

# Causal Creation in Social Processes: Empirical Analysis and Theoretical Implications

Hector Sabelli\*

*Chicago Center for Creative Development, 2400 North Lakeview Ave. Chicago, IL 60614, USA*

**Abstract:** This article presents empirical evidence for the creativity of social processes, as contrasted to both deterministic and random models of biological and economic phenomena. New methods for the analysis of empirical data indicate that population changes, financial data and other socioeconomic time series display non-periodic, apparently irregular patterns that evolve in time (temporal complexity), increase in diversity (diversification), and repeat less frequently than randomized copies of the data (novelty). Recurrence and autocorrelation measures indicate that these patterns are generated causally, not randomly. These measurements demonstrating causality and creativity in economic, social, and population processes indicate a non-stationary chaotic pattern (Bios) and suggest an alternative to current models that postulate either causal determinism or random change. Causal and creative chaotic patterns (Bios) are also observed in fundamental natural and human processes (quantum processes, cosmological expansion in the distribution of galaxies and quasars, animal populations, and heart and respiratory rates). Mathematical models show that Bios patterns are generated by equations that combine recurring change (recursion), bipolar opposition (e.g. sine functions) and conservation. Consumption and production (demand and supply) are obvious factors accounting for the generation of Bios in economic processes. Generations, sex, nations, races and classes are fundamental oppositions in social processes that may explain the generation of Bios. The extreme sensitivity of Bios to initial conditions' (external inputs) indicates the possibility of modifying the course of social processes, and the need to develop flexible methods rather than planning economic development. To develop such methods, and based on the empirical results here reported, this article articulates a new theory of social organization and change that advances three principles: (1) action (flow of energy in unidirectional time) as the one and only component of both processes and ideas; (2) opposition, both synergic and conflictual, as present in, and organizing, all physical, biological and mental processes; and (3) priority to nature and supremacy to persons as an unavoidable reality and a desirable pattern of action.

**Keywords:** Bios, creativity, generation, class, nation, priority of nature, sex, supremacy of persons.

## INTRODUCTION

This article presents empirical evidence for the creativity of social processes, as contrasted to both deterministic and random models of biological and economic phenomena, and articulates a new theory of social organization and change. The need for radically new theory is made evident by the multiple concurrent crises we face -- the destruction of our environment, the depletion of energy resources, continual inhumane wars, widespread poverty, the accumulation of weapons of mass destruction, and the economic crisis generated by the collapse of our financial system. After describing the collapse of our financial system, George Soros [1] concludes that it cannot be restored because it actually includes the collapse of our economic worldview in which markets tend to equilibrium and deviations are generated by extraneous, outside 'shocks' that occur in random fashion. The failure of our political, economic and military systems likewise involves the collapse of our social worldview. The collapse of the financial system refutes standard capitalist economics. The collapse of communism represents a practical refutation of Marxism. Restoring our

social and economic system to what it was would not be desirable, even if possible as it is destroying the planet, impoverishes majorities all over the world (including America), condemns people to war, and has created our current financial and social crises. The failure of standard economic theory and the disintegration of alternative socioeconomic systems indicate the urgent need for radically new social theory.

While many theories, particularly in economics, assume that biological or economic factors are universal and stable, it is evident that social changes are continual, discontinuous, and complex. Discarding older views positing stability or periodicity, the apparently erratic character of the empirical data is assumed to be generated by random processes. The discovery of Chaos has revealed that causal processes can generate apparently random series. The identification of Bios, a chaotic process with features of creativity [2] in mathematical [3, 4], quantum [5, 6] and cosmic [7, 8] physical processes, meteorological data [2], animal populations [9], DNA sequences [2] and economic time series indicates the widespread occurrence of causal creativity. Bios is fractal; it repeats at multiple levels of organization.

This article presents evidence for causal creativity in social processes. The data considered are population, employment and financial time series.

\*Address correspondence to this author at the Chicago Center for Creative Development, 2400 North Lakeview Ave. Chicago, IL 60614, USA; Tel: 773-348-5679; E-mail: Hector\_Sabelli@rush.edu

The empirical studies here reported involve:

- (1) The demonstration of complex patterns in biological, economic and social processes that display features of creativity (novelty, diversification and temporal complexity) [10-13] and causality. To reveal creative features in social processes involves (a) the analysis of change and hence of time series; statistical analysis at one period of time that can only reveal static features; (b) their analysis with embedding methods that examine both simple and complex levels of variation; and (c) the comparison of the results obtained with those observed in randomized copies of the data and with causal and stochastic mathematical models.
- (2) The development of mathematical models for the causal generation of creative patterns. Bios is a new mathematical model for complex, non-periodic processes that combines chaoticity with creative features [2-4] and is generated by interaction of bipolar opposites.
- (3) The generation of multiple, discontinuous patterns of increasing complexity by mathematical recursions as a model for the evolution of levels of increasing complexity (physical, chemical, biological, social, psychological).

The identification of Bios in empirical data requires the use of new methods to detect novelty, diversification and temporal complexity recently developed and described in the Methods section. A mathematical model for the generation of Bios will be presented in Results after the analysis of empirical data. In the Discussion section, we explore the possible implications of causal creativity for the development of social theory.

## METHODS

Economic data consisted of 270 time series from the Federal Reserve Economic Data, Economic Research Division and the Federal Reserve Bank of St. Louis (<http://research.stlouisfed.org/fred2/>) from the following categories: Banking, Business/Fiscal, Consumer Price Indexes (CPI), Employment & Population, Exchange Rates, Gross Domestic Product (GDP) and Components, Interest Rates, Monetary Aggregates, Producer Price Indexes (PPI), Reserves and Monetary Base, U.S. Trade & International Transactions, U.S. Financial Data, Regional Data. **Human population data was obtained from Gapminder.org, which is a non-profit organization based out of Sweden that provides statistical data online that is related to social and environmental, global concerns.**

The results are analyzed statistically as well as with recurrence methods. Instead of analyzing just the one-dimensional time series, embedded series are constructed to examine the process in multiple dimensions; vectors of 2, 3...N successive terms are constructed starting with each term of the series and the Euclidean norm is calculated. The other important characteristic of these tests is comparison of results with the results obtained from the shuffled (randomized) series. These series are also compared with random data, random walks (generated by the addition of

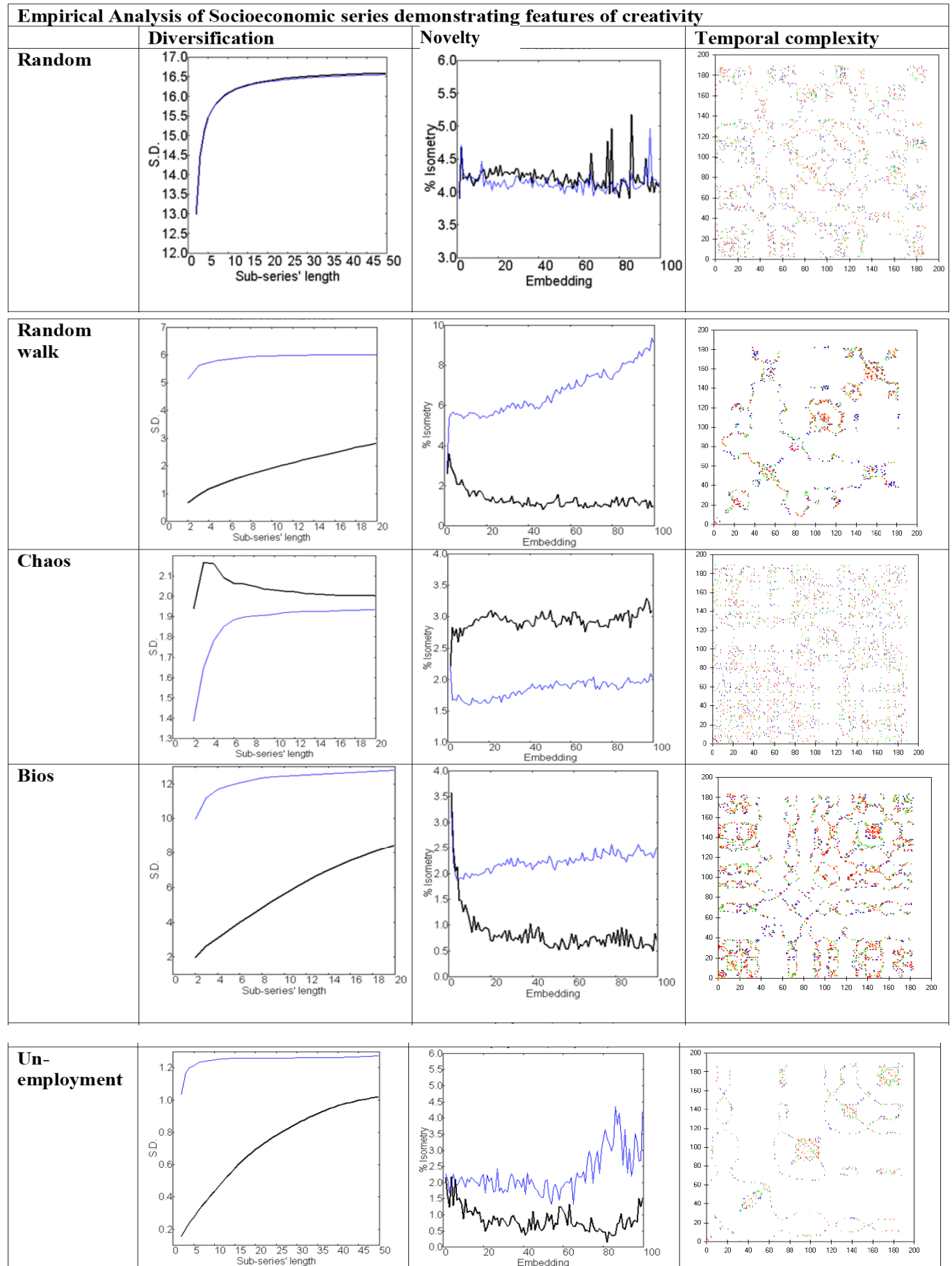
random data), and mathematical models of Chaos and Bios generated by the process equation  $A_{t+1} = A_t + g * \sin(A_t)$  where the gain  $g = k * t$  [3, 4].

