# UNIVERSE, COMPLEXITY AND HUMAN HISTORY

# HUMAN HISTORY IN LIGHT OF THE LAWS OF THE UNIVERSE

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ABSTRACT: The aim of this work is to analyze whether human societies are governed by laws analogous to those governing the evolution of the universe. Specifically, we examine the development of complexity, the law of increasing entropy, and the predominance of non-equilibrium and non-stable systems in the universe. Our findings indicate that throughout human history, there has been a prevalence of rigid, stable systems in equilibrium, characterized by lower complexity in human activities and social relations. These systems have primarily benefited a minority rather than the broader population, resulting in reduced entropy generation. Conversely, we have observed that transitioning partially or entirely toward non-stable, non-equilibrium systems—where the living conditions and rights of the population are protected and expanded—fosters a greater complexity of societies. This transition is associated with increased activity, complexity, wealth, and entropy creation, aligning with the laws governing the evolution of the universe.

KEYWORDS: Universe, human history, non-stable and stable systems, non-equilibrium and equilibrium realities, human rights, complexity and entropy.

## INTRODUCTION

Universe, complexity and human history. We have chosen this title as it best encapsulates the objective of the present study. This paper analyses to what an extent human history obeys the basic laws of the universe, among which are the

development of complex realities, the laws of increase in entropy, and the predominance of non-stable, non-equilibrium systems**,** or whether human history differs from how the universe works. The development of science, especially since the scientific revolution of the 17th century, has enabled us to understand the universe from a classical and quantum and relativistic perspective, as well as from the perspective of complex and non-stable systems.

The 20th century has brought about substantial technological change in the analysis of the universe. The generalization of radio telescopes, the creation of spacecraft and satellites that have allowed greater knowledge of the Solar System and, finally, several high-resolution telescopes have made it possible to overcome the reality of a hundred years ago when the existence of other galaxies was unknown outside the Milky Way. Without the knowledge of the universe that results from this technological improvement, the comparative analysis that we want to do would be impossible.

We wish to focus our attention on some basic laws and realities governing the evolution of the universe in order to contrast whether laws of an "equivalent" nature apply to the historical evolution of human societies.

First, we wish to highlight the trend of increasing complexity in the evolution of the universe. Three examples:

1. George Gamow[1] proposed that the presence of chemical elements in the universe is not homogeneous. We would live in a zone where we would benefit from the existence of heavier elements. The chemical elements and their abundance are the result of two processes: the cosmological (primordial nucleosynthesis) and the astrophysical (stellar nucleosynthesis). In the first one -and during a "half" hour since the Big Bang- hydrogen and helium were created in their present proportions; while the rest of the elements were created later in the stellar framework.

2. The explosion of supernovae in Population III stars originated - a more plausible hypothesis - planetary nebulae from which systems like the solar system would form, and a whole series of chemical elements would already be available, including those of medium and high atomic number, necessary, for example, for the development of complex life on Earth. The development of complex realities

[1] Gamow, George (1948). "The Evolution of the Universe". *Nature*, 162, pp. 680-682; Gamow, G. (1967). "History of the Universe", Science, 158: 766-769; Singh, Jagjit (1974). *Teorías de la cosmología moderna*, pp. 177-181, Madrid: Alianza Editorial.

in the universe shows the reuse, the recycling, of existing elements to configure new realities.

3. The third example we propose is the development of life on Earth from the Last Universal Common Ancestor (LUCA) [2], that is, the living organism ancestor of all living beings that existed about 4,000 million years ago, when the Earth was only about 560 million years old. From LUCA would emerge the three fundamental domains: Bacteria, Archaea and Eukarya. Increasingly complex organisms until reaching Homo sapiens with the greatest brain development on Earth.

Secondly, we will highlight the second principle of thermodynamics, which shows how the various physical processes in nature or in living beings involve the expenditure of energy and the release of heat. This heat energy cannot be used to do mechanical work if the system were reversible and is what we know as entropy. This concept is also applied to measure the degree of disorder of a system. Stephen Hawking[3] proposes three timelines: the cosmological one that tells us at what moment we are in the evolution of the universe, either the expansion after the Big Bang or a hypothetical Big Crunch; the psychological one referring to human beings in which what will always happen is the future even if we were in a Big Crunch; and finally the thermodynamic one, always with the dominant tendency of entropy increase while there is "fuel" to do physical work.

And thirdly, we will emphasize that the universe is dominated by non-stable systems[4] and a limited presence of stable systems, such as fully constituted galaxies, stellar systems and intelligent life itself. For example, the solar system, as a stable reality, allows us to define trajectories of rotation of the planets; but other realities, such as the current climate on Earth, have a chaotic, non-stable

[2] Woese, Carl R. ; Kandler, Otto ; Wheelis, Mark L. (1990), "Towards a natural system of organisms: proposal for the domains Archaea, Bacteria, and Eucarya", *Proceedings of the National Academy of Sciences of the United States of America*, Volume 87, Issue 12, 1990, pp.4576-4579. DOI: 10.1073/pnas.87.12.4576; Fouad El Baidouri, Chris Venditti , Sei Suzuki1, Andrew Meade & Stuart Humphries, "Phenotypic reconstruction of the last universal common ancestor reveals a complex cell*",bioRxiv and medRxiv. doi: https://doi.org/10.1101/2020.08.20.260398.*

[3] Hawking, Stephen (1996). *Historia del tiempo ilustrada.* Barcelona: Crítica.

[4] We will use the term non-stable which would incorporate strictly unstable systems in which there is no attractor that conditions the evolution and chaotic systems, in which an attractor -or more than one- conditions the evolution.

behaviour. This would be, for Prigogine,[5] the main dynamics of the universe: "instability → probability → irreversibility".

