Era of Planeterization: Managing Complexity with Intelligence

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Abstract

In our contemporary times, a spectrum of exciting and worrying technologies broadly known as Artificial Intelligence (AI) have demonstrated and continue to demonstrate the capabilities that were previously considered exclusively belonging to humans. Meanwhile, the shortening of social-development's timescale, as a result of informatization and digitalization, speeds up the growth and exhaustion of economical sectors, manifesting as social crises (e.g., job displacement) shown up seemingly randomly but regularly. As a result of the tribal instincts, the win and lose in these "crises" cause social polarization and resentment to the "other" group. The institutionalized individualism interprets the conflicts as ideological contests and is the receipt for disasters, and perhaps civilization collapse. Instead, the root of the problems is an epistemological wall that stands between humans and a science of society since the failure of logistic positivism to understand the limit of the knowable, which was the last straw that broke the spirit of Enlightenment that the world of men (and women) could be understood and managed through reason, and led to postmodernity. In this essay, we speculate that the yet-to-come science of AI might enable us to overcome this epistemological wall, and finally enable humans to understand and manage complex systems—which is an umbrella term for biotic, nervous, economical and social systems—and to approach a science of societies first fathomed by the Enlightenment thinkers. In this essay, we would go through this journey from the Renaissance, and also the ancient China in the Bronze Age to our contemporary times to understand the current events. We also speculate the implications of this efforts of a science of societies: if this effort is successful, we might enter into an era that might be referred as the *Era of Planetarization*.

1 Introduction

> Such are the dilemmas and prospects confronting all humans today. They are uncomfortable and unsettling, but this has been the case in all the great ages of the past—and inevitably so, for great ages by definition are ages of transitions. They are times of rapid change when the old values and institutions are reluctantly cast aside and new ones gradually and painfully evolved. All the golden ages of the past were ages of tension and apprehension. This was true of Periclean Athens, of Renaissance Italy, and of Elizabethan England.
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> Stavrianos (1991, p. 760)

The year 2015 was the year where a broad spectrum of technologies branded as the Artificial Intelligence (AI) caught the attention of the mainstream society. It is considered that the game of Go represents a watershed between the capability of AI and humans because mastering it requires some understanding of human intuition in recognizing patterns of situations as advantageous or disadvantages, which represents a fundamental capability of human intelligence. And at 2015, the algorithm run on a huge amount of computing power defeated the world champion of Go.

What's more, a string of capabilities, that were previously thought exclusively to belong to human intelligence, are being cracked. Douglas Hofstadter, the author of the famous AI book *Gödel, Escher, Bach*, was shocked by the capability of AI to compose music (Mitchell, 2019). Laymen now could produce "arts" in the style of Von Gogh, and seemingly amusing novels now could be written by AI. And computer now could articulate speech with human accents.

The reactions to those events might be indifferent, confused, exciting, alarmed, or a serious face, depending on where people were at the time. But for any society-wide event, its root is much deeper than the facets that are being circulated in the general public. It could date all the way back to the age of Enlightenment, where for the first time in human history, people demonstrated the possibility of fundamental understanding of the world of men (and women) through observations, hypotheses, reason, and verification, in other words, science, which at that times was referred as natural philosophy. And the implication of this event might could be as significant as the previous enlightenment.

In a simplistic description, the emergence of AI technology was the continued effort of the scientists since the failure of logic positivists' search for a foundation of science, to know the limit of what is knowable (Sigmund and Hofstadter, 2017). The negative results of logic positivism, i.e., the Godel Incomplete Theorem (Kline, 1982), might be the last straw that broken the back of the spirit of enlightenment, and led to our post-truth world where demons and angels, demagogues and moral leaders need to resume their struggle in the old fashioned way. Meanwhile, the failure—of logic positivists to seek for the foundation through logic—let Alan Turing transform the concept of "knowable" to "computable", and let McCulloch and Pitts design the first computational model of brain. And those seed results eventually led to the AI technology nowadays, and the yet-to-come science of AI might enable us to overcome the epistemological wall encountered by the logic positivists, and finally enable human to understand and manage complex systems (Waldrop, 1993)—which is an umbrella term for biotic, nervous, economical and social systems—and to approach a science of societies first fathomed by the Enlightenment thinkers.

In this essay, we would go through this journey from the Renaissance, and also the ancient China in the Bronze Age to our contemporary times to understand the event; and this essay is also written to explain my long term research vision, which might be puzzling or interesting given the state of the art. We give a rather succinct outline of this section here, which is itself an introduction to the whole essay. In section 1.1, we discuss the emergence of humanism, and the challenge it faces if it is going to become an overarching intellectual system that serves as the foundation of a civilization. In section 1.2, we discuss the failure of humanists to address the challenge at the Age of Enlightenment, and our current Age of Anger as a consequence of this failure. However, despite the zeitgeist of ages stopped to be the spirits of Enlightenment, the challenge was and is continually being attacked, and in section 1.3, we discuss the progress in the past 200 years, and that Deep Neural network (the backbone of the

current AI technologies) as a phenomenological model of brain could be a step stone to address the setback in the efforts addressing the challenge that catalyzed our postmodern societies, which in turn might lead to a science of society and thus the continuation of Enlightenment; this is the topic of section 1.4. In section 1.5, we discuss the human conditions implied if the previous speculations are true. Then, under this speculated intellectual system, a scientific understanding of human ideals in previous eras could be obtained, and the implication of the system is an era that might be referred as *Era of Planeterization*; this is discussed in section 1.6. The introduction finishes here, and in section 1.7, we present the outline of this essay, which expands the discussion in the introduction.

1.1 The emergence of Humanism in the Western civilization and the perennial questions

To begin with, we need to go all the way back to the Renaissance. Since about 1200s, the stabilization of social order gradually transformed the social mentality: the ascetic virtue, the dogmatic following of authority, the rigid social hierarchy necessitated by hard social conditions, and the desperate longing for the salvation of afterlife morphed into the appreciation of good earthly life, the realization that reason, will, the observation of nature and active action would lead to individual development and improvement of life conditions, and the seeking of good earthly life.

> The mentality of endless possibility of men has been summarized as idea of the Renaissance men: one of its most-accomplished representatives, Leon Battista Alberti (1404 – 72), expressed that "a man can do all things if he will."

This intellectual system gradually developed into what we know as *humanism* today.

However, humanism had a very difficult challenge ahead if the theological system was to be completely replaced, and that is to provide an satisfying answer to the perennial questions:

> what is life? what is life for? what is humans' duty and destiny in face of death?

To see the importance of this problem, we could sample some previous social modes, which all are based on certain speculated answers to the problem, reacting to economical and social conditions. Very simplistically, the Christian societies were based on the extension of the ontology, where there are perfect forms of human societies in the heaven known as *The City of God* (the answer to the first question), earthly societies are imperfect projection of the heavenly city, and people's salvation lie in the returning to the perfect (the third question) through steadfast virtue (the second). As the industrial revolution changed the social conditions, the old mode of agricultural societies, where peasants were organized and led by aristocrats and clergymen, impeded the productivity and urbanization. Meanwhile, the idyllic (in its idealized form) agricultural life were obsolete for the newly emerged middle classes and workers, and yet a new ideal vision of life were missing. Thus, the old social organization was melting away, and the new one was yet to form. This social conditions caused reforms, or revolutions in different nations. After more than a hundred years of industrial development, the new answers to the questions were summarized by Max Weber as the Protestant work ethics where the steadfast virtue were substituted with diligence and calling to industrial work. In the meantime, depending on the goals of social projects, the humanists' answer to the problem varied from time to time. When political reformation was called for by the industrial revolution, Utilitarianism had been developed such that men are all of the equal capacity to pursue happiness, which rationalized the reform for representative democracy. But this simplistic answer never truly satisfied its inventor, J. Stuart Mill, and even caused a ten-year period of depression to him. Social Darwinism, a misdirected social theory developed by Herbert Spencer based on Darwin's "survival of the fittest" biological evolution, were born in the intense competition between nations and interests groups, and eventually led to Fascism. The experience, of building social theory based on the biology of Homo Sapiens, was so traumatic, social theory then took

a U turn to the blank-state answer to the first question, that humans are not presupposed to do anything, and lives are socially conditioned. This led to the unparalleled call for equality in the post WWII period, and the building of welfare states. However, as the goal of material development had achieved in the developed nations, this blank-state social theory did not offer what's next to do? And some kind of "End of History" was described, and the world reverted back to the default state of individualism, which is known as the neoliberalism.

1.2 The failure of Enlightenment and the age of anger

The intellectual system of humanism was never a serious contender to the theological system until the publication of Isaac Newton's *Mathematical Principle of Natural Philosophy*, which for the first time in human history demonstrated the possibility of fundamental understanding of the world of men through observations, hypotheses, reason, and verification. This event milestoned the Age of Enlightenment.

However, despite the great achievement, the Newton's law was a proof of concept that is peculiar to the Christian civilization because it disproved the Ptolemy system, and thus invalidated the authority of Church on societal order—which is an irony considering that the intention of Newton was to understand the existence of deity. In reality, the true functionality of Christianity was to provide a system of social norms and conducts, a hierarchy of political organs in the form of priesthood, and complete and elaborate answers to the perennial questions. Without replacing such critical functions, humanism was incapable of substituting the theological systems.

Consequently, the success of natural science to understand nature was accompanied by the efforts to understand humans and societies. When the Age of Enlightenment came to its end towards the middle of 19th century, there were ideas that the evolution of civilizations were in three stages, the theological, the metaphysical, and the scientific. This doctrine is known as *positivism*, and developed into what is called sociology together; that is, the study of societies through scientific methods. This science of societies turned out to be a much more difficult task. By 1900s, the humanities were regarded as a superior form of knowledge with respect to science. And General Omar Nelson Bradley, chair of the Joint Chiefs of Staff, address to an Armistice Day Luncheon of the Boston Chamber of Commerce on Nov 10, 1948 (Stavrianos, 1991, p. 760):

> We have too many men of science; too few men of God. We have grasped the mystery of the atom and rejected the Sermon on the Mount. Man is stumbling blindly through a spiritual darkness while toying with the precarious secrets of life and death. The world has achieved brilliance without wisdom, power without conscience. Ours is a world of nuclear giants and ethical infants. We know more about war than we known about peace, more about killing than we know about living.