Statistical analyses include partial autocorrelation to investigate causation and the quantification of variance for short and long samples as well as for various embeddings to measure convergence to attractors or increasing diversity. Global Diversification is the increase in variance with increasing size of the sample. In this study we measure local diversification: the standard deviation ( $\sigma = \sqrt{\sum (x_i - \text{mean})^2 / N}$ ) is computed for sets ("embeddings") of 2, 3, ..., 100 consecutive terms of the time series, starting with each term in the series  $x_i$ . The values obtained for each embedding are averaged for the entire series, and these averages are plotted as a function of the number of embeddings. Diversification distinguishes three types of processes: (a) Conservative processes (mechanical, random) maintain phase space volume. (b) Attractive processes converge to equilibrium, periodic, or chaotic attractors. (c) Creative processes diversify, i.e. expand their phase space volume. Parallel can be drawn here with the Lyapunov exponent that quantifies the exponential divergence/convergence of initially close trajectories. Chaotic systems typically show an initial linear increase in the separation of trajectories, followed by a constant plateau since chaotic attractors are bounded.

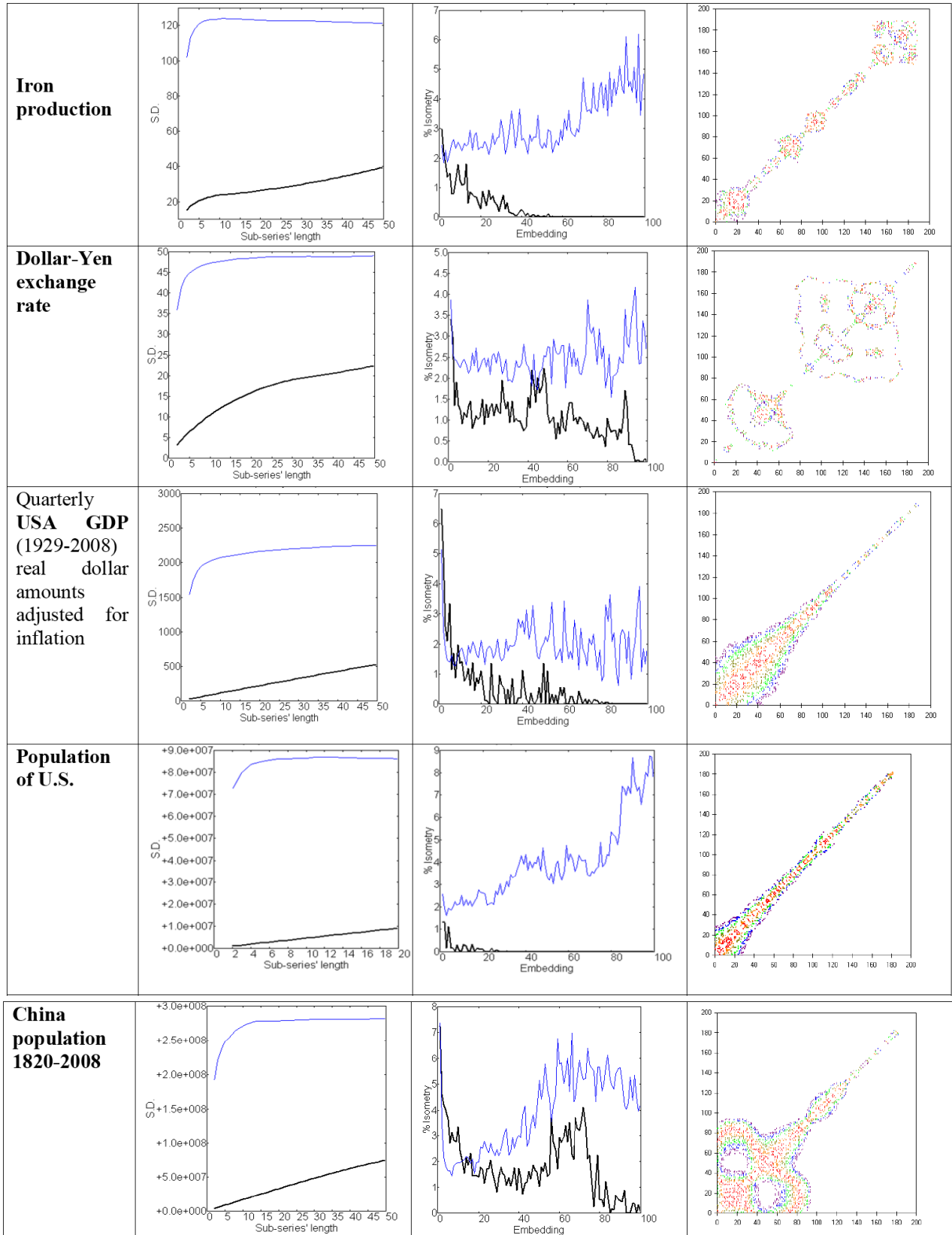
Recurrences are measured using computer programs developed by Sugerman *et al.* [14] and by Kovacevic [15]. Recurrence means repetition. It can be repetition of values, or of sequence (of length  $D$ ) of values in the time series. *Embedded series* of dimension  $D$  is constructed by converting these sequences to vectors of length  $D$  in each point of the series. A vector has length and direction. Standard *recurrence* measures calculate *distance* between vectors; recurrent vectors have similar lengths and directions. We [2] have defined *isometry* (Greek: equal measure) as a recurrence measure that calculates only the *lengths* of these vectors (direction is not important). Vectors of 2, 3, 5...,  $N$  consecutive terms ("embeddings") starting with each term in the series are constructed, and their Euclidean norm are compared. If the difference between them is less than a chosen cutoff radius, they are regarded as isometric, and a recurrence is plotted and counted. The quantification of isometry at low and high embeddings allows one to consider both simple and complex patterns. Consecutive isometry is counted when two vectors are isometric, and their consecutive vectors are also isometric (i.e. if vector  $A_t$  is isometric with vector  $A_k$ , then  $A_{t+1}$  is isometric with  $A_{k+1}$ ). The results reported here were obtained using cutoff radius equal to 1% of the range of the series, but a wide range of cutoff radii were also examined. *Novelty*  $N$  is defined as the increase in recurrence isometry produced by shuffling the data, and is quantified as the ratio of isometries after shuffling over isometries in the original data. Novelty is a key measure to distinguish creative from non-creative processes. The advantage of isometry over standard recurrence is that novelty is demonstrable for isometry but not for standard recurrence (Fig. 1).

## RESULTS

Fig. (1) presents examples of time series of social, economic and population changes that demonstrate

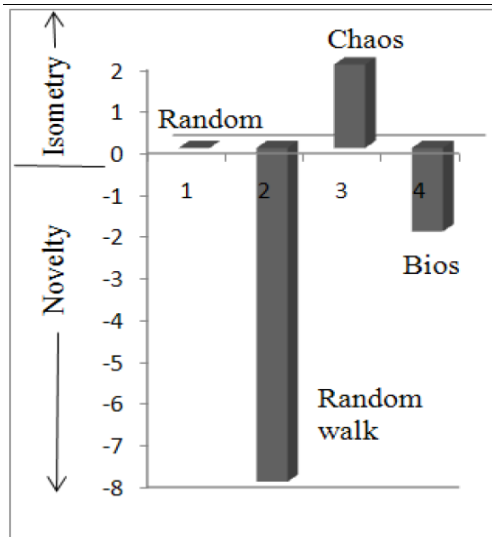


(Fig. 1) contd.....