> Today we know that the law of entropy growth and the physics of non-equilibrium teach us something fundamental about the structure of the universe. In our description of the universe irreversibility becomes a fundamental element. Consequently, it has to find its expression in the fundamental laws of dynamics. The essential condition is that the microscopic description of the universe is made by means of unstable dynamical systems. This is a radical change of point of view. The classical point of view was that stable systems were the rule and unstable systems were exceptions. Now we turn this perspective on its head.
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> Prigogine, Ilya (2019). *Las leyes del caos*, pp. 107-108. Barcelona: Crítica.

Predictions will depend on three variables: the degree of uncertainty, the precision with which the initial conditions can be assessed and the time scale. Times with very different values depending on the systems considered. For example, around one millisecond for chaotic electrical systems or between 4 and 5 million years for the inner solar system. Prigogine states that we need systems in a non-equilibrium situation, dissipative, for changes and transformations to take place, for there to be a "history" of the universe. Chaos theory applied to non-stable systems shows that the dissipation of matter and energy, which we usually characterize as a step towards disorder, becomes a source of order even though it is far from a situation of equilibrium.[6]

This study ignores more hypothetical interpretations of the universe, for example, whether existence is real as long as it can be observed; the mathematical nature of the universe; or the creative incontinence of reality based on such concepts as eternal inflation and the multiverse model of several levels.[7]

While these characteristics are key to define the universe, does the history of humankind on Earth adjust to qualitatively similar realities, of similar nature? And if that were the case, to what an extent? This question is rather interesting as it is posed from the human standpoint –after all, the only one we really possess–, and coexists in the smallest part of the universe, of reality, where stable

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[5] Prigogine, Ilya (2019). *Las leyes del caos*. Crítica. Prigogine, Ilya (2021). *El nacimiento del tiempo*. Tusquets.

[6] Gunzig, Edgar, Jules Géhéniau & Ilya Prigogine (1987), "Entropy and cosmology", Nature, 330: 621–624, https://doi.org/10.1038/330621a0

[7] Everett III., Hugh (1957). *The Theory of The Universal Wave Function*, Doctoral Dissertation. Princeton University; Tegmark, Max (2012). *Our Mathematical Universe: My Quest for the Ultimate Nature of realit*. Knopf.

and well-organized systems prevail. The answer to this question requires due analysis of the results shed by history as a social science. This also requires a proper definition of what is understood by non-equilibrium and equilibrium realities and stable and non-stable systems when referring to human societies.

## EQUILIBRIUM AND NON-EQUILIBRIUM SYSTEMS AND STABLE AND NON-STABLE SYSTEMS IN HUMAN HISTORY

The adaptation of the basic concepts we have detailed about the universe to the study of human societies presents difficulties that we will try to minimize. When we speak of human societies, we are considering more than deterministic physical laws that often incorporate different degrees of randomness.[8] We speak of societies with human groups associated in function of diverse realities: of collaboration, of solidarities, of relations of exploitation, of objectives that can go beyond the simple competitive struggle for the private control of resources. In other words, concrete realities inspired by human intelligence.

Key to our analysis is the consideration of systems in equilibrium and non-equilibrium. We can find human societies in equilibrium that, from the free collaboration of their members, manage to create social, economic and political realities that lead to the development and progress of society. Unfortunately, historical examples of this type are less common: for example, some human groups of hunters/gatherers; some agrarian societies prior to the establishment of the feudal regime in Europe or North American indigenous tribes such as the Iroquois (Haudenosaunee). But it is more frequent to find situations that we will characterize as forced equilibrium. A system in forced equilibrium, applied to human society, would be a social, economic, political and cultural reality characterized by strongly established relationships among its members, difficult to change and which fundamentally serve minorities that hold the violence to maintain the system. For example, the manorial regime in Western Europe

[8] For example, Roger Penrose, without questioning that the universe is deterministic, argues that there must be realities that cannot be expressed by algorithms. It would be contradictory to accept that everything is computable and that we ourselves decide to do something that is not "computationally" predictable. Renrose, Roger (1989), *The Emperor's New Mind: Concerning Computers, Minds and The Laws of Physics*. Oxford U. P.

during the Middle Ages[9], in which the peasant is tied to the land and obliged to make enormous contributions in work, in kind or in money. With his small holdings he can reproduce the family with difficulty, being often indebted to lords or even to some wealthier peasants. He can hardly incorporate crop rotations that increase land yields and diversify production. They generate a reduced and stable entropy.

In this context it is very difficult, therefore, to develop more complex agrarian systems, in which the various human activities grow and diversify, and in which the development of complexity goes hand in hand with an increase in entropy, as occurs in the development of the complexity of the universe. The struggle in the late Middle Ages for the suppression of serfdom and manorial rule in Western Europe is partially successful, with serfdom being abolished with compensation to the lords after peasant wars. [10] This is in line with the establishment of non-equilibrium systems, with greater degrees of freedom on the part of the peasantry. In this sense, the non-equilibrium situation and its interactions on human reality allow the historical development of the societies involved. This interpretation does not deny that humanity has been able to create certain basic structures such as, for example, water management in Mesopotamian farming communities (3.000-1.000 B. C.), which bears a great similarity to water management in medieval European farming communities.[11] But these and other structures are inserted into more complex realities, where we find more frequently that balances and situations of stability are forced by the social groups that control wealth and power. It is when societies want to overcome these limitations that they demand less exploitation and more freedom, moving towards systems in a situation of no/or less forced balance and no/or less forced stability.

This manorial system in forced equilibrium considered would be a forced stable system with clearly defined trajectories in the circulation of products, wealth and power relations. The struggle against the manorial regime aims at the creation of a non-equilibrium and non-stable system in which the degrees of

[9] Bloch Marc (1931), *Les caractères originaux de l'histoire rurale française*. Versión ampliada por discípulos: Bloch, M. (1978), *La historia rural francesa: caracteres originales*. Barcelona: Crítica.

[10] Hilton, Rodney (1978), *Siervos liberados. Los movimientos campesinos medievales y el levantamiento inglés de 1381*. Siglo XXI de España Editores, S.A.