The last straw on spirit of Enlightenment came at the failure of logic positivists' search for a foundation of science, for what is knowable and what is not (Sigmund and Hofstadter, 2017). Instead of confirming that the foundation of science is solid, the efforts discovered that the formal system, which is the language of science, is not self-consistent, implying not all phenomena could be characterized and verified in the system. This incompleteness of science prompted Thomas Kuhn to study the history of science, and concluded that the development of history was not the accumulation of facts and theories where science became increasingly true as it developed, but accumulative development interlaced with episodic revolutions that revised the incompleteness of the previous theories. This reconceptualization tarnished the objective and disinterest public image of science, and demoted science as another intellectual systems that are shaped by various subjective interests groups

The uncertainty of truth caused by the failure of logical positivism, the cold picture of humanity depicted by science, and the bust of the

Utopian dream milestoned by the World Wars (caused by institutionalized political expression of individualism, i.e., institutionalized liberalism) resulted in the transition of societies' mentality from modernity to postmodernity, where no truth is considered solid. In the post-truth world, the lack of objective ground for discourses accompanied an attitude of skepticism, irony, or rejection toward what it describes as the grand narratives and ideologies associated with modernism, often criticizing Enlightenment rationality and focusing on the role of ideology in maintaining political or economic power. Consequently, postmodernism resigns to the alienation, ephemerality, fragmentation and patent chaos of modern life and places individualized aesthetics over science, rationality, politics and morality (Harvey, 1989).

Without no intellectual breakthrough, the continuing of the institutionalization is waiting for a disaster that would set off a dark age. The societal transformation spearheaded by individualism had and has been scaring the regions of the world that did and do not want the transformation, and cast and casting billions adrift in a literally demoralized world. It was from among the ranks of the disaffected and the spiritually disorientated, that the militants of the nineteenth century arose—angry young men who became cultural nationalists in Germany, messianic revolutionaries in Russia, bellicose chauvinists in Italy, and anarchist terrorists internationally. Many more people today, unable to fulfill the promises—freedom, stability, and prosperity—of a globalized economy, are increasingly susceptible to demagogues and their simplifications (Mishra, 2017).

> A common reaction among them is intense hatred of supposed villains, the invention of enemies, attempts to recapture a lost golden age, unfocused fury and self-empowerment through spectacular violence (Mishra, 2017).

And the danger of this tension is civilizational: a nuclear war started by a losing political faction in the geopolitical competition, the self-absorbed internal social and political competitions that let climate change happen, or simply an unaware positive feedback loop that sets the temperature to raise in an irreversible path. In the Anthropocene, the disasters are also of the planetary scale.

1.3 The progress in the past 200 years and a phenomenological model of mind

Despite the zeitgeist of the ages had shifted, the people who believe in the spirit of Enlightenment still continued and continue to work on it. Though the political, economic, social and cultural system of our times are the manifestation of individualism (which is a metaphysical system), the infrastructure of the digital society that we have today is directly the result of positivism, where the word "digital" was emphasized. The axiom inconsistency proved by K. Godel prompted Alan Turing to ponder on what is reducible to logic and what is not, and now it is now known as what is *computable* and what is not. The computability problem led A. Turning to devise a formal system to characterize computability called *Turning Machine*. From the formalism of Turning Machine, John von Neumann designed the first Von-Neumann architecture of computer, and built the first well known computer, ENIAC (Electronic Numerical Integrator and Computer).

The attempt to explain the mechanism of the brain through logic led to the first computational neural network model, the McCulloch-Pitts model. Pitts could be considered as B. Russell's student, and thus was part of the logic positivism movement. The efforts to let the model handle uncertainty resulted in the multilayer neural network model in early 1980s. A statistical-physical model known as the spin glass model inspired a memory known as the Hopfield network, which in turn inspired the neural network model known as Boltzmann machine. The widespread adoption of Internet accumulated a large of amount data that preserved a projection of the real world. Meanwhile, the accumulative increase of computational power created some rudimentary information computing in silicon-based computational system. The synthesis of the big data, the computation power, the Boltzmann machine, and multilayer neural networks at the beginning of the 21st century, which is our times now, led to the blossom of Artificial Intelligence (AI).

Meanwhile, although the vision of Enlightenment faded away, science lived on in more practical pieces, or more technically, disciplines, and inched towards the understanding of biotic systems. And the development of biology, physics,

computation and information converged to give a scientific yet speculative characterization of biotic phenomena: a biotic system is a non-equilibrium thermodynamic system, that constantly intakes energy and infers information from the environment through a feedback loop, both in evolutionary scale in the sense of genes, and in the lifetime of the system (i.e., morphogenesis); the interactions with the environment are implemented by biological circuits, which are expression of genes, that compute coarse-grained variables that have fitness consequences; and the interactive process is also a symmetry-breaking process, where the components (e.g., cells) differentiate in response to feedback signals from the environment.

These developments started to make the formidable epistemological wall identified by the logic positivists approachable. The key observation is that the logic positivists took the logic reasoning in Homo Sapiens as a priori, and started from there to derive the foundation of everything, without understanding how logic emerges in human mind. In the *Probability: the Logic of Science*, Jaynes (2003) describe another layer of mathematical structure underlying the formal logic, which is probability, and discusses that the axiomatic inconsistency identified by Godel is not an inherent property of the proposition or event, but signifies the incompleteness of information. Therefore, the inconsistency that confused Russel and proved by Godel is an intellectual confusion between deduction and induction, and the problem is to understand the inference mechanism underlying the formal system. The inference mechanism is of two parts: the first part is the emergence of assumptions, and the second is the inference from these assumptions. The second part has been solved, and is known as the Bayesian probability. The first part is the currently unsolved part, and is equivalent to understanding the emergence of worldviews in human minds. This realization essentially pushes the problem further down into the rabbit hole: the inconsistency of logic system is a symptom of our inadequate understanding of human mind.

The synthesis of all the previous developments might be the start to break through the epistemological wall. This is where DNNs come in, which we recall is the abbreviation of deep neural networks: DNNs are a serendipitously discovered phenomenological model that is in a position to study the organizing principle of nervous system, and possibly biotic systems. Here "phenomenological" means it has been considerably simplified to only simulate some characteristic behaviors of biotic nervous system. If this sounds not scientific, we note that for the phenomena at people-scale, all existing physical models are actually phenomenological models, both because it is not possible to experimentally measure microscopic events precisely when the scale is too small, or the measurements would destroy the phenomena being measured, and because the observable macroscopic phenomena are actually emergent behaviors where microscopic details stop being very relevant. Thus, the mere fact a theory is based on phenomenological model says nothing about the scientific solidness of this science, and the relevant is whether an organizing principle stably characterizes the phenomena and is verified by experiments. And the task is to investigate whether the phenomenological model of nervous system would be possible to understand the organizing principle of nervous systems without characterizing all the details. This approach looks promising because this phenomenological model could process information of real-world complexity—it has achieved human-level performance in object recognition and the game of go, can utter speech in human voice, and mimic writing amateurish novels. The serendipitous discovery of object of investigation is critical in the development of science: without the simple ellipse behavior of planets, there would be no Newton's law; without the simple hydrogen atoms, there would no Schrodinger's equation.

The statistical mechanics of DNNs developed in Li (2022) is an first attempt in this direction. The general idea could be appreciated by a collage of Kant, Quine, and Badiou, though the details more grounds contemporary developments in science that are hard to describe shortly here. Kant made a "critique of pure reason" by distinguishing two realms: the things as they are and the things as they appear to the human mind. We would never know things as they are, and instead our mind formulate the things in space and time in a causal structure. And in criticizing the shortcoming of logic positivism's goal to reduce phenomena into logic, Quine points out that the reasoning in human mind is based on causal inference in a network of concepts, and is not possible to

reduce every case to the conjunction and disjuction of logic statements. And Badiou states that events observed by human mind are manifestation of hidden structures in object. In Li (2022), the training of a DNN (which is a multi-layer network of neurons) is formalized as a statistical-inference process that estimates the probabilities of groups of events in the environment that forms a hierarchy, such that the probabilities of certain coarse-grained events with fitness consequences are estimated and could be used to predict future events. Thus, the system learns a Bayesian hierarchical probabilistic model that identifies the causal structure between a decision and a network of neurons, and between the representation of events in the system and the hidden structure of events in the environment.

Therefore, the science of DNNs would be the step stone to understand the emergence of logic in human mind. In Li (2022), the operation of DNNs is Bayesian inference of a multilayer probability graphical model of DNNs, and thus is logic inference in the sense of Jaynes. And its relation to formal logic is falsifiable science: its test would be building a system that is capable of handling logic problems in real world scenario. And if this is achieved, we would overcome the intellectual wall that blockages humanism, and arrive at an intellectual system, and a world where truth exists.

1.4 Science of societies and the continuation of Enlightenment

As explained in section 1.2, the study of human mind is not a purely scholarly undertaking; the stake of it is whether societies could be intelligible by human mind. Thus, the science of the mind discussed in section 1.3 is a part of the cause of enlightenment, which was the enlightenment natural philosophers' odyssey to build a good society with observation, reason, and experiments, in other words, science. The insights gleaned there could help us speculate a science of societies, and in this subsection, we outline the basic ideas.