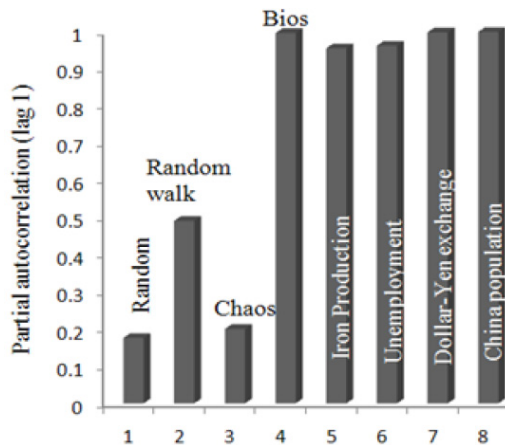
**Fig. (1).** Bios patterns with features of creativity in socioeconomic processes. New analytic methods demonstrate diversification (increasing variation [black line] as contrasted to shuffled, randomized copies of the data [thin blue line]), novelty (less recurrence in time series [black line] than randomized copies [blue line]), and temporal complexity (pattern transformation in recurrence plots).

progressive increase in variance (diversification, left column), lower recurrence than in randomized copies (novelty, middle column), and complex recurrence plots in which recurrence isometries cluster, interspacing with recurrence-free periods (temporal complexity, right column). Novelty (Fig. 2), diversification and temporal complexity are also observed in random walks and in Bios. In contrast, chaotic series show greater recurrence than shuffled copies, and recurrence plots are uniform in random data and in Chaos.



**Fig. (2).** Novelty, the proportion of isometries in the original series over isometries in the shuffled copies at 50 embeddings.

The statistical methods available to demonstrate causality in empirical data are less clear than desirable. Fig. (3) shows that socioeconomic series display high partial autocorrelation as also observed in Bios, but random walks also show significant partial autocorrelation, and Chaos, which is generated causally, shows values of partial autocorrelation as low as random data.



**Fig. (3).** Partial autocorrelation does not differentiate qualitatively Bios from random walk.

Recurrence methods demonstrate causality. High consecutive isometry differentiates causal Chaos and Bios from random and random walks (Fig. 4). There also is clear

pattern in the series of differences between consecutive terms in Chaos and Bios, differentiating them from random and random walks, and in human population and in economic data (Fig. 5). These results support non-random causation and exclude random walk models.

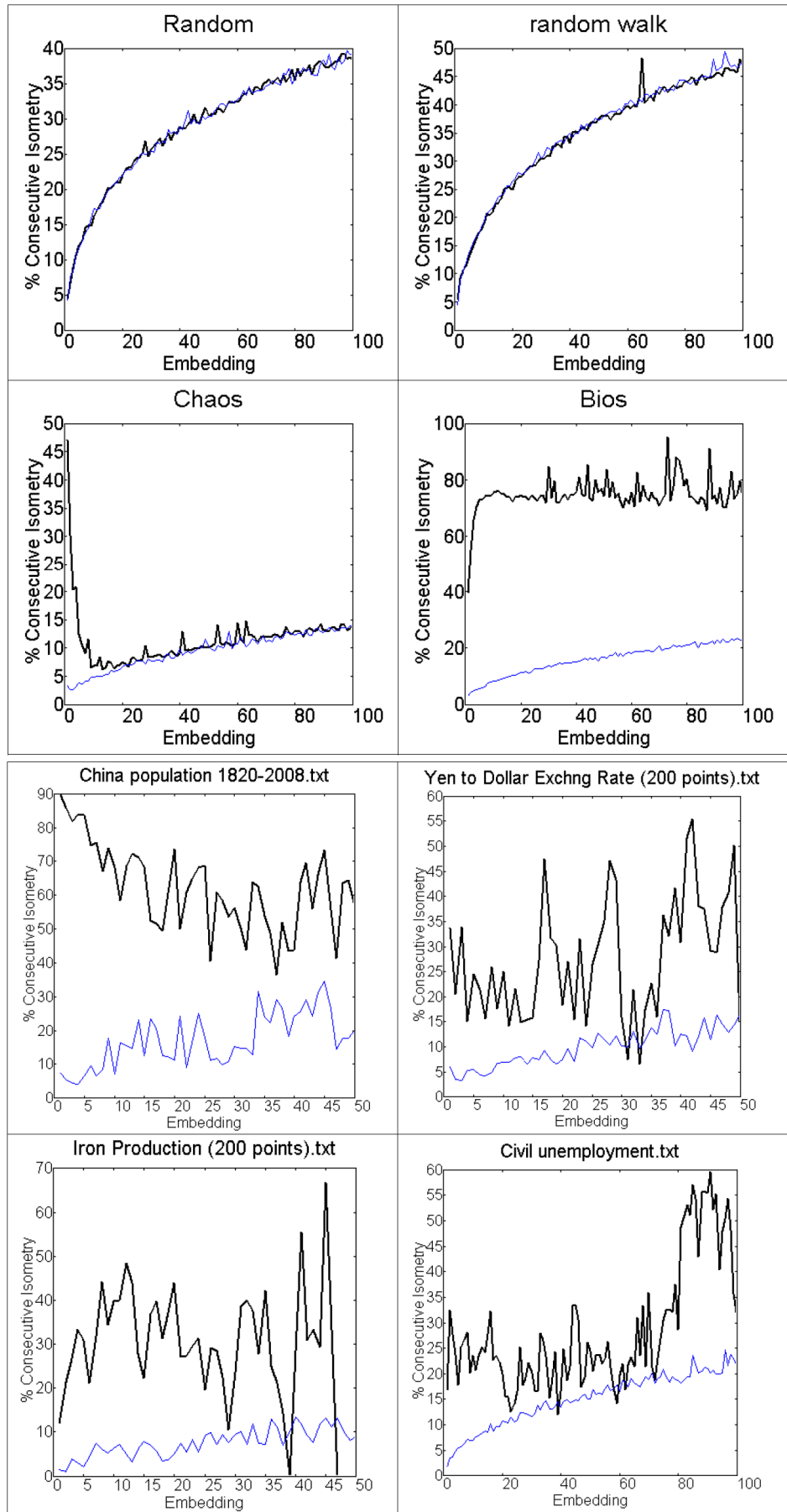
**Mathematical Models of Bios**

Many natural and human processes display a non-stationary chaotic pattern with creative features that we named Bios because it was first found in biological processes [16]. Chaotic trajectories are extremely sensitive to ‘initial conditions’ (external inputs). Biotic trajectories are even more sensitive. This indicates the possibility of modifying the course of social processes with our actions; for the same reason, we can only predict the immediate consequences of these actions. Therefore, ends never justify means, and we need methods, not plans for economic development.

In collaboration with Louis Kauffman, we have developed several models for the causal generation of chaotic and creative patterns (Bios). Biotic features of causality and creativity are generated by recursions of bipolar feedback with a conserved term such as the process equation  $A_{t+1} = A_t + k * t * \sin(A_t)$  [3, 4]. As the gain  $g = k * t$  increases, this recursion generates a series of increasingly complex patterns: steady state, periodicity, chaos, and bios periodically interrupted by period 2 and shifts in order of magnitude (Fig. 6). This sequence of patterns in time corresponds to the hierarchy of complexity: each pattern is simpler than those that follow it. Starting from convergence to one equilibrium state, there is a bifurcation into two complementary and coexisting paths, followed by a cascade of bifurcations into 4, 8, 16... paths, chaos and bios. Note that these bifurcations generate  $2^N$  opposites, not two opposites (as in standard logic and dialectics), and cycling among these opposites, not their partition (as in standard logic). This pattern of multiple bipolar opposites is relevant to social oppositions, as we shall consider later. A sine function (used to generate a mathematical model for Bios) involves a circular rotation; the circumference is composed of infinite number diametrically opposite points.

The process equation is a recursion –repetitive actions generate time series; static equations link variables but do not generate patterns. The generation of Bios depends on repetitive action or process (recursion) bipolar feedback (sine function) of sufficiently high energy ( $g = k * t > 4.6035$ ), and conservation within change (Fig. 6). Unipolar feedback, as in the logistic equation, generates equilibrium, periodicity and chaos, but not bios. Likewise bipolar feedback generates equilibrium, periodicity and chaos, but not bios, if the conservation term is omitted.