[11] Boserup, Ester (1984). *Población y cambio tecnológico*. Crítica.

freedom in the peasant world allow an economic development, an intensification of agriculture, a greater consumption capacity of peasant families, a greater introduction of working livestock. That is, a step towards complexity and towards increasing entropy, as would be characteristic of the universe itself. We will use the term non-stable which would incorporate strictly non-stable systems in which there is no attractor that conditions evolution and chaotic systems, in which an attractor -or more than one- conditions evolution. In historical change we observe the action of attractors that can condition the evolution of societies. For example, attractors such as the Communist Manifesto (1848), which clearly impacts the development and solidarity of the workers' struggle, or the technical progress of the English industrial revolution (especially since 1785 with the steam engine), which implies the development of the industrial revolution in Western Europe and the United States.

A system can be classified as "forced stable" when it has a set of formal or informal rules governing its structures and hinder their change, for example, slavery in sugar plantations in the 17th century, or the capitalist British society during the Industrial Revolution before the introduction of the steam engine, based on labour intensive exploitation,[12] This is a reality with practically zero entropy growth if we limit ourselves to a specific area, in the short term, with a stable technology and based on the use of its own resources. It would be a situation that we can identify with a situation of forced equilibrium. Little innovation and limited growth of its own wealth, although this can be increased through imperial or colonization processes.

An non-stable system can be defined as a system that succeeds, through either formal or informal rules, in bringing forward freedom for its population and their capabilities without structural constraints. Accordingly, such society will evolve and improve uninterruptedly. To achieve this, these systems need to break the rules governing many past and contemporary societies and that foster inequalities in society. This capacity for change generates a non-equilibrium system, with options for improvement that mean a better distribution of resources, a more efficient use of resources that will generate entropy and a greater complexity in work and production. As will be shown below, stable forced and rigid human

[12] Crafts, Nicholas F. R. (1985). *British Economic Growth During the Industrial Revolution.* Clarendon Press.

systems have been more frequent than non-stable and flexible ones.

In a given system with forced balance and stability, there may be spaces with greater autonomy and freedom that we could characterize as non-forced stability. For example, in a framework of predominance of the feudal regime, the public authority has been able to grant freedoms such as the Settlement Charters in medieval Catalonia; or cities that escape feudal control as would happen in Western Germany versus Eastern Germany in the modern age.

## WHAT IS THE CONTRIBUTION OF HUMAN EXISTENCE TO THE UNIVERSE?

One of the historical characteristics of humankind is its tendency towards ecumenical presence, and its presence is felt virtually across the globe. Reaching this stage has required the creation of social organizations aiming to globalization, a phenomenon that, since the 19th century, has determined our existence.[13] In this context, the concentration of wealth and economy has resulted in fixed structures, hard to change and improve. In turn, social and interpersonal inequalities have consolidated[14], and solving these problems has become a huge challenge.[15] All this has had an impact on economic activities in that it is now impossible to guarantee an adequate future for human life. In sum, the first human contribution has been a technological breakthrough that, on the one hand, has made an uneven impact on society and, on the other hand, has worsened the sustainability conditions of the human environment, a most unique ecosystem nowadays.

The study of this present reality would depart from the realities that seem to set the evolution of the universe. A structure of globalization consisting of economic –and hence, political yet not necessarily in the strict sense of the word– power brings about unequal yet stable realities. These situations are less common in the universe, as the sequence instability → probability → irreversibility would

[13] Stiglitz, Joseph E. (2002) *Globalization and its discontents*. W.W. Norton & Company; Wallerstein, Immanuel (2011). *The Modern World-System IV: Centrist Liberalism Triumphant, 1789-1914*. University of California Press.
[14] Frank, André. G. (1978) *Dependent Accumulation and Underdevelopment*. Macmillan; Piketty, Thomas (2014). *Capital in the Twenty-First Century*. Harvard University Press.
[15] Stiglitz, Joseph E. (2012). *The Price of Inequality: How Today's Divided Society Endangers Our Future*. W.W. Norton & Company.

be essential in developing the creative capacity of its timeline.[16]

Stephen G. Bunker has highlighted the role of thermodynamics in understanding the unequal development between human regions:

> I have argued throughout that uneven development between regions and the capacity of one region to subordinate another reflect not only he unequal exchange of labor values but also the very different embodiment of energy flow-through in social organization and infrastructure. All social organization, technology, and information are the results of previous human uses of energy and matter. This is not to say that energy and matter cause, or that the laws of thermodynamics explain, organization, technology, and information, only that none of these can occur without the conversion of matter and energy.
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> Bunker, Stephen G. (1988), *Underdeveloping the Amazon: extraction, unequal exchange, and the failure of the modern state,* p. 245. University of Chicago Press,

## COMPLEXITY, CHANGE AND HUMAN SOCIETIES

One can consider that, since the first great change - the transition from hunting and gathering to agricultural sedentary lifestyle-, the historic evolution of human societies tends towards stability, towards a sequence of stabilities and breaks –of varying duration–, that bring about changes in the social, economic and institutional models, as well as adjustments –traumatic to a greater or lesser extent– to new realities.

Several authors have contributed to characterizing this historic change that has resulted in our globalized world. The theory of the four stages by Adam Smith[17], and Turgot[18] establishes four distinct stages which mankind passes through from hunting, then shepherding, next feudal agricultural, and finally a commercial society in the 18th century.

This model of historical development incorporates a process of maintenance and improvement of realities of the previous stages, with which the timeline is characterized by a greater complexity of social, economic, political and cultural

[16] Prigogine, Ilya (2021). *El nacimiento del tiempo.* Tusquets.

[17] Smith, Adam (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations.* University Of Chicago Press, 1977 (1776); Meek, Ronald L. (1977).*Smith, Marx and After. Ten Essays in the Development of Economic Thought.* Chapman and Hall Ltd.; Smith, Adam (1776). *An Inquiry into the Nature and Causes of the Wealth of Nations.* University Of Chicago Press, 1977 (1776).