To begin with, we need to remark on the relevance of the issue—it is not a thought experiment built on nowhere, but a societal problem that requires urgent solution. The institutions of political economy exist are liberalism (in the sense of strictly free market) and socialism (in the sense of strictly national centralized allocation of energy and matter). Both of them could work under competent leadership during the industrial age. However, the informatization and digitalization of societies shortened the timescale of social development, which concretely implies that the sectors of growth and exhaustion could happen within the lifetime of a generation. In this fast-paced world, socialism has the problem of information bottleneck, which makes the precise identification of the local problems difficult, and when it fails to do so in a large scale, the system would collapse. Liberalism has the problem of societal polarization and cancerization of social groups, as a result of the uncoordinated social development, and the concentration of productive output on a tiny niche of the social system, respectively. When the timescale is long, those problems could self-correct over time, but in the fast-paced societies, its consequences are grave: Soviet Union collapsed, and the liberal alliance had the Age of Anger (see section 1.2).

This society condition is not something that is a cause of dissents or marginalized groups who want an alternative, but a social transition that a modern society would develop itself into, regardless of the political-economical system, and is already well on its way. The shortening of timescale is happening on every facets of human life, and over-amplifies a particular tiny niche of the society, instead of promoting a cooperative social structure. This could be seen clearly from some now well perceived pathology: the e-commerce platform tends to be dominated by a few brands that have the weight to dominate the information bandwidth of people (which is known as marketing) and in turn these brands themselves are dominated by a tiny fraction of products that they made; the social network services tends to over-incentivize the more primitive psychological instincts of people, and induce social bubble of the users (which previously does not exist because such interaction is spatially sporadic, and the temporarily diffusive), instead of promoting mutual understanding; the educational product also tends to self-select, which means that people are not prompted to reach out their comfort zones, but to seek for what they are already acustomized to—in other words, the wise become wiser, and the stupid become more stupid.

This is an evolutionary process is happening to the human system, and we are dealing with the new system with old thinking; but it does not necessarily be so, and if the system is designed properly, the new system could create a large scale cooperative societies that never exist before. An example of the primitive form of this system that has involved a large amount of people would be the ride-hailing service offered by tech companies. The wires, fibers and electromagnetic waves interlinks are the nerve fibers of the city system, ride-hailing apps in the smartphones are the sensors of the system that signal the whereabouts of the resources, and the cloud servers run by the companies are an information process system, which in a biotic system would be called a nervous system, that directs the movement of the cars and people to the resources in a way that maximizes the gain and minimizes the expenditure.

In this rapid-changing and interconnected age, our societies need a social system that resembles an organism, such that the situations at any segments of a society could be effectively signaled to the rest of the segments, and the social groups in the systems would self-rejuvenate to the new situations timely. Under this ideal scenario, the information bottleneck problem of socialism and the polarization problem of liberalism could be resolved. This is also a trend in history, where the social system becomes more complex, and this complexity is of fitness-benefits that provides a more sustainable access to energy and matter. The agricultural societies are more sustainable to hunter-gather existence by providing crops and livestock sustainably, instead of seeking for fruits and preys in a nomadic lifestyle. The commercial societies layered over the agricultural societies and are more sustainable to agricultural societies by forming a large scale cooperative system where the deficiency or disasters of one region could be mitigated by the diversity and production from the rest of the regions in the system. The organic societies would be layered over the commercial societies, and be more sustainable to the commercial societies by organizing supply and demand in the whole system at the timescale of minutes, days and mostly months, instead of the normally years in the commercial society, and by connecting a large number of distributed small productive and consumptive cells that do not previously exist because the barriers of operation is more costly than the benefits—this trend could already be seen in the on-demand shelving algorithms used in Walmart and the small international business made possible by the e-commercial platforms. This might be how the societies look like when the sustainable transition being executed by United Nations finishes.

In section 1.3, we explain that DNNs could be a phenomenological model to understand the mind, and in abstraction, a DNN is an informational multi-scale network. And a society is an energy-matter-information multi-scale networks in a similar way. Thus, we might speculate that a society is an organism at another scale but under a similar organizing principle where the constituent units are humans. This Russian-doll structure is the characteristics of nature. For example, The ride-hailing system here resembles a DNN (though the current technology needs to be reworked). Each region in the city system is a coarse-grained description of the supply and demand of human units in it. The supply from other regions are the incoming synapses, and the supply from a region to other regions are the outgoing dendrites. The supply and demand are perception and actions in a multi-scale network. Therefore, an organic management system would become the infrastructure that manages the energy and matter in the social system. These are systems that operate at the timescale of minutes to hours. A science of the cyber-systems, in the sense of the multilayer causal network of DNNs could be the start of the science of societies.

Therefore, we have a series of manageable problems to work on and to gather pieces that might lead to a general science, or the proof of the lack of it. As in evolution, a biotic system first occupies a niche in the environment to self-rejuvenate before it cooperates with other systems to form a more complex system. The organic society speculated would first emerge in societal niches, which are the specific cyber-systems that manage a niche of social system, e.g., traffic, food, energy, etc. When these systems at the timescale of minutes to hours are built, the causal-regulating experiments at the timescales of months could proceed, and build a science of these phenomena—it is like the cooperation of multicellular organisms that forms a more complex organism where each original organism is an organ in this new organism. The legal, cultural

and political subsystems of the social system are emergent constraints during this social development process that operates at different timescales. And ultimately, the raise and fall of civilizations is the temporal coarse-grain effect of the multi-scale network that collectively optimizes the fitness of the whole system.

To conclude, if this characterization of social system is directionally valid, at the end of the day, we might only have an intelligent system that could be used to manage social complexity such that the self-rejuvenation of the social system would continue, instead of an overarching social system prescribed by the science in the sense of the Newton paradigm of science where everything is deterministic given initial conditions. This long term unpredictability is a likely a consequence of the chaos phenomena in nonlinear science: small perturbations in the initial conditions would cause radically different outcomes.

1.5 Human's search for permanence and the human conditions

And this science of societies is not only about science, but also is about humanity. As discussed in section 1.1, the stake of the answers to the perennial questions is the rise and fall of civilizations. And ultimately they needs to be answered. In this subsection, we discuss the speculated answers, and their implications.

The perennial questions arise because humanity seeks for permanence in the face of all the transience of human lives. In the thousands of years of human civilizations, we could find the noblest heroes and also the most despicable humans, the burst of optimism over new possibilities and also abyss of pessimism when it seems all hope had been lost, the transient and cherishing prosperity and also the equally transient and disheartening chaos. And in the end, all things ended. In this ebbs and flows of history, it seems that,

> nothing lasts forever, and everything changes.

The early civilization were always theological and was always associated with astrology because the stars in the sky seemed to be the only thing that were permanent, and at the same time could be seen by every ordinate man to be a vehicle of persuasion. Thus, the order of humanity were always illusively associated with stars.

With the development of science and technology, the agency of humanity increased, and the social mentality transited from theological systems to metaphysical humanistic systems, which have two major modes of mentality: one is individualism that is best represented by the Western civilization resolving around the concept of individual rights; the other is the societism—this denotation of this word shall be explained in section 2.2—that is best represented by the ancient Chinese civilization resolving around the concept of morality.

Further recall the characterization of biotic system given in section 1.3, that a biotic system is characterized as a system in a non-equilibrium process that constantly intakes energy from the environment to infer information from the environment that has fitness consequence. The consequence eventually means that it could *self-rejuvenate* itself; here self-rejuvenation has two layers of implications: first, self-replication in an informational sense that a spatiotemporal structure perpetuated over time, which is not only restricted to self-reproduction, but also the self-repair and thus the renewal of itself within its life cycle; second, self-betterment in the sense of utilizing energy more competitively than the previous ways.

Thus, we might speculate that at the spatial and temporal scale of humanity, the self-rejuvenating process manifests two major modes of existence: the first is to maintain the inherited complex cooperative social system (i.e., an informational structure) that provides energy and matter to self-perpetuate, and the second is to explore alternative cooperative and more complex social systems that would provide energy and matter at the larger scale and in a more sustainable/slow timescale. The first mode of existence incarnates itself as individualism, and the second incarnates itself as societism. Thus, civilization-wise, this capacity to self-rejuvenate becomes something that we call desires, which individually manifests as the desire for prosperity, which is a combination of security, social bonding and individual realizations, and socially manifests as the desire for a prosperous and just society. And the

desire ruminated by philosophers became visions for the future.

Consequently, although to search for permanence among human transience, the first humans attempted to associate humanity with the sky in all kinds of ways, and the story did not end up with what they had in mind from the perspective of science, they were somehow right: life is a fundamental process of the Universe, not just in living organisms but everywhere, at every level. This view of life has been known as *Big History*, and could be summarized as one sentence:

> Universe makes galaxies, galaxies make stars, stars make planets, and planets make life.

This implies that humanity is a part of the cosmic order where it exists to self-rejuvenate itself.

Meanwhile, the speculations on the science of mind and societies are all derived from a concept referred as *adaptive symmetry*. Physics is the testimony of the success of science because a characteristic known as *conservative symmetries*, that allows for repetitive experiments. The symmetry in biology is a different category of symmetry with the conservative symmetries in physics: the conservative symmetries refer to a symmetrical transformation of states in a physical system (e.g., rotation or translation) that would conserve the free energy of the system. An example would be that if a system is translated from New York to Paris, the properties of the system would stay the same. The symmetry in biology is rather different. It is a non-equilibrium state that poses to take symmetrical pathways in response to feedback signals from the environment; the symmetry means the equal tendency (technically probability) to take these pathways in absence of signals. A biotic system was composed with repetitive units (e.g., cells) that would break the symmetry in different ways according different environmental signals. Meanwhile, the broken and intact symmetries coexist: the intact symmetries maintain adaptability, and the broken symmetries manifest as functional structures. These symmetry-breaking enables the system to adapt to the environment, and thus we refer them as **adaptive symmetries**.

Therefore, the self-rejuvenating process is an adaptive-symmetries breaking process, and the consequence of the symmetries breaking is the increase of envelop of complexity. We give a series of example ranging from biology to civilization development.