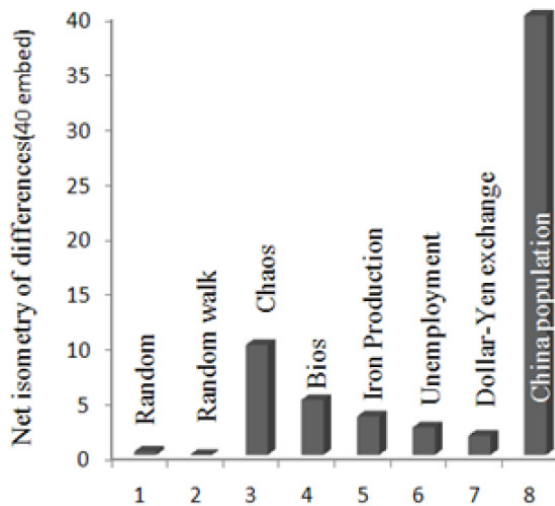
Bipolar opposition is a key factor in the creation of novelty, in line with ancient Greek philosophy (Heraclitus), Chinese Taoism and modern dialectics. Opposites annul each other in certain ways (e.g. in mathematical groups), but create in another; e.g. the union of an electron plus a positron destroys the particles but generates energy, and the union of electrons and protons make atoms. Opposition is most creative when it is continual interaction and feedback. Feedback is most creative when it is bipolar, i.e. both



**Fig. (4).** The consecutive isometry at 100 embeddings for random, random walk, chaos and bios and examples of socioeconomic series. The same test was also run for all the socioeconomic data used in this study.

positive and negative. Bipolar feedback [2, 17] is a cyclic engine for development. Bios is generated by the interaction of opposites in systems with bipolar feedback [2]. Bipolar feedback is prominent in social processes; e.g. cooperation and conflict coexist in class relations; social processes are neither integrated into harmonic systems (society as organism, a medieval concept resurrected by some systems scientists and self-organization models) nor shaped solely by conflict as in neo-Darwinist and simplistic Marxist theories (Darwin noted the importance of cooperation in evolution and highlighted love in human interactions; Marx proposed to replace class struggle by social cooperation). Social health, political democracy, and sustainable economic progress require both cooperation and conflict. Ideas flourish through discussion and are equally unmanned by ready acceptance or pure criticism. One-party systems and bipartisan consensus hinder progress.

Bios is generated by the positive and negative interaction of opposites in systems with bipolar feedback [2, 18], providing a cybernetic formulation for dialectics. Unipolar feedback (either positive or negative) can generate chaos or equilibrium, but not biotic creativity and complexity. In social processes, as in natural ones, progress results from the coexistence or alternation of synergy and antagonism, as contrasted to strategies that rely on either cooperation or competition/struggle.



**Fig. (5).** Causality. Net isometry (isometry of series minus isometry in its shuffled copy) in the series of differences between consecutive terms demonstrates causation in social and economic processes as observed in Chaos and Bios, as contrasted to random series and random walks.

The Bios pattern of social processes indicates bipolar feedback, as indeed observed in cooperation and conflict in class relations. Complementary opposites co-create diversity, novelty, and complexity rather than equilibrium. Unipolar feedback generates chaos but not bios. Stressing the need for both positive and negative interactions departs from Darwinian evolutionism, Marxist class struggle, and capitalist economics. Creative outcomes such as Bios are generated by action, opposition and conservation, thereby suggesting methods to promote social change.

## DISCUSSION

We propose that Bios is exemplary of social development. Development is a concept formulated by Aristotle based on his empirical studies of biological development. What characterizes embryological development is that it is **causal** (largely predetermined by our genes, albeit also depending on interactions with the environment), **creative** –no two persons grow to be identical–, and that it occurs in **stages**, with new, complex patterns arising at each level as result of the causal and creative process, not as unexplainable “emergence”. These features, readily observable in child development, are demonstrable in socioeconomic development by mathematical analyses. The key component for generating Bios is the interaction of opposites.

### Bipolar Feedback in Economic Processes

The mathematical analysis of economic data presented here, together with previous studies [2, 13, 19-21], show that economic processes do not tend to equilibrium and display random variation as postulated by standard economics. Instead, they show Bios.

Feedback is necessary for creative development. The economy deteriorates when determined by plans drafted by financial institutions, governments, or corporations without any feedback. Classic economics postulates scarcity as the sole economic motivator, and international institutions and international financiers have proposed austerity programs for third world countries. Just as mathematical models of scarcity (unipolar feedback) produce chaos (but not bios), social chaos is indeed observed in third world economies that have accepted austerity programs. Development is fostered by the interaction of abundance and scarcity. Natural abundance allowed the emergence of life and human societies, and is still a central issue in the modern economy. Social progress emerges from the ability of farming and industry to generate abundance, and crises often result from overproduction. Our current economic crisis results from a decrease in demand, which is continually aggravated by unemployment and decreased income for the majority of the population. **Creative economic development requires bipolar feedback (abundance and scarcity).** Economic processes display a biotic pattern, indicating their generation by bipolar feedback processes. The interaction of demand and supply, consumption and production, generates bios, not equilibrium as postulated by standard economics.

### Bipolar Oppositions in Social Processes

Relations of mutual bipolar feedback occur in society at large and in the family. They shape social roles and classes. Socially-determined roles precede personally chosen ones. The roles performed by individual persons emerge from these social roles. Social roles are more immediate than the feeling of membership in a social group, e.g. being American, woman, or worker. Each person plays multiple, coexisting generic social roles determined by age, sex, nationality, class, ethnic group, “race”, religion, education, and health. Age is the most basic social factor because it is biologically determined, applies to all humans, and directly portrays process. It determines a sequences of stages, clearly recognizable but not separated by boundaries, basic social

roles (parents and children) and significant social groups (generations). Sex is likewise biologically determined, but more complex because it includes two categories throughout persons' life that play complementary roles in reproduction and therefore in other social functions. In many mammalian species, males have supremacy physically and psychologically, although there is great variation among species, societies and individuals, as well as enormous change throughout history, particularly in our times. Male supremacy is complemented by intrinsic forms of females power derived from their role in reproduction and in the rear of children, and their longer life span (female priority). At a higher level of complexity, one must consider nation, race, class, and so on. Each of these roles is paired with a complementary opposite counter-role in a relation of mutual bipolar feedback. These relations of mutual bipolar feedback include (1) the temporal changes of age and consequent relation between generations; (2) the relation between two biologically determined sexes; (3) the interactions among three or more nations, races and classes defined by power over the use of tools and weapons. The latter establish class differences between ethnic groups largely defined by membership into national systems.

The individual person is at a level higher, in terms of complexity, intelligence and morality, from the generic roles and the collective system. Indeed each person plays simultaneously multiple social roles.

**Age** is the most basic power structure. Child and adult, young and old, are more similar than they are different. Our basic needs and our personal identities remain similar throughout our life. At all ages we have the same physical needs, we require affection, freedom of expression, and meaningful work. Focusing on the similarities between children, adults, and elders, rather than on their differences allows us to treat each other as humanly.

In all societies, just as in almost all animal species, the adult age-class dominates social intercourse, **adult supremacy**. Equally fundamental is the psychobiological (familial) power of the younger, or **priority of children**, manifested in each individual (our child self predetermines our adult self, and coexists with it throughout life) and in the family, as first the parents provide and serve the children, and as adults, the offspring dominates over their elders both physically and socially. Children continue to constitute the most oppressed group in society. The worst paid doctors are those of children, infant mortality rates in the U.S. are huge in comparison with those of other wealthy countries.

Up to now, human societies comprised of three generations: children, adults, and elders. As result of the prolongation of life and health, we have at this time in history a new age-class, persons who enter the age of retirement with considerable physical, mental, and economic capabilities. This is a crucial change in the structure of our society, because persons tend to be very creative at this age. This is the most creative age, claimed psychoanalyst Carl Jung; it is the age of philosophy, said Aristotle. Indeed, persons are creative at all ages, but the point is that creativity does not decrease with age and can rather be enhanced by experience and knowledge with advancement in age.

Up to now, only relatively few lived to reach this age. Now, however, there are entire cohorts of "adult 2" persons. The members of this group are not necessarily working, but have political power, so they play a key role in changing society. Often this age group is seen as a burden for the younger generation that produces. In reality, this is can be a productive group if we changed the structure of economic labor allowing for some meaningful employment after retirement from standard jobs. Further, we have proposed, that **this new age-class (adult 2) represents a protagonist force for emancipatory action** [22, 23]. In fact, this group has already started a process of emancipation which has led to considerable improvements of its standard of living in the U.S.A. However, there remains an enormous amount of discrimination against adult 2 and elders in this country.

