molecular neurotransmission and cellular interactions that takes place at the synaptic end and as also, to elicit the electro-chemical events involving voltage-gated channels within the neuron itself. This takes place when a sensory stimulus excites a neuron and generates action potentials. Sensory receptors transduce stimuli into electrical responses by activating ion channels in their membranes. The plasma membrane of the neuron is semipermeable, being highly permeable to K^+ and slightly permeable to Cl^- and Na^+. The electrical events that constitute signaling in the nervous system depend upon the distribution of ions (Na^+, K^+/ Cl^-) on either side of the nerve membrane. The resting potential is maintained by the sodium-potassium pump. In most neurons this potential, called the membrane potential, is between −60 and −75 millivolts. When the inside of the plasma membrane has a negative charge compared to the outside, the neuron is said to be polarized. Any change in membrane potential tending to make the inside even more negative is called hyperpolarization, while any change tending to make it less negative is called depolarization, which initiates action potential. This is the result of potential differences across the semipermeable membrane that initiates all action potentials. At the receptor level, it is however important to elicit the interplay between chemical messengers and hormones which induce biophysical-biochemical changes. Action potential in the CNS in response to stimuli depolarizes receptor cells which are Ca^{2+} dependent. Ca^{2+} is also essential to initiate smooth muscle contraction, as in cardiac muscles. The neuroendocrine responses of learning are attributed to secretion of neurotransmitters and hormones i.e. dopamine (precursor of norepinephrine), serotonin (5-HT α agonists) at the presynaptic terminal from synaptic vesicles. The concentration of serotonin is somewhat lower but it is related to behavioral patterns like sleep, mood and sexual urge. There are certain charge carriers across nerve cell membrane (Ca^{2+}, Na^+) to generate action potentials in nerve cells and motor neurons (depolarization). Ca^{2+} entry into the presynaptic terminal is the first step to the release of acetylcholine (from cholinergic receptors) from nerve terminals (voltage-dependent gate) that allow cations to permeate. This means that much more Na^+ and Ca^{2+} diffuse into the cell than K^+ diffuse out, causing depolarization and excitation of the neuron or muscle cell. Excitability of neurons is thus calcium (Ca^{2+}) dependent in the central nervous system where extracellular Ca^{2+} is essential for neuromuscular transmission (depolarization) as also, for any substance secretion from a cell (hormone, neuropeptides, mucus). These calcium channels are in turn controlled by neurotransmitters and aminoacids at the postsynaptic receptor sites, i.e. GABA, glutamate, serotonin (5HT receptors) through feedback mechanisms. GABA is highly concentrated in the brain and is produced from glutamate. This direct control of voltage dependent Ca^{2+} channels is modified by a second messenger, the cAMP through some complex mechanisms which is beyond the scope of this paper.

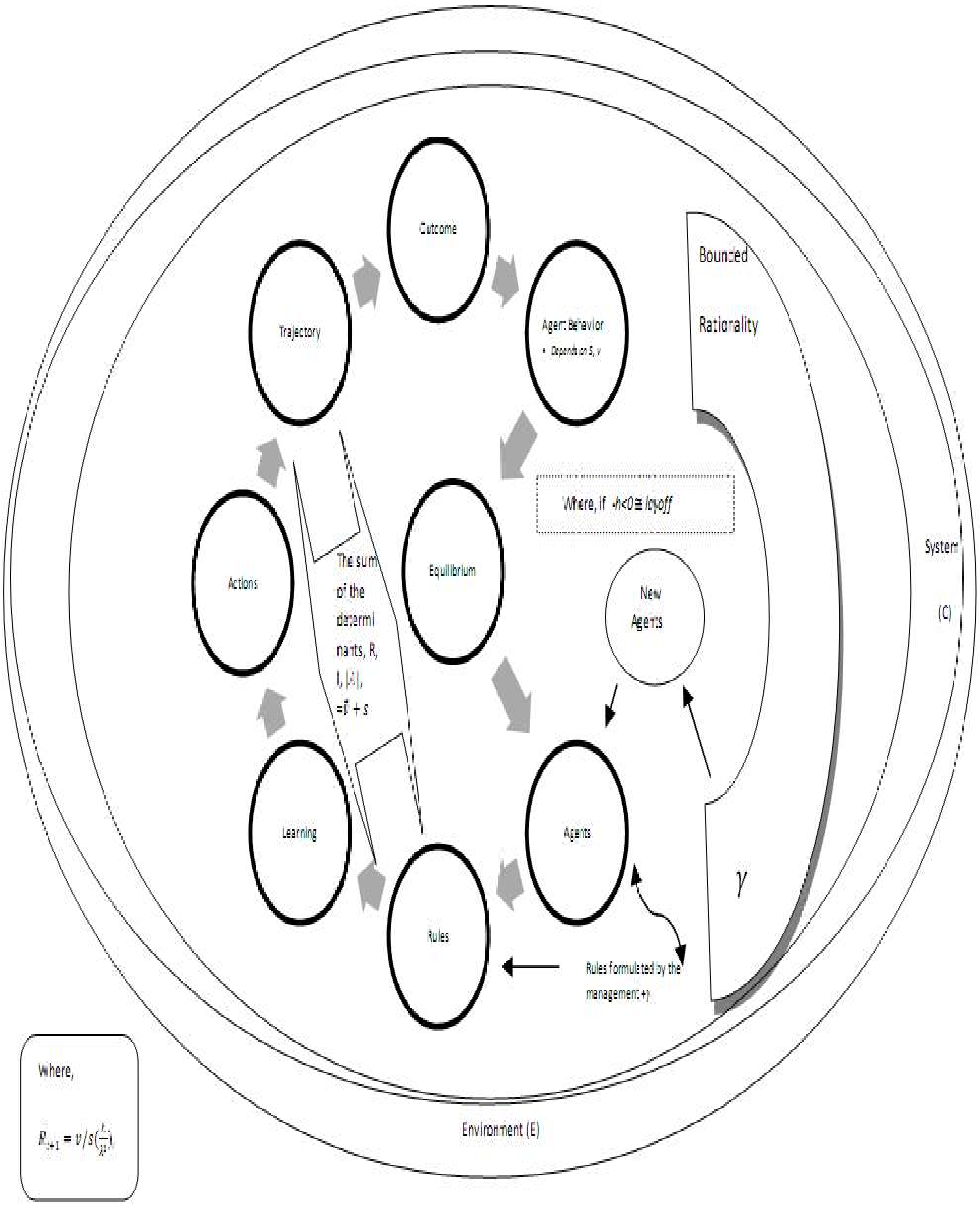

Fig. 1 The employee (agent)-management-behavior cycle.