1. The cooperation/composition between mitochondria (the organelle that generates energy for cells) and eukaryote (a technical name for a type of cell) could be understood as complexity increase that resulted from the breaking of adaptive symmetries. A mitochondria was free to move around to anywhere that contains food source, and ended up in an eukaryote. And the eukaryote was also free to get the energy from any available sources, and accidentally acquired a reliable source from the mitochondria. The former gets reliable source of good from the host cells, and the latter gets a reliable mechanism to produce energy. This symbiosis provides a better metabolism and is the foundation where the multicellular organism, e.g., plants and animals, could evolve.
2. The emergence of early civilizations observed by Jared Diamond in *Guns, Germs, and Steel, The Fates of Human Societies* could be understood as a process of adaptive-symmetries breaking. The diversity of species in the Eurasian continent is a large amount of coexisting intact and broken adaptive symmetries that are existing function structure encoded by DNA molecules known as biological species; here function structure not only means a particular three dimensional structure, but the spatiotemporal structure that includes the propensity to prefer certain behaviors. There were particular wild species that were posed to form symbiosis relationship with other species such that collectively they could increase the fitness of both species. For example, dogs could scavenge food in the wild, and also accept food from humans, thus these could be understood as a spatiotemporal adaptive symmetrical behavior, and this degree of freedom in the behavior allows for the domestication of dogs. By forming this symbiosis, humans got, for examples, shepherd dogs, and dogs got stable source of food. Meanwhile, wolves do not have such capacity, and cannot be domesticated. The breaking of such adaptive symmetries led

to a more complex system consists of dogs and men. This example is a symbiosis between species similar to the symbiosis between mitochondria and eukaryote, but at a higher temporal and spatial scale. This complexification resulting from broken symmetries happened also between humans and wild species, and among humans. The advantage in domestication resulted in better food production, and the accumulated surplus was a reservoir of adaptive symmetries whose breaking was the early emergence of political organization that support specialists who developed technologies and invented writing, required the politicians and priests who worked on the abstract ideas to lead and unify population, and maintained standing arms to explore and conquest.

3. Lastly, the clashes between nomadic and agriculture civilizations only ended when the mode of production and commerce between these civilizations have surpassed a threshold, such that the benefits of trade between these two types of civilizations make the wars meaningless; that is, the formation of the commercial civilization. This is a form of adaptive-symmetries breaking. Previously, the people in the either civilizations could choose to fight or trade, however, the operation cost of trade is too much, and the benefits are too small, and thus the people in the either civilizations predominately chose to fight. When the infrastructure developed and the mode of production changed, it was more beneficial to choose the other end of the symmetry, and the civilizations converged under this cooperative and more complex network.

This self-rejuvenating process and the emergence of complex society implies a set of human conditions that form a hierarchy in term of the spatial and temporal span, from individual survival to civilizational rejuvenation.

1. First, at the lowest of the hierarchy, as an autonomous individual, a human needs to satisfies imminent self-rejuvenation at the timescale of hours by finding matters and energy source (i.e., food and water) to sustain the daily metabolism. After hoarding a sufficient amount of energy (e.g., stored food or money) and acquired a protective shell (a cave or house), the individual would possess a sufficient number of adaptive symmetries to break to mate with another individual, such that informationally, the human system could self-rejuvenate beyond the timescale of decades. This reproduction process happens at the timescale of decades.
2. Second, a number of individuals form a group, which has a particular group organization that we might call group norm, and typically has one or many leaders. The self-rejuvenation of individuals are meshed in the social relationship within a group: physically, this relation could be understood by Karl Marx's relation of production, the sum total of social relationships that people must enter into in order to survive, to produce, and to reproduce their means of life; informationally, this relation could also be an aspiration or vision of life that individuals in it find an identity. The self-rejuvenation of individuals in the group results in the self-rejuvenation of the group, which manifests as the replacement of individuals in certain group roles.
3. Third, move a further step up in the hierarchy, a large number of groups form a society. Therefore, a society is characterized by the cooperation and competition among various social groups. A society has dominant social norms and a system of institutes that maintain the complex cooperative among individuals and groups. Social norms could include a set of explicitly or implicitly accepted social conducts, and a dominant and well perceived way of life. And the institutes could include the political system to govern the society, the educational system to educate people, the monetary system to run the economy, and the court to resolve dispute and carry out jurisdiction. These institutes to a society are the equivalence of social roles to a group, and an institute is operated by a social group. And thus a society self-rejuvenates physical-informationally in the sense of perpetuated and evolving norms and institutes, in a way similar to the self-rejuvenation of groups, but at a larger scale, both spatially and temporally.

1.6 Human ideals and the era of planetarization

Many societies under the same vision and instruments for self-rejuvenation are refer as a civilization, whose temporal span could last thousands of years. This observation leads to the speculation to the last question of the perennial question: what is humans' duty and destiny in face of death? In this subsection, we describe it and speculate its implications.

In *a broad stroke*, ever since the emergence of consciousness, human condition became the struggle between good and evil.

> This struggle, in theological age, had acquired a mythological mantle and was depicted as the battle between Satan and God, while in metaphysical age, had been depicted as the defense of values or Dao (Way).

The good is roughly the cooperative structure that sustains the complex societies that we call civilizations, and is known largely under the umbrella concept of morality. The appreciation of the good lies in the acceptance of the collective identity under such a society, and could only be acquired by people who have been meshed socially into the society through years of interaction with positive feedback (and the negative feedback from deviating from such practices), and form a materially and spiritually symbiosis with the society. This symbiosing process does not happen for people who are exploited by the social system, or the marginalized group, or people who have seen the long term negative consequences in the current social norm (who are typically intellectuals). When this "other" group degenerates, in the sense it degenerates into behaviors that run against the complex cooperative behaviors that make civilizations possible, such as behaviors that we refer as criminal (which exploits the production of the cooperative structure without contributing to it), small clique groups that form a coherent but despotic group, or the revert to tribal killing (e.g., fascism) pre-civilization behaviors. This tension is the struggle between less complex systems and more complex systems, and is the major theme in human's history.

> Meanwhile, as intended in the phrase "in a broad stroke", this struggle actually results from a feature, not a bug.

On the other hand, the innovative individuals always live as outsider, as "the other" at the seed stage of social transition. Confucius traveled from kingdom to kingdom with his disciples in his prime years, and ended up compiling classics and histories late in his life. Socrates was an annoying individual who would wonder in the wild covered with snow barefooted, and was ultimately executed when the democracy of Athens fell. Erasmus was a vagabond hopped among universities and royal patrons while writing the translation of Bible that unified the Greek and the Latin traditions of the New Testament in early Renaissance. Einstein worked as a patent worker outside the academics before he worked out the theory of relativity. And as well known, the legacy of these individuals transformed the respective civilizations and science.

> This struggle between individuals and societies is a key of the mechanism where the system evolves, and is not possible in the ant society. A blend of star gazers and moral guardians are the ingredients for conscious evolution.

The cosmic epic origin of humanism and the hierarchy of human conditions in the sense of complexity imply a duty and destiny of mankind that had been discovered under theological and metaphysical intellectual systems in the past, which we might refer it as *Project Humanity*, is where the permanence of humanity is embodied, and is incarnated as varieties of *human ideals* in history. From the level of individuals, to groups, societies, and civilizations, and ultimately the whole earth system, all of these systems are in a diachronic process of self-rejuvenating. The progress of this process manifests in the increasing complexity, such that the units in the system as a whole would collectively access to an increasingly sustainable supply of matter and energy.

The emergence, unconsciously or consciously, of an organic society discussed in section 1.4 is to build a complex and cooperative system where

the humans in the system collectively provide for one another, such that a thick safety net is an intrinsic feature out of mutual cooperation—this cooperative phenomenon has taken the mantle of *social capital* currently under the language of commercial societies. A high level of morality might be required for people who maintain the system, which would be a natural outcome by the time they reach there—"a great man does not seek to lead; he is called to it, and he answers" (Dune, 2021). For the average people, they only need to be good at what they specialize in this system. Thus, the taxing unrealistic morality in the ancient civilizations (e.g., ancient Chinese, Christianity, or Victoria moralism) would do not exist, and a well maintained system would solve the self-perpetuation part of the problem. Meanwhile, because no coercive control exists in the system—the organic social system are simply superbly efficient market—individuals could "do their own things". The inferior individual creations would die out on their own, and the superior ones ultimately would end up becoming a part of the system because a more complex system is more powewrful, and sustains itself for a longer timescale.

This more complex, powerful, sustainable social system derived from the organism intellectual system would naturally lead to the next item in the never-ending diachronic project of humanity: an interstellar species. Before the emergence of multicellular organism, the ocean might look rather lifeless. This might be the situation of our currently observed universe: the organisms of the human size are like bacteria in the ocean, and the activities of bacteria are restricted in the spatial range where geological forces allow. And the emergence of large complex cooperative system of cells, such as the system known as a fish, enables the collective of cells to move allover the ocean. A complete form of the organic society would acquire the ability to terraform planets—one of the first problems it needs to address before such a society emerges is the climate change, and this is actually what an organism at a planetary scale means for.

This vision has been seen by Carl Sagan, the missionary of science, who we quote below.

> That' s here. That' s home. That' s us. On it, everyone you love, everyone you know, everyone you have ever heard of, every human being who ever was, lived out their lives...Every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every revered teacher of morals, every corrupt politician, every superstar, every supreme leader, every saint and sinner in the history of our species lived there – on a mote of dust suspended in a sunbeam.
>
> Those worlds in space are as countless as all the grains of sand on all the beaches of the Earth. Each of those worlds is as real as ours. In every one of them, there's a succession of incidence, events, occurences which influence its future. Countless worlds, numberless moments, an immensity of space and time.
>
> And our small planet, at this moment, here we face a critical branch-point in the history. What we do with our world, right now, will propagate down through the centuries and powerfully affect the destiny of our descendants. It is well within our power to destroy our civilization, and perhaps our species as well. If we capitulate to superstition, or greed, or stupidty we can plunge our world into a darkness deeper than time between the collapse of classical civilization and the Italian Renaissance. But, we are also capable of using our compassion and our intelligence, our technology and our wealth, to make an abundant and meaningful life for every inhabitant of this planet, to enhance enormously our understanding of the Universe, and to carry us to the stars.
>
> By the time we are ready to settle even the nearest other planetary systems, we will have changed. The simple passage of so many generations will have changed us; necessity will have changed us. We are… an adaptable species. It will not be we who reach Alpha Centauri and the other nearby stars. It will be a species very like us, but with more of our strengths, and fewer of our weaknesses; more confident, farseeing, capable and prudent. — Carl Sagan, *Cosmos*

If this era ever comes, we might refer it as the **Era of Planetarization**.