Elders are often consigned to nursing homes, a separation of adults from their parents, which is often encouraged in our society yet regarded as inhuman in other cultures. Indeed this matter may differ from family to family. While many elders who can afford to live in senior or seniors-only apartment buildings or communities, the poor elders are consigned to depressing nursing homes in America and in Europe.

**Sex** presents another fundamental opposition. The co-creation of opposites, as illustrated by the interaction of the sexes, constitutes a central feature of the Bios model for causal and creative processes.

We must speak of sex not gender, because sex is biological and not just social. Pregnancy is the central hindrance to the freedom of women, and the main reason for the constitution of families. Since antiquity, the poor have been called proletarians. Identifying workers as "proletarians" (from proles "offspring, progeny") in modern times indicates the importance of reproduction in contemporary class conflicts. Reproduction rights therefore have significant political implications.

The most important social process of the twentieth century has been women's liberation. Up to then, male-centered emancipation ideologies placed the focus on class, race, and national issues. The current focus of religious fundamentalism is male supremacy and their target is reproductive rights.<sup>1</sup> Pregnancy remains the essential avenue through which men attempt to exert control over the lives of women as was highlighted by Simone de Beauvoir in *The Second Sex* in 1952 [24].

Women and men are more similar than they are different, yet their differences are essential, and serve as the bases for creative interaction and reproduction. This is at the core of the concept co-creation of opposites, as we shall discuss later. Again, focusing on similarities rather than on differences allows us to treat the other humanely.

Power is unequally distributed between women and men. Here I shall describe a concept of female priority that we introduced in 1989 [25]. The cause, significance, social value, and the ultimate direction of this inequality is such a conflict-laden subject that it is necessary to make our definitions very clear. A dominant societal role for men is

<sup>1</sup>The "Christian right" has put enormous pressure to prevent the marketing of a vaccine that can prevent more than 70% of cervical cancer because of the fear that safety would promote more sexual activity.



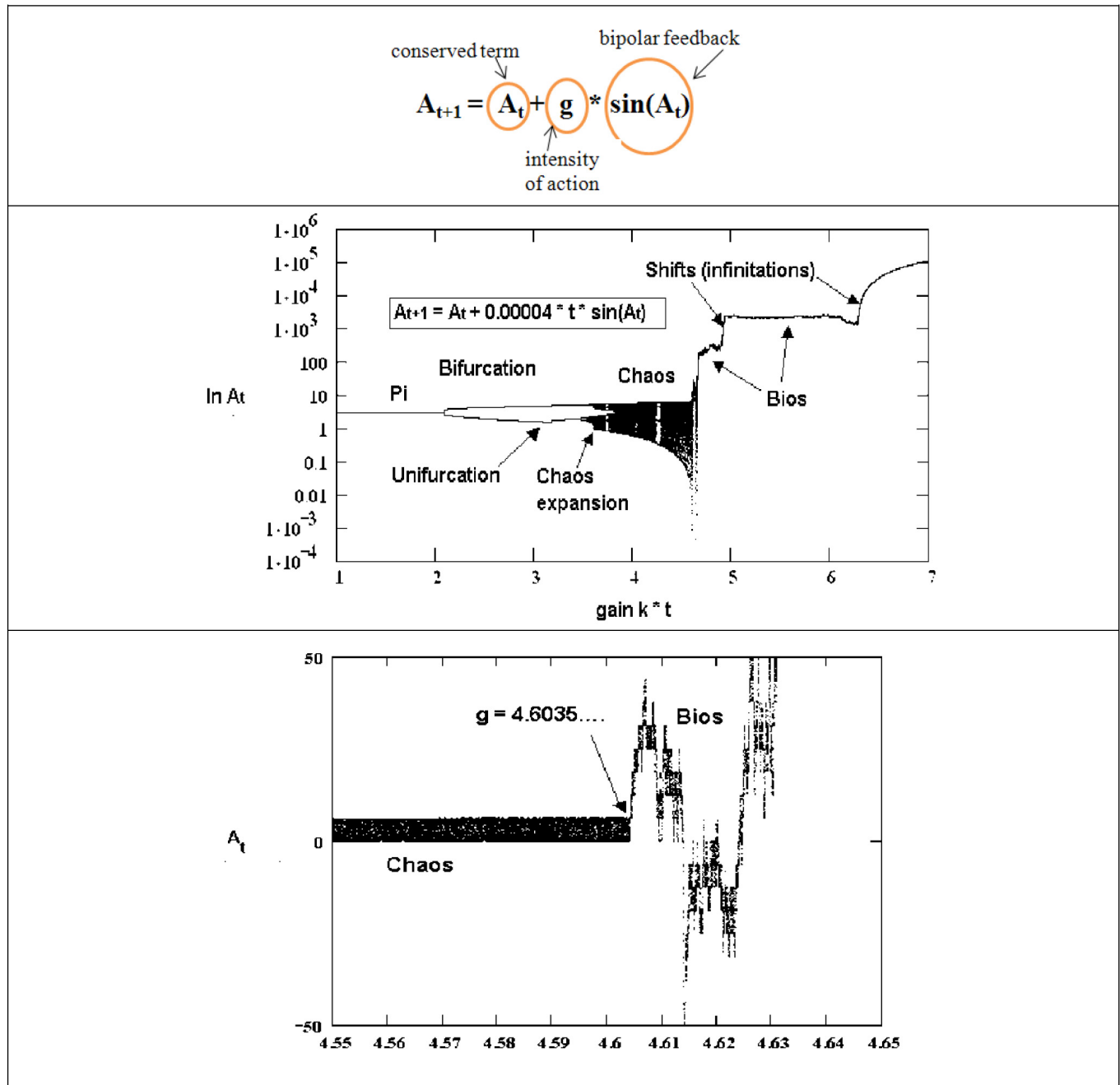


Fig. (6). Process equation.

often supported by cultural traditions and religions, and “justified” by many social and psychological theories. The concepts of female priority and male supremacy discussed here are purely descriptive. They should not be read as having any prescriptive intentions behind them, in contrast to the positive or negative value assigned to power relations among sexes by many ideologies. But still in our times the social reality of male supremacy includes many dark aspects, such as wife abuse.

Male supremacy exists, to a greater or lesser degree, in most animal societies and in most human societies, although in extremely different degrees. For instance, many “primitive” societies –many of the extremely civilized, like

the Mayans—have a much greater degree of equality than “more developed” societies, like the Spanish conquerors, including the election of couples to public office [26]. This quasi-universality of male supremacy among mammals indicates that patriarchy is at least in part biological in origin, while the wide range of behaviors indicates that there is a large sociological component to it. The cause behind male supremacy cannot be located in neither nature nor nurture. Both nature and nurture contribute to male supremacy, it is a fact. But it is also a fact that can and should be changed, and is changing.

This illustrates central features of the concept of creative processes. Patriarchy has a biological cause (pregnancy), but

it is not determined by it. In fact, contraceptives, among other things, allow women to control their reproductive life. Simpler and more complex levels of organization (nature and nurture) interact in a largely synergistic manner, such that the priority of the simpler (nature) shapes up initially the pattern of the more complex (society) yet the more complex can and does achieve supremacy, and can thereby change qualitatively the outcome.

The fact that something is natural or biological, or more specifically caused by a physical process or a gene, does not make it an unchangeable fact. For instance, it is a fact that persons with a certain genetic variation that prevents them from metabolizing a common food ingredient, the amino acid phenylalanine, become mentally retarded, but it is also a fact that restricting phenylalanine from their diet can prevent mental retardation. In a similar manner, the biological origin of male supremacy (or of any other trait) can be drastically changed by social action.

While patriarchal domination is regarded by many as a major, crucial flaw in society, few question its existence in every area of human life. Clinical experience, however, presents a different picture. It includes families ruled, and/or supported by the mother; husbands emotionally and socially dependent on their wives; sons tied to the present, or past, authority of their mothers; narcissistic wives who enjoy leisure and demand attention, services, and privileges from their hard-working husbands; and widows surviving their husbands for eleven years on average in the United States.

The relation between men and women also includes at its foundation the power of women. We call it female priority because it exists before, during, and after that of male supremacy. What facts support the idea of female priority? Life expectancy offers the most dramatic evidence for female power. At every age and in every country, males die more often than females do. Among the elderly, the proportion of men to women is 25% to 75% in the United States. Likewise in Russia (both now and during the Soviet system) Union and in contemporary Russia, life expectancy is much shorter for men than for women. A ten year difference in average life duration is due to the sexual division of labor, because it is diminishing as women participate more in the work force. Similar differences in life expectancy between African-Americans and other Americans, or rich and poor are often raised to demonstrate the unfairness of society.