[18] Turgot, Anne Robert Jacques (1766). *Réflexions sur la formation et la distribution des Richesses;* Meek, Ronald L. ed. (1973), *Turgot on Progress, Sociology and Economics.* Cambridge University Press.

realities. For example, the advances of the English agrarian revolution that began around 1600[19] are incorporated when the commercial - and industrial[20] - model is developed from the middle of the 18th century onwards. The new rotations - such as the Norfolk system - or the coupling system in enclosures - increase productivity and production, and their imitation by small and medium-sized farmers increases the complexity of ecosystems, generating greater availability of resources and, therefore, greater entropy with their use.

Guha and Gadgil[21] have explored the evolution of changing patterns of natural resource use modes: from gathering –including shifting cultivation–, nomadic pastoralism, sedentary agricultural lifestyles, and industrial agriculture based on exploitation of fossil fuel.

Regarding class relations and the ways of obtaining surplus value, ever since the Marxist economy, new historic models of production modes have been established: from slavery to feudalism, and then onto capitalism, considering that class struggle has driven the past and, ideally, should drive the present (c. 1848), since this is the only way to establish a truly equalitarian and communist system.[22] This would be a radical change that would overcome the limited improvements in the worker's situation that would occur with the passage from slavery to serfdom of the glebe, and from this to the legally free capitalist worker. [23]

Behind each of these explanatory paradigms there is a final reality established in our global world, as explained in this paper. This reality is characterized by the predominance of market economy, fossil fuels and the prevalence of social differences both in developed societies and the Third World, as well as other intermediate societies. This reality falls behind equalitarian predictions claimed on several occasions in the past.

From different angles, we can verify the achievement of stable stages that,

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[19] Allen, R. C. (2004): *Revolución en los campos. La reinterpretación de la revolución agrícola inglesa*, Monografías de Historia Rural, SEHA. Zaragoza: Prensas Universitarias de Zaragoza.

[20] Recall that Adam Smith writes his basic work before 1785, the time when Watt's second steam engine is incorporated into the textile spinning industry.

[21] Guha, Ramachandra & M. Gadgil (1993). 'Los hábitats en la historia de la humanidad', *Ayer,* 11: 49-110, http://www.jstor.org/stable/41324333

[22] Marx, Karl & Friedrich Engels (1848), *Manifesto of the Communist Party*, C.H. Kerr Pub, 1998, 150th anniversary ed.

[23] Lenin, V.I. (1899, 1974), *El desarrollo del capitalismo en Rusia*, Barcelona: Ariel Historia. English edition: https://www.marxists.org/archive/lenin/works/cw/pdf/lenin-cw-vol-03.pdf

inevitably, end up in a crisis and the formation of a new stability, either with respect to economy but also resource exploitation and social structure. Stability and equilibrium often forced

These referenced models attempt to establish the stages of the historical development of human societies. At the time, Nicholas Georgescu-Roegen[24] offered an optimistic vision of the future of humanity:

> My second point is related to the attitude that now prevails towards the entropic problem of humanity. In one form or another, technology will save us from any hole we can fall into. "Come what comes, we'll find a way" - as the majority of economists point out. Isn't this the form in which we have survived since the time of the pharaohs and even before? There is always a technological position so that we can continue even happier than before, insist the faithful to technology.

With the actual data that confirm climate change[25] and the difficulties that generate to human societies, scholars of the subject propose a new governance that implies the end of the use of fossil resources, and propose an economic evolution in which degrowth is contemplated as a fundamental element of the policies of a first group of countries that took the initiative. [26]

This brief reference raises the ease or difficulty of the future survival of humanity, a topic that goes beyond the objective of this study. [27]

Richard Newbold Adams reformulated social theory through thermodynamics. [28] Following the contributions of Ilya Prigogine, he considered that human societies can be defined as dissipative structures that need a high contribution of energy so that they can consolidate new structures generated throughout their evolution. The survival of humanity is very expensive

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[24] Nicholas Georgescu-Roegen (1994), ¿Qué puede enseñar a los economistas la termodinámica y la biología?", F. Aguilera Klink, V. Alcántara (Comp.), *De la Economía Ambiental a la Economía Ecológica*. Fuhem e Icaria, 1994, pp.188-198. Revised electronic edition, 2011. CIP-Ecosocial.

[25] https://www.ncei.noaa.gov/access/monitoring/monthly-report/global/202410, consulted by 06-12--2024.

[26] Järvensivu, Paavo et al. (2019), *Global Sustainable Development Report 2019 drafted by the Group of independent scientists*. https://bios.fi/bios-governance_of_economic_transition.pdf

[27] Richard Newbold Adams it also reflects on the future alternatives of human society. Adams, Richard Newbold (1988), "The Origins and Future of Civilization", *The Eighth Day: Social Evolution as the Self-Organization of Energy*, pp. 166-167. University of Texas Press, Austin.

[28] Adams, Richard Newbold (1975), *Energy & Structure: A Theory of Social Power*. University of Texas Press; Ídem (1988), *The Eighth Day: Social Evolution as the Self-Organization of Energy'*. University of Texas Press, Austin.

energetically.[29] Natural selection is not a restrictive force, but a selective force that results in more complex organisms and societies, with a new level of input/product. In this framework, Adams highlights the role of power at different levels as an element that acts in the evolution and development of these dissipative structures.

> The basic characteristic that we must appreciate in power structures is that it is present as a binary contrast in every social relationship. As part of the dissipative structure constituted by the human species in the biosphere, it is as inevitable as gravity in the world of classical physics.
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> Adams, Richard Newbold (1978), *La red de la expansión humana. Un ensayo sobre energía, estructuras disipativas, poder y ciertos procesos mentales en la evolución de la sociedad humana*, p. 179. Ediciones de la Casa Chata, México.[30]

In the framework of the consideration that human societies are dissipative structures that require large amounts of energy for their evolution and improvement, and that consequently also generate enormous amounts of entropy, our work focuses primarily on various historical moments in which the survival of humanity is not in question. Our hypothesis could be synthesized by considering that those societies in which there are more degrees of freedom for their members and, therefore, less power that limits their actions, can perform more and more complex activities, with a greater energy consumption and an equivalent increase of entropy, adjusting more and better to the laws of the universe.