1.7 Outline

This introduction is a condensed version of the whole essay, and lacks many details. In this subsection, we outline the main body of this essay,

such that interested readers might delve into the details if one desires. We also note that even the main body might not be substantial enough given the scope that this essay aims for—this is why this piece is referred as an essay, instead of a scholarly work. It is more about delivering the vision, instead of being a vehicle of persuasion, which not only needs perhaps a book-length exposition, but also real-world proofs that verify the vision. Efforts at that scale perhaps won't happen for some years. And thus we are content with an essay.

The main body of this work is written actually in a somehow reverse narrative to the narrative in the introduction—this is also a typical phenomenon in science, which normally started with a vision, and then work out the details.

In section 2, we shall start with empirical data on the dawn and decadence, rise and fall of humanistic civilizations. This section expands the discussion in section 1.1 and 1.2. More specifically, in section 2.1, we shall discuss the dawn of humanism of Western civilization with a leaning over individualism at Renaissance, and the decadence of this intellectual system at our postmodern age. In section 2.2, we shall discuss the rise of the humanism of the ancient Chinese civilization with a leaning over societism at the Zhou Dynasty in the Bronze Age, and the fall of this civilization at Qing dynasty during Industrial Revolution. In section 2.3, we shall discuss the dawn of scientific humanism at the Age of Enlightenment, and the failure of this cause.

In section 3, we shall analyze the data, and the analysis should be taken in the sense of natural philosophy. This section expands the discussion in section 1.3, 1.5 and 1.6. In section 3.1, we discuss that both the intellectual systems in the theological eras and the humanistic eras are the reaction to the humans' desire for permanence in face of all kinds of transience, but humanists they failed to do so because of an epistemological wall that prevents them from understanding the regularities in societies. Nevertheless, the progress in science and technology in the past 200 years makes the problem start to be approachable, which is discussed in section 3.2. The concept of adaptive symmetry is introduced in section 3.3 to characterize and analyze the rise and fall of civilization, and what is permanent for humans. The analysis gives an answer to the perennial questions, implies a set of human conditions forming a hierarchy, and derives human ideals in the early eras from the perspective of science; this is discussed in section 3.4.

In section 4, the analysis is put to predict, or more precisely understand our contemporary civilizations. This section expands the discussion in section 1.3 1.4, and 1.6. In section 4.1, we analyze our current society condition whose characteristic is the shortening of social-development timescale, which causes a cluster of social problems and obsoletes the dominant political-economic systems; we also speculate the emergence and design of organic societies where social complexity is managed by intelligent systems, the emergence of an intellectual humanistic system that would synthesize individualism and societism, and ultimately the formation of a planetary civilization. In section 4.2, we discuss how the natural philosophy could be developed into a science, which includes a science of mind and a science of societies. In section 4.3, we clarify possible confusions, which includes the concept of intelligence singularity, privacy in the organic societies, and the possibility of unemployment as a result of massive automation.

1.8 Terminologies and clarifications

We make some clarifications in this section.

First, this essay gleans ideas from diverse sources, but currently, only the criticisms are made sure to be cited, such that the criticism would be sound. This is both because of the highly condensed narrative, where it is difficult to cite relevant works for that several points are actually combined together, and because of the lack of time to minutely track the bibliography.

Second, this conclusions, or we would rather say speculations, in this essay are far from solid by the standard of science, though it is rather acceptable in the style of philosophy. They are to explain and clarify research vision, instead of providing definite answers.

Third, some terminologies require clarifications. In this essay, individualism and societism are considered intellectual systems, which each denotes a system of ideas that guide humans' action and societies' organization and development, and are known in philosophy roughly as

the ontology, epistemology, moral and ethic philosophy, and the political philosophy derived from them. Liberalism and socialism do not denote political philosophy, but systems of political economy. Eras refer to the times that span over the entire life cycle of an intellectual system, which typically overlays over the life cycle a civilization (e.g., the Western civilization since Renaissance, or the ancient Chinese civilization), while ages refer to the times that span over distinctive times within the life cycle of an intellectual system (e.g., the Age of Enlightenment, or the Age of Voyage).

2 Data, or historical eras of humanism

> The perennial questions:
> What is life? What is life for? What is man's duty and destiny in face of death?

To begin with, we might need some clarifications. There is no such a thing as a definite history of the past, and historians only provide narratives that are the vision of the past. Meanwhile, there is also no such things as a predetermined future, and philosophers only provide the vision of the future. Thus, the historical eras narrated in this section are only visions of the past. In addition, we would only visit the milestones that punctuate the big cycles, and note that the big cycles were interlaced with small cycles, where fragments of all kinds of ideas existed. This is because we only aim to discuss the macroscopic life cycle of civilizations without getting into too much details.

2.1 The era of individualism, from dawn to decadence

If we are to understand the development of AI, we need to put the development under the context of intellectual history. And if I have the time to write a book-length exposition, I perhaps would start with the Mesopotamian Civilization, then to the classic civilization between Homer and the Peloponnesian War, and lastly to the modern world beginning since Renaissance. But for now, I could only start with the Renaissance.

The five hundred years since Renaissance has been a spectacular era of humanity, where a paranormal of ideas spanned from arts, religion, philosophy, social thoughts, and science have blossomed. Seeded from earlier civilizations, although interlaced with the usual dramas happened during the transitions of social order—the purging and exploitation of the "others", the class struggle, the petty and the catastrophic wars, the Democles sword of nuclear weapons, and planetary disruption of nature—the era has been the results of heroic efforts that demonstrated the potential of human agency: it thrived on dissents and originality, developed with dialectically opposing ideas, sought truth with a peerless adamant will, and achieved prosperity that had been unthinkable in previous civilizations.

However, such an era has been drawing to an end, not in term of the actual collapse of social order, as what happened after the fall of political regimes, but in term of the finishing of the driving cause of this era. In this section, we attempt to summarize the main cause of this era, and speculate why it is coming to an end. And the message is: to borrow the metaphor from Barzun (2001), the Renaissance had been the Dawn where the idea of *Renaissance Man* had awaken the individuality of Homo Sapiens, and the Post-modernity is the Decadence where individualism succeeded, institutionalized and is bringing itself to its own demise.

And to articulate, the cause might be called individualization, and the era as the **Era of Individualism**.

2.1.1 The disintegration of the Christian order and the rise of individualism

To appreciate the beginning of the individualization cause, we need to discuss the antithetic counterpart that engendered it. Before the Renaissance, the characteristic era preceded it is known as the Dark Age. After the fall of the Roman empire, this era of Europe had been through hundreds of years of chaos: the factions in the disintegrated Roman empire warred with one another, the Danes and Normans caused havoc from the north, and the Arabs invaded from the east. The chaos did not settle until about 1000 A.D., the time when the different ethnic groups became mutually assimilated through these hundreds of years violent contact, and the Christianity and Islam faced a standstill. In those violent times,

for ordinary people, the precarious, hardship, and uncertainty could only be mitigated by the cooperation and mutual support in the fraternity and fellowship of Christianity, and the psychological certainty of an afterlife.

> And the life of the good was a pilgrimage to the heavenly city; nothing of value was possible in the earthly world except the steadfast virtue that would lead, in the end, to eternal bliss in the afterlife (Russell, 2004, p. 286).

In this era, individualism was nothing less than martyrdom.

The social, economics and political condition gradually stabilized since about 1200s, and the possibility of an earthly good life gradually permeated social mentality, manifesting in the reorientation of arts on men, revision of theology, and resurrection of humanism. The ascetic virtue, the dogmatic following of authority, the rigid social hierarchy necessitated by hard social conditions, and the desperate longing for the salvation of afterlife morphed into the appreciation of good earthly life, the realization that reason, will, the observation of nature and active action would lead to individual development and improvement of life conditions, and the seeking of good earthly life.

> The mentality of endless possibility of men has been summarized as idea of the Renaissance men: one of its most-accomplished representatives, Leon Battista Alberti (1404 – 72), expressed that "a man can do all things if he will."

And more realistically, the Renaissance period clustered a cultural type nowadays perhaps known as the transdisciplinary mind who cultivate a variety of interests without disciplinary boundaries.

> An example of the shift of the mentality would be Montaigne, who, while writing his *Essays* (Montaigne and Screech, 2004), shifted from the mentality, that to philosophize is to learn how to die, to the one, that to philosophize is to learn how to live.

These men clustered in city states of Italy, which had been placed in the unique place at the juncture between the Christian and Islam world, where trade from Asia, India, Islam must pierce through, commerce could prosper, and the ideas could cross-fertilize.

This development of social and cultural conditions led into political development that cleared the political obstacle of the development of individualism. The sufficiently prospered economic condition also accompanied the disintegration of the old order: corruption of the priests for whom the vices in the previous era did not lead to destruction easily now; the momentum of ordinary people to break from the heavy burden and dogmatic routine that were necessary for the hard time; the unwillingness of the emerging social interests group (e.g., princes, artisans, merchants, and the priests themselves) to maintain such a hierarchical cooperation structure centralized by Pope. Such a social condition led to Reformation that revolutionized religion, and through which Protestantism substituted the papal authority with Gospel. Reformation distributed authority into local groups, and cleared away the theological obstacle of individualism.