Even early in their lives, women are hardier than men. To achieve parity at age of sexual maturity, a ratio of 130 males to 100 females would be required at conception, and this ratio decreases to 104:100 at birth through spontaneous abortion. Infant mortality is consistently higher for males than it is for females in almost all countries, including wealthy and socially conscious nations like Canada and poor countries like Pakistan. After age 20, there are more women than men in all societies, from Neanderthal to the present [27]. As a rule, women receive more medical attention than men do. Yet, the fact that women live longer indicates that they enjoy, in general, better health throughout most of their lives. It is not only a question of duration of life, but of its quality. Stress triggers, worsens, and may even cause, a variety of illnesses from heart disease and arthritis, to cancer and psychiatric dysfunctions in men and women. Work

outside the home, the responsibility of supporting the family, even if the wife contributes to this task, making men's lives shorter and more prone to sickness.

If survival is a measure of the significant social advantages that women have over men, the origin of female power originates at the other extreme, in infancy. As biological organisms, we are mammals; the term itself expressing the idea of being nurtured by our mother is a fundamental identifying trait: we are literally raised at our mother's breast. This is the essence of female priority: **in every person's life, his or her mother is the first authority and first identification figure.** For a child, certainly for infants, power resides largely with the mother. As adults, women and men daily confront the overt authority of men. However, their overt authority also coexists with an unconscious recognition of the authority of mothers. Female priority has a biological root on maternal behavior, which is conveyed and conserved, in a largely unconscious manner, by each of us. The administration of progesterone, the maternal hormone, induces maternal behavior in male rats.

Female power is not an alternative to male supremacy. Male and female powers are not oppositional, growing at each others' expense. Female priority is the correlative of male supremacy in all human societies. This notion has profound implications for personal psychology, family function, and social action. It should not be misconstrued as an endorsement of sexual inequalities. This idea is meant to be used as a tool for personal and social liberation. Female priority and male supremacy do not balance each other in harmonious symmetry, making this "the best of all possible worlds." Women are justified to resent and struggle against the discriminations of male supremacy. Women are socially, economically, and often also educationally, weaker than men, and have been, and continue to be, the victims of physical violence.

**Family** is the most immediate social system and its biological core extends through marriage and economic processes—economics meaning literally the management of the family in Greek. Family extends to community, clan, and nation. Nations originally involved such connection, but in time states evolved so they no longer coincide with nationality of origin, and eventually the notion of races coexisting within one country became significant. Race, nationality and class—have much to do with one another; these conceptions change from time, country and person, and they are not just a question of discrimination but they are actually killing in war and often in peace.

**Nationality**, although often coinciding with religion and race, became increasingly important and expanded to include the conquest of other nations creating empires; much of the social discourse regarding nations is confounded by justifications of imperialism, often criminal, as the Nazi regime illustrated to all, and equally destructive in the Spanish conquest of Latin America and the British empire in America, India, and many other Asian countries. Also significant is the notion of American exceptionalism and its duty to bring civilization and freedom to other nations, a concept embraced by neoconservative ideologues, but also President Obama stated "*I believe in American exceptionalism, just as I suspect that the Brits believe in*

*British exceptionalism and the Greeks believe in Greek exceptionalism.” [28].*

**Race** as a biological differentiation does not appear to be a significant factor in social processes, but racism is. You are a Jew, a Black, or a Hispanic because those in power label you so. In Christian Europe, Jews were regarded as being of the same race because they shared the same hatred from others. Racism is today supported by “psychologists” that discover differences between black and white Americans regarding intellectual abilities or criminal records, while ignoring the facts of poverty and slavery. Racism starts with wars of conquest: the conquered become a lower caste in the social system organized by the conqueror. Anti-Semitism originated with the Hebrew revolution for independence, which was defeated by the Roman Empire and executed Jesus as “the King of the Jews.” In the American continent, racism began with the kidnapping of Africans for enslavement.

Native Americans became the lower classes within the Spanish hierarchical society. The more egalitarian Protestant communities had no place for other races, so they waged a genocidal war against the estimated ten million “Indians” who inhabited North America [29]. The few survivors live on reservations and were only granted the right to vote in the 1920s. The Anglo-Saxon/Spanish war first enacted by the Caribbean pirates, whose assault, murder, and rape of the Latin colonists is glorified by Hollywood, and continues today. Anti-Hispanic racism, anti-Indian racism, and anti-Catholicism co-mingle today in anti-Latin American racism. Militarism, dictatorship and poverty are attributed to racial, national and religious Latin American traditions. In reality, no Latin American country ever invaded the U.S. whereas it has invaded Latin countries regularly, appropriated half of Mexico and all of Puerto Rico, maintaining military bases (used for torture) in Cuba, and established and/or supported dictators throughout the hemisphere for much of the twentieth century.

Illustrating the importance of unwanted consequences, slave trade was promoted in the continent by a Catholic priest wishing to protect the Native Americans. The heroic Haitian Revolution of black slaves (1791-1803) was cynically opposed by former American revolutionaries like Jefferson and French revolutionaries like Napoleon. The crime of being the first black republic has never been forgiven. Haiti is currently under the rule of a dictatorship sponsored by the U.S.

Race, nationality and class are intimately connected. “The problem of racism, the problem of economic exploitation, and the problem of war are all tied together. These are the triple evils that are interrelated,” explained M. L. King. And he added: “I could never raise again my voice against the violence of the oppressed in the ghettos without having first spoken clearly to the greatest purveyor of violence in the world today –my own government” [30].

**Class** is the most important category that does not stand on a biological basis. The differentiation of occupational roles plays an important function in modern society. Occupations are roles practiced in interaction with others, depending on exchange of products and services, and organized in hierarchical relations with others, such as

employer-employee. In all societies since the beginning of agriculture, three or more classes are differentiated by power over the use of land, tools, and weapons, which in a modern context mean the control of the means of production such as land, factories, capital, technology, and of the means of destruction such as weapons and organized armies. Patricians, plebeians and slaves in ancient Rome; lords, freemen and serfs in the Middle Ages; Brahmins (priests), Kshatriya (ruler, warrior, landowner), Vaishya (merchants, artisans), Sudra (unskilled workers, servants) and Harijan (outcasts or “untouchables”) in the Indian caste system; capitalists, middle classes, farmers, workers (“proletarians”), and the “lumpenproletariat” (the almost unemployable underclass) in Victorian England. Consider these triads that often diversify into larger number of categories, in contrast to the pairs of opposite classes described by Marx and Engels in the Communist Manifesto, a description that led to the notion of class polarization and unavoidable violent confrontation.

Class is such a controversial issue that many have opted to deny its existence. Dominant discourse claims that the U.S. is a classless society, just as it was claimed by Soviet authorities about Soviet Russia. Some intellectuals ask me to give up “class” as an obsolete nineteenth century idea. To do so in the midst of one of the cruelest class wars of modern times is like asking Jews to ignore the issue of race in the midst of the Holocaust. We are indeed experiencing an acute class war when the ratio of incomes between CEO and workers within an enterprise is 500, there are massive layoffs of workers in the U.S., corporations demand a reduction in worker salaries to less than one half the current one,<sup>2</sup> almost fifty million Americans are deprived of health care benefits, and public wealth has been siphoned out to benefit private corporations.

What defines class is not only control over the means of production, but also control over the means of destruction. Today, the wealthy no longer produce wealth, but rather they take it from nature or from others. Among animals, fighting is required to prey and to compete for status within the social hierarchy, thereby determining the availability of food, mating, and territory. Among nation states, military force provides the capacity for preying and competing within the international hierarchy; military force determines the distribution of wealth among nations. Military force therefore is the most fundamental form of exerting energy, as it obtains highest immediate energetic return. War is the enhancement of competition and intra-species predation by the production of weapons. Weapons, when used aggressively, act very much like tools to satisfy our desire for consumption.

What matters is not ownership of tools and weapons, but their control, a corporate executive or a government bureaucrat may not own the means of production, nor does a general own the weapons used by his soldiers. “Ownership” is nothing more than a form of control over the means of production (land, factories, capital, and patents).

**The foremost class division is the enslavement of prisoners of war.** Many wars were waged to capture slaves,

<sup>2</sup>The Delphi corporation demanded a reduction from \$27 to \$10 per hour as a condition not to terminate its USA workforce (November 2005).

and the African Americans were the victims of forceful kidnapping by the civilized Christian Europeans. Violence rather than the division of labor underlies class. The legacy of slavery is central to social processes in the USA, just as the legacy of colonialism is central to Africa's poverty. Slavery itself persists in the world, including the forced labor of jail inmates and the indentured work of many illegal immigrants in the USA. Slavery also existed in the Soviet Union's Gulag. Also in these cases the class division is a product of violence, not of the division of labor. Slavery is a socioeconomic class only in the sense that when the productivity of one person exceeds what he consumes, slavery is profitable.