The cycle of freedom, complexity, entropy does not simply consist of the sum of units, of individuals of the societies that we will consider. There may be more egalitarian and more efficient solutions. The examples we will consider in this work do not yet reach constant states. And maybe they can hardly get there. The objective of the movements is to modify the current power relations to create a more favorable future for the members of society.

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[29] Following Lotka's law which concludes that emergent forms use more energy to survive. Lotka, Alfred J. (1945), "The law of evolution as a maximal principle." *Human Biology*, 17: 167-194.

[30] We have used this updated and expanded version by the author of the original book already cited *Energy & Structure: A Theory of Social Power.*

## NON-STABLE SYSTEMS AND HISTORICAL DEVELOPMENTS.

The history of mankind is characterized by a struggle between powerful social groups whose aim is to set up and consolidate stable social, economic and political systems favouring their own interests, on the one hand, and those of other social groups or classes who have attempted to bring about, at specific times, alternative open and flexible systems of social organization. And a whole array of philosophers, thinkers, who have tried to open cracks in forced stable systems.

As regards human reality, we can differentiate between forced stable systems and systems that, by virtue of a set of rules, can modify realities, render them non-stable and move from forced balance to non-balance. The latter are infrequent though. Naturally, we assume that the rules of the game bring about norms that, in turn, favour freedom, equal opportunities, fewer social and economic differences, and, in general, what we now know as human rights. In other words, unforced stable systems. Across history, humankind has overcome the laws of nature consisting in competitive fights between peoples and sometimes –partly and gradually– substituted them with concepts aiming to create a more egalitarian distribution of rights and social advances.[31] What the English Constitutionalists or the French Enlightened referred to as natural laws on which the new society would be built upon turned out not to be so natural but rather cultural. These so-called "natural" laws would be part of the new basic rules that, by being better than nature, constitute the new frameworks. It was in this context that they would establish –or rather, would try to establish– non-stable systems, in not equilibrium situation. In other words, an non-stable system in human society does not necessarily imply lack of rules.

Human history covers a wide variety of stages in which the creation of non-stable systems aims to improve the living conditions of people. Our initial hypothesis states that progress in living conditions and human rights occurs under non-stable conditions, by breaking away from pre-established principles, and exploiting –or re-using– the historical experience throughout a series of creative moments. These moments are those that follow the rules of the universe. We will now briefly analyse five historical experiences that illustrate these trends, some of them short-lived. These examples demonstrate social and political endeavours

[31] Roll, Eric (1962), *A History of Economic Thought*. Faber.

aiming to dismantle forced stable systems and create –not always successfully – non-stable open systems that can offer few irreversible possibilities. The five examples show how the processes analysed tend, insofar as they are achieved, to increasingly complex realities that incorporate a more efficient reuse of existing realities and consequently to an increase in entropy amplified by a greater territorial presence of the changes.

## GERMAN PEASANTS' WAR (1524-1525)

The German Peasants' War is one of the leading peasants' wars of the Modern Age. This event represents a paradigm shift in areas, like Germany, where Martin Luther's Reform had a relevant impact.[32]. Leaving doctrinal issues aside, it meant a dramatic change on claiming that every believer should read the Bible and interpret it, regardless of the "official" versions from the Church. Luther was facing up to one of the ideological, political and economic forces of the Western world that would have fundamental consequences on the population as a whole.

The Twelve Articles (German Zwölf Artikel) were part of the peasants' demands in the town of Memmingen, Bavaria (Germany), and were adopted on 20th March 1525.[33] By virtue of these Articles, they agreed to pay the nobles what was fair, according to God's word. But they also condemned a series of impositions, among which extortionate land rent, compulsory free labour, excessive punishment, communal privatization, deprivation of various types of usage and rights for the poor, and abusive inheritance tax, among others.

In sum, this document aims to transform a rigid, feudal, stable social and economic structure into a system of freedom for peasants, despite their acceptance of such economic duties as tithes. Nevertheless, these Articles were drafted in an attempt to gain respect for the people and required from their rulers to act according to the Gospel. Peasant demands would mean, if achieved, a greater availability of communal resources such as pasture for livestock or wood

[32] Lortz, Joseph (1963). *Historia de la Reforma*. Taurus.

[33] '20th March 1525. The fundamental and correct main articles of all the peasants and subjects of the ecclesiastical and secular lords, relating to these matters in which they feel themselves aggrieved'. "Zwölf Bauernartikel 1525", Stadtarchiv Memmingen, https://stadtarchiv.memmingen.de/blaetterkataloge/index.html?catalog=Stadtarchiv/Zwoelf-Bauernartikel_1525#page_1; accessed March 1, 2024.

for the home and the construction of dwellings; the suppression of free labour ("corvée") and payment for labour. etc. That is, greater farming activity, increased human labour and the use of working cattle. In short, more complexity in farming and more generation of entropy.

The Peasants' revolt was heavily repressed with dozens of thousands of peasants killed; still as a result of the peasants' pressure and also pressure from other west German cities, the serfdom system was not imposed in this area, while less influential cities of east Germany were subjected to serfdom despite of their meagre participation in the 16th century revolt.[34]

The different evolution of both German areas shows, on the one hand, the evolution towards a more non-stable system –admittedly, lordly– but based on liberating ideas from the Gospel in the western area, and a more rigid lordly serfdom in eastern Germany.[35]. In sum, consolidation of non-stable systems results in more respect to human dignity, with greater availability of resources and greater diversity of activities for rural families.

Until the anarchist developments of the 19th century, the popular and peasants' uprisings always set general guidelines that guaranteed certain rights for the population. The Gospel in the case of Germany or the monarchy in the case of the French revolts in the next century, under the slogan "Vive le roi sans taille et sans gabelle", defended a higher power to guarantee the rights of the peasants' communities.[36]

GLORIOUS REVOLUTION (1688-1689).