2.1.2 The emergence of liberal domestic and international order

However, the disintegration of the old order did not immediately bring to the establishment of a new order. It has left two open problems, the intellectual confusion, and the political disorder—we shall discuss the intellectual confusion later in section 2.3. The efforts that reestablished of social order led to the liberal social system in the Western nations, and the current liberal international order that was stabilized on commerce.

Politically, the disintegration of central authority led to the sectarian wars between different theological factions powered by political interests. And this torn-apart world developed to the second phase of individualism, the development of the nationalism. The distributed authorities was ensued by the development of the *group-wise individuality*, and by centuries of wars between nation states. In this age, political philosophy and the rule of law were developed to replace the theological rules, separated Church from State, and established types of governments

that gradually shifted from theocracy, to aristocracy, then to representative democracy. This state-building process happened at different times for different ethnic groups, and for the Western nations, the last influential nation to finish this process was the German under the rule of Bismark. And for the non-Western nations, this is still an ongoing process.

The group-wise individuality left the inter-group interaction undeveloped, and as a result, it was left to the base instincts of tribalism, and finally culminated into the two Great Wars. After seeing the devastating effect of modern warfare, and realizing the real possibility of the civilization collapse, the nations after the WWII established a system of rules to conciliate and arbitrate the interaction among group-wise individuality, i.e., the currently international liberal order.

Meanwhile, the political expression of individualism, i.e., liberalism, has the problem that the expression of individualism that were at the expense of that of others'. This led to the polarization of the societies after the industrial revolution, where with a simplistic categorization, the proletariat are exploited by the capitalists. The class struggle, and the competing among nation states developed the social thoughts that enabled the universal education, individual rights, state regulation of markets, and welfare systems in current societies.

2.1.3 The apogee of individualism

Although the process was a spiral process of chaos and progress, for the first time in history at a large scale, the advance of science, technology, and commerce had made group interaction a non-zero-sum game. And at the contemporary times, we could safely say that the cause of individualization has been accomplished. An individual in the contemporary societies, conditioning on that the societies are sufficiently developed economically and socially, now have access to infrastructure that enables oneself to "his own thing". To quote the statement of the latest incarnation of this spirit in the counterculture movement,

> "We are as gods and might as well get good at it. So far remotely done power and glory—as via government, big business, formal education, church—has succeeded to the point where gross defects obscure actual gains. In response to this dilemma and to these gains a realm of intimate, personal power is developing—power of the individual to conduct his own education, find his own inspiration, shape his own environment, and share his adventure with whoever is interested." — Stewart Brand, *Whole Earth Catalog*

Though there are still variations in local conditions. An individual is immensely empowered than the average men in the pre-modern eras. Internet has made the once scare books available to anyone who have cable access, which were only available in royal and university libraries. Starvation has been eliminated in regions where sufficient social stability has emerged, which was a condition that people worked all their lifetime to prevent—the Roman empire was always three weeks from starvation. Transportation infrastructure enables the majority of the population to experience the foreign cultures, which were only available to the upper class. The venture capital system enables a cooperation between the ones with money, and the ones with the skills, which was non-exist previously because it was the land and capital that mattered, not the talents. Science and technology is an mostly open system now that everyone can access with the proper preparation through Open Science and Open Source movement, which was held as divine revelation by the priests, were guarded as secrets by guilds.

Truth be told, this freedom still needs to tread carefully to not provoke powerful interests groups, being them governments, or corporations (see story of Aaron Swartz in the documentary, *The Internet's Own Boy*), or religious extremists. The classed education still persists, because classed education is always partially group competition that is very hard to eliminate—it is the relative power, not the absolute conditions that tease human desires. Yet, the tolerance over constructive social efforts are immensely different from the Feudal or Imperial societies in the pre-modern era.

The conflicts are more in the nature of misunderstanding of the dynamics of societal change, than the totalitarian repression, for example, as that of the inquisition performed by the Catholic inquisitors.

2.1.4 The institutionalization and decadence of individualism

When the apogee is achieved, it is the decadence that waits. The decadence has repeatedly happened in history, when the liberator slay the dragon, and it became the dragon, and the decline begin: what does one mean by individual realization? this is an ambiguous concept at the beginning since Renaissance.

After the collapse of Soviet Union, the free world was left with no villain to liberate it from, yet the societies are still under the inertial of the cause of individualism, and the liberator started to fight with its own shadow. In the realm of politics, the most powerful nation fought a number of regional wars in the name of freedom and democracy, which all ended up with disrupting the development dynamics of the local societies and maintaining chaos in the region without substantially modernizing the region (Sabio, 2015); to destroy, and to fight wars is easy, but to build societies is hard. In the realm of societies, the institutionalized individualism resulted in the polarization of societies as a result of the decoupling between the prosperous liberal groups under emerging new economical models and the demoralized conservative groups under traditional torn apart societies (Mishra, 2017), which could be a rather healthy development without such institutionalization. This rift is captured by the life who transits between these two world in the touching novel *Educated* by Westover (2018). And in the realm of culture, though not with subconscious doubt, the archetype of individualism is some kind of self-made super-riches, with byproduct interests, and often hypocritical lip service, to social goals, which could not be realized by the nameless masses (Strenger, 2011).

Subconsciously, a great number of people feel something is missing, however, the forces that aim for changes also still yet to get rid of the intellectual inertial of individualism. This subconscious discontent has been a persistent mentality throughout the Era of Individualism that drove its progress. But within the intellectual constraints of individualism, this discontent has exhausted all the possibilities, and for such an overreaching evaluation, we might quote Barzun (2001, pp. xvi-xvii):

> It will be asked, how does the historian know when Decadence sets in? By the open confessions of malaise, by the search in all directions for a new faith or faiths. Dozens of cults have latterly arisen in the Christian West: Buddhism, Islam, Yoga, Transcendental Meditation, Dr. Moon's Unification Church, and a large collection of others, some dedicated to group suicide. To secular minds, the old ideals look outworn or hopeless and practical aims are made into creeds sustained by violent acts: fighting nuclear power, global warming, and abortion; saving from use the environment with its fauna and flora ("Bring back the wolf!"); promoting organic against processed foods, and proclaiming disaffection from science and technology.
>
> Such causes serve to concentrate the desire for action in a stalled society; for in every town, county, or nation, it is seen that most of what government sets out to do for the public good is resisted as soon as proposed. Not two, but three or four groups, organized or impromptu, are ready with contrary reasons as sensible as those behind the project. The upshot is a floating hostility to things as they are. It inspires the repeated use of the dismissive prefixes anti- 2nd post- (anti-art, post-modernism) and the promise to reinvent this or that institution. The

hope is that getting rid of what is will by itself generate the new life.

The morbid individualization cause could be glimpsed through the super hero movies. The heroes in the movies always fought some villains, from outer space, from evil scientists, from criminals, or from corporation executives. But where do those villains come from? and why they have become villains? In modern criminology, criminals are not criminals because they choose to do so, but the environment they are born into conditions them, and most of them are not strong enough make alternative choices. In the *Batman* series, Joker sometimes would emerge from nowhere to talk with Batman. This is some metaphoric way to express that Joker is the shadow of Batman, and they are the duality of the same entity. Thus, it is not surprising that currently there starts a turn in popularity of super hero movies whose main heroes are the "bad guys" (e.g., *Joker* by Todd Phillips), or where the heroes grew up from fighting imaginary outer space invasion to protecting the environment and actually helping farmers (e.g., Atom Eve in *Invincible*).

This developmental pattern of civilizations have been summarized as institutionalization by Quigley (2003), *Evolution of Civilizations*: a civilization disintegrates when social *instruments* that drive progress gradually transforms into *institutions* that exists only to self-perpetuate; that is, transformation of social arrangements functioning to meet real social needs into social institutions serving their own purposes regardless of real social needs. This was what happened to all civilizations that existed, Greek City States, Roman Empire, Chinese Dynasties, and Soviet Union, to name a few representatives.

At the time the hero slayed the dragon, the hero became the dragon.

This institutionalization of individualism runs against the biological law of individuality. The era of individualism discovered the agency of individuals that in the previous eras was repressed under in environment because of inferior technologies and superstitious worldviews. However, there is no super man who can fly, no genius who discovers the theory of relativity at blink of thoughts, and no inventor who build the three-phase electricity generator through magic. The wield of agency requires exerting willpower over a long stretch of time, besides possessing talent and knowing how to manage it, and a system that could amplify the efforts. Individuals are constituents of families, interests groups, societies, ecosystems, or the universe. Institutions change at a timescale of decades instead of the hopefully years, and a social system is under the constraints of historicity that also takes decades to adapt away from. The interaction between individuals and the system that individuals are meshed in is illusively under-publicized in this era of individualism, and we might even misunderstand individuality. The time has been reached that they cannot be ignored anymore.

Without no intellectual breakthrough, the continuing of the institutionalization is waiting for a disaster that would set off a dark age. The societal transformation spearheaded by individualism had and has been scaring the regions of the world that did and do not want the transformation, and cast and casting billions adrift in a literally demoralized world. It was from among the ranks of the disaffected and the spiritually disorientated, that the militants of the nineteenth century arose—angry young men who became cultural nationalists in Germany, messianic revolutionaries in Russia, bellicose chauvinists in Italy, and anarchist terrorists internationally. Many more people today, unable to fulfill the promises—freedom, stability, and prosperity—of a globalized economy, are increasingly susceptible to demagogues and their simplifications (Mishra, 2017).

A common reaction among them is intense hatred of supposed villains, the invention of enemies, attempts to recapture a lost golden age, unfocused fury and self-empowerment through spectacular violence (Mishra, 2017).

And the danger of this tension is civilizational: a nuclear war started by a losing political faction in the geopolitical competition, the self-absorbed internal social and political competitions that let climate change happen, or simply an unaware positive feedback loop that sets the temperature to

raise in an irreversible path. In the Anthropocene, the disasters are also of the planetary scale.