War is a crime.<sup>3</sup> The most common outcome of expanding national power is invasion, conquest, colonization, enslavement, and genocide. The history of the British and the Spanish empires demonstrates just that in contrast to the myth of a "civilizing mission," propagating Christianity, or exporting democracy.

In the twenty first century, self-defense has been used to wage "preventive" war. While self-defense is natural and conflict is sometimes unavoidable and at times necessary, war is systematic and massive murder; it is systematic and massive robbery. The appropriation of the property of the defeated "natives" has been the main source of wealth and poverty since antiquity to our times. **War, not the division of labor, is the main cause of class domination.** Warriors enslave the conquered and become lords to their compatriots.

The concept of "race" originates as class. Throughout history, military classes have become dominant as a consequence of war. Militarism, not capitalism, communism, or Islam, is the main enemy of freedom and justice. The defining feature of fascism in Germany, Japan, and Latin America has been the overt and crude domination of society by military classes. The Red Army, and other armies of national liberation, dominated Communist and post-colonial African and Asian countries. A reason why war is prevalent in contemporary society is the development of war-based economies and war-based cultures, and the consequent domination of a nation state by a complex of financial, industrial, and military classes.

Since the Second World War, U.S. foreign policy as well as internal economic priorities and political discourse have been dominated by military objectives. The current expansion of the USA military, and its role as an agent of multinational corporations, together with the power of modern weapons, generates new dangers for society. Yet the U.S. has also a strong tradition of civil control over its military. Also, the celebration of heroism, patriotism, holy wars, and crusades by schools, churches, and the news and entertainment media may cease as those who have until now monopolized military power begin to realize that chemical and biological weapons constitute "poor man's atomic bombs". Nuclear proliferation has been a reality for some time. In addition to that, military force cannot always preserve the life of civilians even in the wealthier nations.

<sup>3</sup>This concept is thoroughly explored in *The Crime of War*, the title of a leading book by the Argentine thinker Juan Bautista Alberdi, in which he does not even hesitate to point out the crimes of war committed by his own nation [31].

And when used to destroy the enemy, military force only causes them to multiply in numbers. Therefore, self-defense is crucial but peace-making is its most important tools.

**Stopping the ongoing wars and creating jobs are the only practical solutions for the economic crisis.** The economic system needs demand. People need money to satisfy their needs, and they need jobs to earn it. The current bailout of financial institutions does not provide a stable source of income for people, and at best it can only patch up temporarily the irrational economic system that allowed the crisis to occur in the first place while leaving in power those who created it. The concept of personalization provides practical solutions to the current economic crisis: to serve persons, governments must **rescue persons not banks.**

Class is a question of freedom, not wealth. **Classes are defined by the interaction among them.** Class is not simply a relation of rank. It is a role in social and economic processes. According to Weber, dominance, power, and authority are the backbones of social processes, and they account for class hierarchies and conflicts that Marx envisioned primarily in economic terms [31]. This view is consistent with the existence of social hierarchies among animals, which historically and logically preceded the existence of the economic division of labor.

It is noteworthy that the proto-fascist economist Pareto described the power law distribution as the "law for all societies at all times and in all countries." This is clearly false, yet it is still quoted as fact by some chaos theoreticians.<sup>4</sup> There is an important political implication to Pareto's "law" (1917), namely that a skewed, highly asymmetric distribution of incomes is normal expected, natural, universal [32]. Is this the reason why is it quoted as fact?

Class is an objective, social (intersubjective) and subjective category. It is objective insofar as it relates to power, wealth, and economic role; in immigrant societies like the American countries, people think of financial means as being analogous with social class. It is intersubjective insofar as it depends on how others relate to you; a penniless middle class immigrant soon becomes middle class again. It is subjective insofar as it depends on how you treat yourself; numerous traits from trivial "mores and manners" to ethical "noblesse oblige" differentiate those who have "class" from the merely rich. An impoverished aristocrat, an unemployed professional, and a bankrupt millionaire are not treated in the same fashion as a person who has always been poor.

This characterization of class departs from many others, in particular to the identification of class with money (predominant in capitalist culture) or with family (a favorite of impoverished aristocrats) or with education (the view of

<sup>4</sup>This complex distribution is described in many different ways. Statisticians say that the great majority of population is described by an exponential distribution, whereas the high-end tail follows a power law. In recent years, "econophysicists" have described exactly the same data and describe them through thermodynamic metaphors that sound more scientific but do not address the crucial issue, class differences. More strikingly, many sociologists and "cutting-edge" dynamicists describe the entire curve as a power law distribution (Pareto's distribution), implying that there is no class distinction and that natural, invariable "laws" determine the extremely uneven distribution of incomes. This is a clear example of the misuse of 'science' to obscure social reality.

intellectual elites), as well as with the Marxist definition of class as depending on the ownership of the means of production. This is not a question of definitions. Class is a social reality, so its characterization is an empirical matter, not a convention. What matters is control, not ownership, of the means of production, so administrators (corporate executives, state bureaucrats) are as much members of the upper class as the owners.

In modern societies there are always at least **three** classes. The always feared and often predicted polarization of classes into 'have's' and 'have not's' is yet to occur. On the contrary, with social and technological development, there is a **diversification of classes**. The basic idea of communism, a trajectory toward a classless society, runs against what is observed in history. The issue is to abolish classism, i.e. the notion that lower class people deserve only subsistence level salaries, and that wealthy people have been so blessed by a special act of God, and should steward the wealth of their family and stockholders as custodians of God's will. Perhaps the idea of divinely sanctioned ownership of wealth is passé today, as many have found reasons (work, intelligence, Christianity) to horde wealth, but the bizarre sense of entitlement is the same.

Age, sex, class, and race are generators of behavior, not simply categories for classification. Roles do not determine sharply delimited groupings, as a person may play multiple roles (e.g. son and father, employer and employee), and while social mobility is real in modern society it is, however, limited and in any case it would not take away the need for social equity.

Social opposites co-determine each other. Conflict generates paranoia, rage, fear, and submission to authoritarian leaders. We co-create not only with our allies but also with our enemies. Therefore, it is desirable to promote cooperation and non-violent opposition rather than class or nationalist struggle. At the very least, make peace. Armed conflicts devastate both antagonists; even the most powerful nations cannot sustain destruction caused by terrorism or financial collapse. It is meaningless to be peaceful only with our allies.

One can make peace only with one's enemies. One cannot afford to be indifferent when the other is an enemy: one must defend oneself and protect others. But "preventive" war is not conducive to peace. One can never kill every enemy: attempting to do so only creates new ones. Terrorism flourishes when political opposition is suppressed. One cannot wait until the enemy changes leader or tactics, but rather makes peace by opposing war parties on both sides of a conflict. One makes peace by respecting the other, and abstaining from exploitation and superfluous aggression.

History is created by cooperation and conflict within and among generations, sexes, classes, and systems, not solely by their struggle or their integration into harmonic systems. This role theory is at variance with individualistic accounts that focus on conflict within classes and with socialist theories of progress through class struggle. It is more insightful to see the continuity of families and of age roles than to focus on the conflict of generations. It is insightful to see that sexes epitomize the co-creation of opposites rather than to focus on patriarchy or feminism. It diminishes history

to regard it as struggle between rich and poor. Class struggle is not more noble than racial struggle. It is not a desirable path to social liberation. Yet, social movements cannot ignore class issues, particularly not in the midst of an offensive against workers' rights. **Class struggle is currently waged by ruling classes** to further enhance their privileges, thereby generating destabilizing polarization. Likewise, the exploitation of poor nations requires wars of conquest, and generates terrorism and revolution. The 1989 revolutions in Eastern Europe and South Africa demonstrate the possibility for profound change without violence. Social progress is best served by class peace and through legal means. Resisting the offensive of the greedy in a nonviolent manner, and taking the initiative with new proposals for social development that generate effective majorities.

Marxism attributed class differentiation to production, but the most important class and racial differences have been generated by war, conquest, dispossession, and enslavement only the latter has disappeared being transformed into economic exploitation. The model for class struggle is not patricians and plebeians in ancient Rome, as brought up by the Communist Manifesto, but conquerors and slaves.

Social processes also embody the interaction between **planetary and human** processes. In our times, we have become conscious that human processes are part and parcel of planetary life, so the depletion, degradation and destruction of the environment is fundamental, indeed more fundamental than the social and national struggles in which we are immersed. Conversely, culture, belief and education have supremacy. Fear (e.g. American after the 9-11 attack) emotional depression (as during economic depressions), and rage (e.g. German response to Versailles "peace"; suicidal terrorists after USA Middle East wars) drives people to intolerance, racism and war. While popular ideologies focus on the material roots (priority) of social phenomena, it is actually necessary to attend also to knowledge, feelings, and beliefs. Further, our success or failure in controlling environmental degradation depends heavily in economic policies that in turn reflect our intellectual and emotional insight. Persons significantly influence the physical and biological environment (supremacy), upon which they depend (priority). Hence a guiding principle for political education and governmental action: Give Priority to Nature and Supremacy to Persons. Personalizing education, health care, property, and work complements the protection and regeneration of nature required to sustain our species.