The victory of the army of the English Parliament over the Crown facilitated the development of a political regime akin to modern parliamentarism with the Glorious Revolution, 1688. The Declaration of Rights (1689) gave pre-eminence to the Parliament over the Crown.[37]. We are referring here to a more flexible regime, less stable than absolute monarchy, miles away from a system resting on

[34] Engels, Friedrich (1926). *The Peasant War in Germany.* International Publishers. Original in German, 1850.

[35] Kula, Witold (1986). An Economic Theory of the Feudal System: Towards A Model Of The Polish Economy 1500-1800. Verso Books.

[36] Accatti, Luisa (1972). ''Vive le roi sans taille et sans gabelle': Una discussione sulle rivolte contadine', *Quaderni Storici*, 21, 1071-1103, http://www.jstor.org/stable/43776429.

[37] Vallance, Edward (2006). *The Glorious Revolution: 1688 and Britain's Fight for Liberty*. Little, Brown and Co,

universal suffrage or having proportional representation. The system becomes more non-stable and less balanced until new forms of rigidness reconfigure a stable system with less freedom.

Such rights as freedom of the press, non-permanent army and irrevocability of judges were recognized with an eye on creating a more open social and political model, including more possibilities –in other words, more non-stable – and more freedom.[38] The non-permanent army was necessary to avoid consolidation of a military power that could impose its own world view and private interests. The irrevocability of judges strives to keep the powerful from changing tribunals that would benefit their own private interests. This new system, proposed by John Locke and established in England in 1688, was a step forward in political freedom. The struggle against the privileges of the guilds, in which Adam Smith was one of the most combative economists, succeeded in expanding the freedom of enterprise. [39] Both processes contributed to the creation of more complex, non-stable societies and economies, with higher productivities and greater use of energy with the consequent increase in entropy.

But establishing general norms may end up in limitations of free systems wavering between not stability and stability, non-balance and balance.

## ABOLITION OF SLAVERY IN THE UNITED STATES (1865)

From the early 18th century, slavery spread across the south-east of the US. In the cotton economy, the revenue per dollar invested in buying slaves grew exponentially between 1802 and 1860. Slavery-based economy was highly profitable and was not a mere prestige symbol.[40] In 1865, after the American Civil War came to an end, the 13th amendment of the Constitution of the United States abolished slavery, previously abolished in New England colonies.[41]

This case shows the challenge of changing a real, forced stable, forced balanced situation into an unpredictable, non-stable and not balanced one. Racial discrimination would still continue for over a century, and still the

[38] Locke, John (1690). *Two treatises of Government*. London.
[39] Roll, Eric (1962), *A History of Economic Thought*.
[40] Conrad, Alfred H. & John R. Meyer (1958). 'The Economics of Slavery in the Ante Bellum South', *The Journal of Political Economy*, volume LXVI, 2: 95-130, https://doi.org/10.1086/258020
[41] Engerman, Stanley L. & Robert E. Gallman (1996-2000). *The Cambridge Economic History of the United States*. Cambridge University Press,

problems persist to date. Even leaders of the liberal economy acknowledge this fact.[42] They defended a radically free economy that ensured equal opportunities but were against the politics of equal results.

The same insight into the discriminatory situation of the black population of the United States sheds light on neoliberal theories. The social and economic interests of some, from local to worldwide, revolve around the preservation of power relations opposed to "long-term" and permanent equal opportunities. This situation requires from public institutions –like the welfare state in several levels, forms and limitations– to take action in an attempt to ensure equal results, consisting in many parts of industrial societies in the mere reproduction and, often, few services.

No society seeking global development can marginalize broad sectors of its society from education and personal freedom through slavery or various forms of discrimination. The participation of all these sectors will mean, to the extent that it takes place, a development of the complexity of society and its activities, which has in the use of energy one of the revealing elements. We are still at a time when the impact of fossil fuels on the climate is still far from being significant. The problem was low wages, not climate change.

## THE PARIS COMMUNE (1871)

The workers' political revolt of the Paris Commune is a crucial episode in the history of workers' movements during the early stages of the Second Industrial Revolution.[43] This event consolidates an increasingly globalised world, with Great Britain at its center, and colonial politics spreading across the continents. The short-lived Parisian experience –i.e., just over two months long– had long-term consequences like the First International crisis.[44]

To the anarchists, the Paris Commune failed because of its rejection of a more libertarian political orientation. The Marxists consider that more strict measures should have been implemented. In other words, the former believed that a freer –and hence more non-stable and permanently transformed– system should have

[42] Friedman, Milton & Rose Friedman (1980), *Free to Choose: A Personal Statement*. Harvest Book.

[43] Lissagaray, Prosper-Oivier (2012). *History of the Paris Commune of 1871*. Verso Books.

[44] Stekloff, G. M. (1928). *History of The First International*. Martin Lawrence Limited.

been set up, in an not equilibrium situation.[45] Faced with this libertarian approach, the Marxist approach – despite pursuing as the first the liberation of the working class – will end up formulating the need to go through a stage of rigid structure – of dictatorship of the proletariat – in order to consolidate the revolution. Therefore, establish a stable social, political and cultural forced structure, in forced balance, in principle transitory.

Two alternatives: either considering non-stable systems, or stable systems within a legal framework, of such common –yet hardly achievable– principle of positioning labour, equality and solidarity at the center of a general framework.

## THE TECHNOLOGICAL REVOLUTION OF THE 19TH CENTURY

As stated by post-phenomenology or post-humanism, humankind has always been technological. The number of the first human technologies –choppers and chopping tools or the control of fire– increased at specific times in history, yet this growth was gradual. But from the second half of the 18th century, the whole process accelerated with the advent of the Industrial Revolution.[46]

Although the Industrial Revolution can be divided into several stages –i.e., there were several industrial revolutions–, the movement was unique and worldwide. It featured entrepreneurial concentration, oligopolistic capitalism, and inequalities between countries and societies across the globe.