2.2 The era of societism of ancient Chinese civilization

Being a Chinese, section 2.1 might read irksome to some Westerners because the statement of decadence, and read as lack of self-esteem to some Chinese because the "West-centered" narrative. Thus, it is necessary to discuss the role of China in this narrative. The modern China is still in the nationalism process depicted in section 2.1.2, and has not contributed to the progress of humanity substantially as a whole yet. However, the ancient China was an unusual civilization that is unique in the sense that it demonstrated what a civilization built on the antithetic side of humanism to individualism is like. We shall discuss this side of humanism, and what led to its decadence. This antithesis would synthesize with the thesis of individualism in section 4.1.4.

The ancient China also lived through the developmental pattern of civilizations, i.e., from instrument to institutionalization. And the the Qing dynasty was the decadent stage of the development. The central instrument of the development is not individualism, but an intellectual system that might be referred as **societism**. And the pre-modern era of China, the era from the Zhou Dynasty to the Qing Dynasty, might be referred as the **Era of Societism**.

2.2.1 The end of brutal theological order and the beginning of societism

As the era of individualism of Western civilization reacted away from institutionalized Christianity, the era of societism of Chinese civilization reacted away from institutionalized theology of Shang dynasty. Shang dynasty were started approximately the second millennium B.C., which was the known as the Bronze Age. During the period, Homo Sapiens had populated the globe, and the population pressure led to the emergence of early states, or civilizations, whose characteristic is the technological systems that utilize bronze. This period of human history had been rather brutal and violent in most of the cases (cf. Fagan et al. (2020), *The Cambridge World History of Violence*,). Homo Sapiens evolved in small hunting-gathering tribes, and psychological studies had shown that a human approximately could only know personally most 100 peoples, and thus the large-scale societies were sustained by certain abstract ideas. In the early ages, the ideas were typically theological, and also accompanied religiously legitimized violence and ritual sacrifices. And in this case of Shang, the outlook was particularly brutal and primitive (cf. 王平, Gubin (2007),《甲骨文与殷商人祭》). Unlike Christianity whose theology was derived from LOVE, the theology of Shang was derived from FEAR. Shang people believed prosperous earthly life, whatever that meant, was at the mercy of the God, and needed to be paid by human sacrifice, which was likely personification of the bloody period of the early state formation. Shang people probably were cannibals, and had a dozen ways to kill people to offer sacrifices. A particular horrifying sacrifice was denoted by a character 卯, which hallows out the viscera of a human, and hangs it on a hook, just like how animals are treated nowadays in slaughterhouses. Besides war conquered slaves, the human sacrifices were typically taken from subjugated tribes in the peripheral, and the tribes of the founders of Zhou Dynasty were the primary sources. A turtle shell that records "卯五羌", meaning sacrifying five humans from the tribe of Qiang, is shown in fig. 1.

As the Christianity civilization institutionalized when the social and economical conditions changed, the theology of Shang institutionalized after hundreds of years' development, which might be a natural consequence of the diffusion of superior technology controlled by Shang, and the fusion of the culture of different tribes. The brutal ruling was overthrown by the tribes that found Zhou, which understood the system of Shang, by offering the most humans for Shang to make sacrifices. This experience of human-sacrifices offering was so traumatic, such that after overthrowing Shang, the brother of King Wu, Duke of Zhou, buried this brutal and bloody history, selectively propagated the stories of prehistory sages, scapegoated the atrocity of Shang to the pervert character of King Zhou (the last King of Shang)—here "Zhou (纣)" is a different characterize with the "Zhou (周)" of Zhou Dynasty—and established an intellectual and political system of ruling that was the antithesis of Shang.

Fig. 1 Rubbing of an inscription on a turtle shell that records human sacrifices in Shang Dynasty.

The theological system, that the legitimacy of ruling was derived from human sacrifices to the God, was substituted by the Mandate of Heaven, which consists of a system of ritual and ways of conducts that emphasizes virtues (e.g., abstentions, and benevolence) such that a just and prosperous society could be maintained. Thus, the human sacrifices that was so horrifying to the tribe of Zhou was abolished. The political hierarchy among tribes was instead maintained by rituals and conducts designed by Duke of Zhou that followed a strict hierarchical standard based on people's social status, and the King of Zhou was Son of Heaven who arbitrated dispute among the aristocratic families. The philosophical ideas was summarized in the *I Ching*, i.e., *the Book of Change*, from which the philosophies of all great sages of China derived, such as Confucius and Lao Zi. Since then, the kind of religious personification psychologically required by ordinary people was substituted by the worship of sages, and gods were considered not involving with men's affairs directly. And the era of humanism of Chinese civilization, which centered on building just and prosperous society and is referred as **societism**, started.

The rest of the history of ancient China was the perfection, and adaptation of the societism of Zhou Dynasty to changing social conditions, and ultimately the decadence of this idea at the final dynasty, Qing Dynasty. We briefly walk through this era, from rise to fall, in the following.

2.2.2 The emergence of imperial China and Confucianism

In this societism of ancient Chinese civilization, Son of Heaven, or the royal family, performed the critical function to maintain the cooperative structure among the aristocratic families, and thus as long as the royal family became corrupted, selfish or simply incompetent for a prolonged period of time, this structure tended to disintegrate, which was referred as losing the mandate of Heaven. This led to the Spring and Autumn period of China, where the leadership of the royal family became nominal. Meanwhile, culture and knowledge that was initially available to the aristocrats gradually diffused to the masses, and contact and conflict among people increased as a result of the stability maintained by this order. As a result, the system where societies were ruled by local aristocrats gradually became outdated, and through the Warring States period, a new system known as imperial system was established by Qin Dynasty and Han Dynasty—the times of Han roughly overlapped with the times of the Roman Empire.

The first emperor of Qin unified written language, metric system, divided the nation into hierarchical administration units to break down the feudal system that had been organized by local aristocrats, started building the Grand Canal that connected the north and the south (which was not finished until Tang Dynasty), and connected the separated walls that were built to defend the nomadic people in the steppe in the further north. The physical and political reform could be done in a short time, but the cultural reform required a longer time. The Qin dynasty did not stabilize sufficiently to undertake the task.

The Han Dynasty took the torch, and the intellectual system of Zhou, mediated by Confucius, was adapted to fit the imperial system, and is the known as *Confucianism*. The system's answered the perennial questions as such: from the time of Duke of Zhou, the society was organized according to a system of rituals and conducts known as *Li (禮)*, and by following the sages' teaching (i.e., Confucius, Mencius and etc.) that

emphasizes the cultivation of virtues and this system of Li, a fulfilling life could be lived and a just and prosper society could be built. Since then, the fundamental characteristics of Chinese culture were formed.

However, at then the main goal of this system was to establish the legitimacy of the imperial system, and thus it left the first (the origin) and the last (the death) perennial questions unanswered. At the highest hierarchy and the lowest hierarchy, the people was rather superstitious, and a certain of mixture of Shamanism, Buddhism, and Taoism was practiced to handle the questions of origin and death: this could be seen that after building the mightiest empire in East Asia, the Wu Di (Martial Emperor) in his late age was confused, unsatisfied with the philosophy of Confucianism, and sought for ways to be immortal, just as what the first emperor of Qin did.

2.2.3 The apogee of societism and the emergence of Neoconfucianism

The malfunction of the royal family again resulted in another two cycles of chaos and order, leading to the establishment of the Tang Dynasty and Song Dynasty—this period roughly overlapped with the Middle Age. Despite the cyclic appearance of the history, the civilization metamorphosed. The Chinese culture gradually diffused to the once peripheral regions, through the established transportation system, especially the grand Canal between the north and the south. A market-based economy developed in the south, and international marine commerce also developed among China, Japan, and Southeast Asia, and so was land commerce through the Silk Road. Printing was invented, and the education level of the society improved. A system of state schools and the civic service examination was established to replenish the leadership, and selected bureaucrats from all segments of the society, though again most of them were from the families who have the means to get the education for the exam.

Meanwhile, the collapse of the previous dynasties and the threats from the northern nomadic civilizations also prompted intellectuals to investigate the foundation of the previous intellectual system. As discussed previously, the previous system was mostly a system that resolved around politics. The failures of this system, the threat of the nomadic civilizations, the development of civil societies, and the influence of imported philosophies, i.e., Buddhism, prompted a revision of the foundation that is known as the *Neoconfucianism*.

Neoconfucianism was a synthesis of the Confucianism, Buddhism, and Taoism. It started to break away from the mental shackles that only historic sages were the authorities to answer the perennial questions—this is similar to the shift of mentality after 200 years' development since Renaissance in the Western civilization. The metaphysical system, that natural order (Dao (道), loosely translated to Way) manifests in human mind (*Xing (性)*)—this answers the origin question—and also human could understand Way and obtain knowledge by investigating nature and societies (格物致知), started to be the mentality. This looks like a mixture of idealism and empiricism in the Age of Enlightenment, but we do not discuss the subtleties here.