To integrate these different aspects of social life, we need general theory.

## **Theory**

**Action, bipolar opposition and evolution from simple to complex** are generic forms that repeat in natural and human processes. The equations that generate a series of increasingly complex patterns from steady state to Bios involve these three forms, **action** (recursion), **bipolar opposition** (trigonometric function) and **transformation** (change and conservation). They are abstracted by the mother structures of mathematics described by a seminal group of French mathematicians [33] whose work is regarded as a major contribution to the foundations of mathematics. They are (1) order (defined as asymmetry and

transitivity), the subject matter of lattice theory, (2) opposition, studied by group theory; and (3) transformation, studied by topology. The leading psychologist Jean Piaget identified these same forms as fundamental cognitive structures of the human mind [34].

They are also fundamental in physical processes. Action is the flow of energy in time. Thus action (which is asymmetric and changing), not energy (which is conserved), is the “substance” of physical reality and of social processes. Gravitational attraction exemplifies action. Modern science, from Newtonian mechanics to quantum mechanics, makes action its central concept.

Human activities and ideas are also actions. The physical concept of action thus captures the process view of evolutionary theories, as contrasted to static models, either deterministic or random, that deter from progressive social action.

Opposition is prominent in physics (many aspects of reality are described by groups, quantum complementarity, bipolar electromagnetic energy), biology (sexuality; cooperation and competition among species), economics (supply and demand) and human processes (woman and man, upper and lower classes, self and other, harmony and conflict). Evolution proceeds by bifurcations, i.e. the partition of a trajectory into opposites; in turn, opposites interact and combine, thereby forming complex systems. While economic theories (both capitalist and Marxist) stress competition and struggle, creative feedback involves both cooperation and antagonism. Economic processes depend on supply and demand, not one or the other, and must support both upper and lower classes. The current collapse of the economy resulted from the disparity between supply and demand, and possibly low salaries that reduce demand.

The concept of universal opposition fosters tolerance and co-creation. It captures the core of dialectics, but also expands it by stressing the coexistence of synergy and conflict, and implying the multiplicity and interaction of oppositions; this is particularly meaningful for social processes. Age, sex, class, national and ideological oppositions interact in constructing social politics, as contrasted to simple explanations in terms of economics, sex or nationality being presented nowadays (in contrast, nineteenth century feminism was profoundly conscious of issues of race and class).

Matter is tridimensional and tripolar --protons and neutrons are made of three quarks. The strong and weak nuclear forces that form and transform nucleons (protons and neutrons) that make the atomic nuclei are tripolar. Continuous and discontinuous transformations transform of matter, which into ever more complex atoms, molecules, and beyond. Recognizing the tripolarity of social processes is obviously useful in a world turned asunder by bipolar conflicts.

Asymmetry, opposition, and evolution from simple to complex are clearly embodied in the three dimensions of the central nervous system (CNS), the most complex system known, its dorsal sensory to ventral motor asymmetry corresponds to the direction of action—the flow of energy in time. There is opposition between the right and left structures of the CNS. Opposite sides are fairly symmetric at

the spinal level while the brain hemispheres are asymmetric, indicating that opposition, not symmetry, is the fundamental form. There is a hierarchy of levels of increasing complexity in the CNS vertical axis, with priority of the simpler spinal cord and supremacy of newer, complex brain structures. The vertical hierarchy is the product of evolution (the amphibian, the reptilian and the mammalian brain) and represents a topological transformation of structures into complex ones. Simple and complex nervous structures interact in both directions. The spinal cord executes simple sensory and motor functions, so the higher structures depend on the spinal level (*priority*). Conversely, the higher levels control the lower nervous structures; this control involves processes of excitation and inhibition, i.e. *bipolarity*. The interaction of simple and complex processes is an additional source of creativity, beyond the dialectic of opposites.

The rate of flux of energy is faster in the cerebral cortex than in any other process—energy flows at the rate of 1 in ergs/second per gram in the galaxy, 2 in the sun, 80 in the human body and 1,500 in the brain [35]. As a consequence, complex processes have greater power (*supremacy* of the cerebral cortex).

This hierarchy of levels, from simpler and older to newer and more complex, also applies to human processes: biological, socioeconomic, cultural and personal factors. Social processes precede personal experience and psychology. Our age, sex, even class, culture and religion are determined before we are born. In turn, individual factors have supremacy over social ones in determining economic, political and cultural phenomena. Persons are the most complex entities in the known universe. As a person is a member of society before being an individual, social issues have priority for personal liberation. Health, age and sex issues have priority over class issues. Striving for the rights of elders must be given priority as a political issue; the increase of the elder generation and the failure of private retirement plans provide an opportunity to take the initiative.

#### **PERSONALIZATION, A NEW VISION OF SOCIAL HEALTH AND HUMAN LIBERATION**

Personalization describes an important process in historical development and provides a new vision of social health: placing family, social, economic, political and educational policies at the service of persons as both individuals and society members --not for state, church (“God”), corporations or parties [36]. As contrasted to individualism and to socialism, personalization involves both the personalization of social and economic processes and the socialization of individuals. A personalized social policy places medicine, education, industry and commerce at the service of persons (in plural), their health and liberty, rather than at the service of state, church or corporation.

Personal is not the same as individual. As economics has priority over political life, personal freedom requires employment and personal property. In economic crises, governments must rescue persons not banks. Personalization offers a new social program beyond both individualism and socialism.

Personal is not the same as private. In fact, abusing the concept of private property, modern capitalist system started with the expropriation of the land and the enslavement of

native populations in America, Africa and Asia. In our times, expropriations of national, family and personal property (e.g. Americans are losing their homes and their jobs) are often labeled as “privatization”. But, as property is fundamentally collective and only secondarily private, an unexpected result of the destruction of national economies by capitalist globalization has been an increase in cooperative ownership economy in culturally developed countries. In Brazil, lands that sat vacant and unused were distributed by the Landless Workers’ Movement amongst over 25,000,000 landless families. After years of austerity economic programs recommended by international agencies that weakened its economy, Argentine wealth was impounded in 2001 by international banks. Many businesses failed and many factories were closed. Argentine law transfers the ownership of factories that close to the workers if they make it function as a cooperative. Workers did, and were able to produce profits [37]. This is a strategy to provide job security in all countries. This is not a utopia vision emerging from intellectuals but a collective co-creation in countries transformed from rich to hungry by globalization and economic “austerity” programs.

### CONCLUSION AND SUMMARY

In conclusion, the concept of causal creation provides a new source for social theory. Social processes are creative, generating complexity. But creation also has destructive consequences. Industrial growth often produces ecological destruction. The accumulation of wealth by some often impoverishes others; globalization generates deindustrialization and pauperization. Technological advance accelerates both creative and destructive processes, hence the catastrophes that opened the 21<sup>st</sup> century.

Creativity is often attributed nowadays to random change. Random models are useful as foils in statistical testing of hypotheses but random explanations are inadequate for science, and detrimental to the health of our planet and of life. Portraying nature as governed by random fluctuations encourages its exploitation and abuse. Assuming randomness discourages the search for cause. The American financier George Soros [1] attributes the generation, delayed recognition, and inadequate solution to the current economic crisis to the widespread assumption among economists that processes are driven by random fluctuations [38].

Biotic processes are extremely sensitive to conditions (more than simple chaos), so we can modify them with our actions; for the same reason, we can only predict the immediate consequences of these actions. Therefore **we need methods, not plans.**

In summary, this article:

- (1) Describes new methods to demonstrate creativity in empirical time series (novelty, diversification, temporal complexity) already used in published physical, biological and medical research to demonstrate that socioeconomic processes are creative.
- (2) Compares statistical and recurrence methods to demonstrate causality to demonstrate that socioeconomic processes are causally, not randomly, generated.

- (3) Presents a mathematical model for causal creative processes, Bios, and identifies action, bipolar opposition and conservation as the necessary components to generate it.
- (4) Points to the interaction of demand and supply as required to move economic processes, in contradistinction to demand or supply economics and to the hoarding of wealth that decreases the demand of the majority of the population thereby weakening the power of the middle and upper classes.
- (5) Points to the interaction of increasingly more complex social oppositions (generation, sex, nation, race and class) as the motors of social processes.
- (6) Sketches the formulation of new theory of social development that addresses both the scientific and the humanistic aspects of social organization.

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