This forced stable structure of capitalism ensures the existence of a class – business class and inverter- determined to accumulate wealth and power over a population that, at best, enjoys a social market economy that guarantees food – albeit thanks to a welfare state and the NGO– and a few services. At best, capitalism offers the sole hope of climbing up the social and economic ladder. The FAO and the UN reports[47] on nourishment and economic development, respectively, reveal the significant inequalities between continents, countries and

[45] Kropotkin, Piotr A. *Folletos revolucionarios*. Spanish edition, Tusquets, 1977.

[46] Mokyr, Joel (1990). *The Lever of Riches: Technological Creativity and Economic Progress*. Oxford University Press; Fogel, Robert W. (2004) *The Escape From Hunger And Premature Death, 1700-2100: Europe, America, and the Third* . Cambridge University Press.

[47] FAO, IFAD, UNICEF, WFP, WHO, *The State of Food Security and Nutrition in the World 2021. Transforming food systems for food security, improved nutrition and affordable healthy diets for all*. (FAO, Roma, 2021). ONU, *Human Development Report 2020. The Next Frontier - Human Development and the Anthropocen*. (United Nations Development Programme, New York, 2020).

societies.

The Industrial Revolution has given us the chance of using up fossil fuel as a power source from the advent of James Watt's steam engine to steam-powered ship navigation and aviation; or enjoying such communication systems as the telegraph, cable communication by means of underwater cables since 1858 and Marconi's wireless. These technological advances have been mismanaged by lobbies holding the world economy. These powers have shown no ethical, economic and environmental awareness and conscience. As a result, the world can hardly be put right because of the uncontrolled mismanagement of resources geared to obtaining the highest economic returns. The existence of a rigid structural economy focusing on wealth and power makes it difficult to evolve towards less rigid and freer systems, set on building up more humane societies that follow the non-stable nature of the universe.

A non-stable system can and must have formal or informal rules to correct those misalignments that free economic activity generates or may generate. In 1866 Stanley Jevons already warned: "But the economy of coal in manufactures is a different matter. It is wholly a confusion of ideas to suppose that the economical use of fuel is equivalent to a diminished consumption. The very contrary is the truth".[48] In other words, the use of more energy-efficient technologies would not reduce the use of coal as, by imitation, the inventions would become widespread in Britain, Europe and the world. One hundred years later, around the middle of the 20th century, scientists were already beginning to warn of the problem of global warming as a result of greenhouse gas emissions.

## UNDER WHAT CONDITIONS HAS HUMANKIND ACHIEVED THE HIGHEST WELFARE SITUATION?

The five cases explained above bear witness to the existence of regenerating proposals that guarantee progress of human societies at social, political and cultural levels. In all cases it was a question of breaking up systems that have been in place for a long time and replacing them – in most of them – with more open, non-stable systems, non-equilibrium systems, which would allow society to

[48] Jevons, W. Stanley (1866), T*he coal quest.ion; an inquiry concerning the progress of the nation, and the probable exhaustion of our coal-mines*, pp. 123-125. London: McMillan and Co.
https://oll-resources.s3.us-east-2.amazonaws.com/oll3/store/titles/317/0546_Bk.pdf

act more freely.

Such breakthroughs as the railway or the electricity allowed production in large areas and movement of goods to several consumption centres. Cooperative marketing in the United States would allow citrus and other fruit producers not to worry about searching for markets to sell. The idea was based on the farmer as the production specialist and the cooperative managers as sales specialists.[49] This general law offered many options that allowed freedom to society members involved in production. But such a system based on less rigid, less fixed and more non-stable realities was easily controlled by monopolies or railway or other oligopolies, like oil or power oligopolies.[50]

These examples illustrate how the struggle between non-stable and forced stable systems remains constant and spearheads historic evolutions. Railways or power stations that generated significant freedom of action in human activities ended up becoming part of rigid and forced stable systems, in fact the least common systems in the universe.

Human history shows us the predominance until the present moment of forced stable, rigid and forced balanced systems. Revolts, revolutions, great advances that have wanted to configure a different and perhaps better world have often developed non-stable systems, where all options are possible, but have only worked for a limited time, or partially. The development of the imperialist system since the modern age has gained in complexity, but it has been configured as a forced stable, rigid system, with few possibilities of being transformed in favor of the populations of underdeveloped human societies. With limited possibilities of production and consumption on the part of its inhabitants, with limited possibilities of creating more productive, complex and less unequal societies[51]

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[49] Steen, Herman (1923). *Coöperative Marketing. The Golden Rule in Agriculture*. Garden City/ Doubleday, Page and Company.

[50] Engerman, Stanley L. & Robert E. Gallman (1996-2000). *The Cambridge Economic History of the United States*. Cambridge University Press.

[51] Wallerstein, Immanuel (1974), *The Modern World-System, I: Capitalist Agriculture and the Origins of the European World-Economy in the Sixteenth Century*. New York & London: Academic Press; Wallerstein, Immanuel (1980), The Modern World-System, II: Mercantilism and the Consolidation of the European World-Economy, l600-l750. New York: Academic Press; Wallerstein, Immanuel (1989), *The Modern World-System, III: The Second Great Expansion of the Capitalist World-Economy, 1730-1840's*. San Diego: Academic Press; Wallerstein, Immanuel (2011), *The Modern World-System IV Centrist Liberalism Triumphant, 1789–1914*. University of California Press. Gunder Frank, A, (1967), *Capitalismo y subdesarrollo en América Latina*, Siglo XXI.

## CONCLUSIONS

The conclusion is obvious. On very few occasions have the historic developments of human societies, based on permanent changes, evolved towards non- stable and non-equilibrium systems and wide freedom. This stands in contrast to the universe, where stable realities –e.g., galaxies, stars and planets, as well as living beings– are rigid, stable and exceptional systems.

Human experiences of non-stable realities, despite being often partial, short-lived or temporary, coincide with situations where equality, freedom and human rights have been more respected. History is not cyclical, as seen in the progressive evolutionary models of Turgot, Adam Smith, Guha and Gadgil and Marxism. Like in the universe, the processes of human experiences are mainly irreversible. They move from a process of advance, of creation of realities that help understand certain social and economic models described in this paper. At a specific time, societies often incorporate realities from previous societies, and these will constitute the basis of future societies. Hence, economists from the classic tradition believe that wealth of a specific moment results too from work carried out in previous stages.[52] Therefore, human societies use, in line with the universe, realities generated in previous stages. Greater complexity is accentuated in non-stable systems when the population enjoys greater freedom and the possibility of developing their material living conditions.

In human history there are no collective - or individual - improvement activities that do not require significant investments of energy and work. And when a society has achieved greater degrees of freedom it generates more activities, more complexity and a resulting greater entropy. Like in the evolution of the universe, human creation, especially regarding human rights, has not occurred at one single moment but across a series of moments, some of them described in this paper.

Beyond the biological and social survival of human societies, we have to consider that in their development they often have objectives that seek greater degrees of solidarity and equality. For example, before the establishment of the lordly regime in Europe, local societies enjoyed communal goods and uses, which, with the new system, they could often use but paid a set of lordly rents.

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[52] Petty, William (1662). *A Treatise of Taxes and Contributions*. N. Brooke.

The struggle for the enjoyment of the commons will be a constant in the history of Europe trying to achieve the most favorable situation for the peasantry.[53]

We agree with Richard Newbold Adams when he argues that both material culture and ideas form part of the dissipative structures that are human societies. The claims that we have seen that pursue greater degrees of equality and initiative with the increase of the energy used, of its efficiency, of the complexity of the society considered and of the resulting entropy show us different options than those of the centralized power and that also are forms of self-organization of societies.

> The current emphasis on endogenous development underlines that how this increasing energy is used lies in the nature of the society, in its historically evolving power and distribution. All societies are today under both internal and external influences to expand their uses of energy. While how they decide to do this is expressly a product of their own self-organization, that they do it is creating a more demanding field for natural selection.
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> Adams, Richard Newbold (1988), *The Eighth Day: Social Evolution as the Self-Organization of Energy*, p. 242. University of Texas Press, Austin.

The history of humanity shows us multiple examples of societies that strive to organize their communities in a more free, complex, and diverse manner in the face of the often dominant tendencies towards the concentration of power. Should one day human societies achieve a significant degree of permanent freedom and equality, we will be witnessing the consolidation of free, probabilistic, flexible, in a main situation of non-equilibrium and non-stability - although they may incorporate some stabilities and partial equilibria- in social, economic and political systems which far surpass biological evolution and progress, through culture, guaranteeing human rights for everyone. This behaviour reproduces that of the universe. At that point, human creativity will have achieved, despite being a minority part of stable systems of the universe, causing a break with reality –based on competitive fight and the rule of the strongest– and stand in a more convenient line with the true nature of the universe. This moment, if it occurs, would be a point of arrival for humanity and a point of departure for new stages of the same that we are still far from intuiting.

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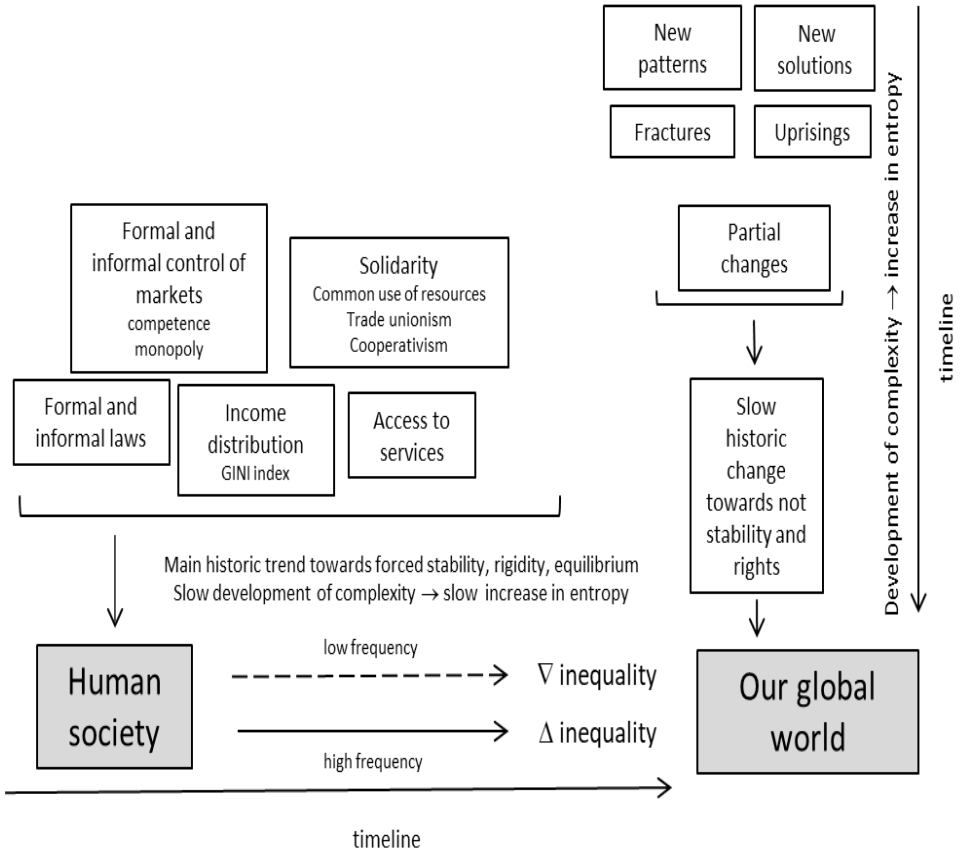
[53] Bloch, Marc (1931; 1999), *Les caractères originaux de l'histoire rurale française - nouvelle présentation*. Armand Colin.

Fig. 1. Analysed paradigm.

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