This renaissance established an intellectual system known as the *Learning of Way* (道学). The core innovation was the concept of *Li (理)*, which is a different character with the Li (礼) previously, and means natural coherent order of things—physics currently in Chinese is called the Li of Things. It answered the missing perennial questions by formulating an ontology: principles that coherent order were endowed equally in all human beings as human nature, and that the social worth of individuals should be a function of their cultivation of this moral nature. Under this system, the individual lives did not solely resolve around politics anymore. Intellectual life was beset by creative tension between commitment to formal cultural continuity, to maintaining the culture of the past, and a search for the ideas that had guided the sages, for the Way of the ancients (before the sages)—this answers the death question. And the ideal life in this time was summarized as

> Investigate things to arrive at knowledge (格物致知); make sincere the intention, rectify the mind, and cultivate the body (诚意正心修身); order the family (齐家); well govern the nation (治国); and ultimately

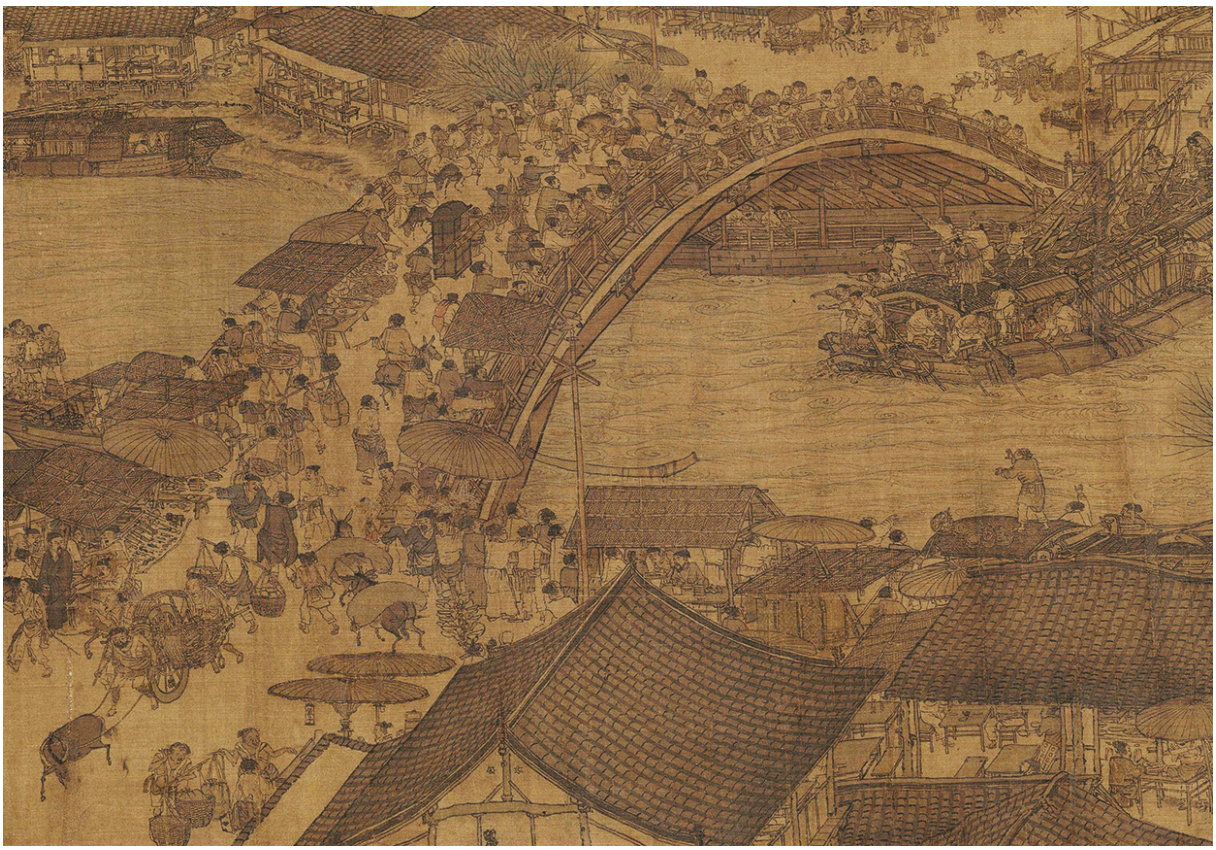

Fig. 2 A small part of the *Along the River During the Qingming Festival*, a painting by the Song dynasty painter Zhang Zeduan (1085 – 1145), The scroll is 25.5 centimetres (10.0 inches) in height and 5.25 meters (5.74 yards) long. It captures the daily life of people and the landscape of the capital, Bianjing (present-day Kaifeng) during the Northern Song. The theme is often said to celebrate the festive spirit and worldly commotion at the Qingming Festival, rather than the holiday's ceremonial aspects, such as tomb sweeping and prayers. Successive scenes reveal the lifestyle of all levels of the society from rich to poor as well as different economic activities in rural areas and the city, and offer glimpses of period clothing and architecture. The painting is considered to be the most renowned work among all Chinese paintings, and it has been called "China's Mona Lisa" (Wikipedia, 2021).

make the society prosper and just (平天下).

Consequently, a complete intellectual system of societism formed.

The political and social consequence of this intellectual advance was similar to the Reformation of Protestantism: the authority was distributed into local societies. And the life purpose was not to be solely a part of the political power that aimed to build a prosperous and just national society, but to be also a part of local communities, which consisted of mostly extended local families, and to preserve lineage. A system of private academies were established that weaved with local economy and communities. And the ultimate destiny of life is to preserve the ancestry heritage, and thus the ancestor worship played the role of god worship in Christian civilization. The apogee of Chinese societism was reached.

However, although this ideal society could be considered achieved for some time in the region known as South of River, referring to lands immediately to the south of the lower reaches of the Yangtze River—a glimpse of this civilization could be seen in the painting *Along the River During the Qingming Festival*, a part of which is shown in fig. 2—the civilization as a whole suffered a number of problems: periodical leadership exhaustion, unmanageable contingent or structural system change, and confrontation with the surrounding nomadic civilizations.

1. The competence of the royal family still was the deciding factor of success of this system, and power struggle between the royal family, the bureaucratic class and also the military class was constant and delicate. Peace and prosperity were transient, and only a few generations' time would be enough to let the royal family forget the hardship of the early years, and find the societism ideal unattractive—because it does not offer further guidance after an ideal society has been built. Thus, as long as a dynasty achieved the ideal form envisioned by the societism system, the enchantment of this intellectual system waned, and the dynasty started to go downwards. At the same time, the technology was too backward, the nation was too vast, and thus it was impossible to educate the masses to reach a system of representative governments to replenish the leadership, locally and nationally, through the civil examination system.
2. Meanwhile, under this system, the ideal society was achieved by moral perfection of people, and as a result, despite the seedlings of consistent existence of natural philosophy, this philosophy unfortunately chose a problem that was way to difficult given the state of the art at the time—we shall further discuss this in section 3.1.2. Thus, the intellectual system faced a formidable wall that almost stalled the development of what we call science and technology today. Consequently, the elites were unaware of, or simply did not know how to deal with disruptive social changes that were caused by contingency such as natural disaster, or structural force such as the growth of population. These changes were considered the will of heaven, and the compounding effect of these change would make the system, explaining everything through morality, obsolete and disintegrate.
3. In addition, the system was conditioned on agricultural economic and social condition, and thus even if the nomadic civilizations had been defeated many times, they could not be assimilated, would eventually came back and take down the current dynasty if it was weak.

2.2.4 The epistemological crisis and the decadence of societism

We would not go through the military economic and social history of Ming and Qing dynasty—this period roughly overlapped with the early Renaissance until the Industrial Revolution. The history was the dramas of the tensions described previously, but also with marvelous achievements. One of the nomadic civilization built by the family of Genghis Khan ultimately conquered the whole Eurasia continent. The prosperity of Yuan Dynasty idealized by Marco Polo was one of the reason that the Europeans started the Age of Voyage. Ming Dynasty perhaps had the most advanced gun at the time, and had definitely the biggest navy fleet in the world. We only go through the intellectual history quickly.

The cycles of dynasties, particularly the defeat and chaos, again led to further intellectual development, of which was similar to the collage of Romantic Age and Postmodern Age of Western civilization, unfortunately without the Modern Age.

In Ming Dynasty, the morality taxed by the Neoconfucianism was too much for ordinary people, and the elites practiced it not without hypocrisy. As a result, individualism (*吾性自足*), pragmatism (*知行合一*) and romanticism (*情*) emerged. The philosophy of this time was not as magnificent as the Tang-Song period. What stood out was the literature and dramas, which depicted and criticized the taxing moral system. To give some samples, among the famous Four Classic Chinese Novels (*四大名著*), *The Journey to the West* (*《西游记》*) metaphorically depicted the struggle between individualism and societism, and the heroes ended up in Buddhism; *Legend of Water Margin* (*《水浒传》*) romantically characterized the irony and hypocrisy in the system that was supposed to base on virtue. And also there were works (e.g., *The Dream of Huang Liang*,*《黄粱梦》*) that considered the social ladder devised by the civic service examination system as illusive, and the dramas and novels (e.g., *The Golden Lotus* (*《金瓶梅》*)) that revolted against the abstention with romantics and emotions.

As discussed in the section 2.1, the possibility of individual realizations preconditions on infrastructure that enables individuals to exert their talents over a long strength of time, and amplifies

the efforts of individuals. Without infrastructure built by science and technology, this individualism could not prosper, and in turn became some dangerous instability to the social order. As a result, individualism was considered dangerous by the intellectuals and did not become the dominant mentality.

The revision of the intellectual system ended with the conquering of Ming Dynasty by the Manchurians, who established the Qing Dynasty. At the time, the general mentality of intellectuals were confusions, and the dominant philosophy was known as *evidential learning* (考据学): that is, obtaining learning (knowledge) by examining evidence, which could be understood as some kind of awareness of the verification step of science development was developed. The evidence was not only restricted to classical texts, but also all available sources both in texts and in phenomena. Despite being an advance from the current point view of science, such learning revealed the ontological assumption made early in Neoconfucianism—natural order manifests in human mind to achieve moral perfection for betterment of society—and raised the question of epistemology: that is, where to look for evidence, and how to assess the acceptability of that evidence as proof for accumulating certain (or true) knowledge that would contribute to the betterment of society. As would be discussed in section 2.3, this is a very difficult problem that caused the Postmodern Age of Western civilization. As such, the society had no clear ways to advance, and decadence set in. It is very empathetic to quote J. Barzun again,

> It will be asked, how does the historian know when Decadence sets in? By the open confessions of malaise, by the search in all directions for a new faith or faiths.

Lastly, the institutionalization of societism only waited for a disaster to come that would set off a dark age. It happened when the young Western civilization knocked open the door with superior technologies, financial instruments, newly found political institutions, and an expanding economy seeking markets, which were powered by individualism orchestrated by commerce and science. Then, this decadent civilization collapsed, and the society subsumed into 140 years' of disheartening chaos.

2.3 The unfinished cause of enlightenment

We could see that for the ancient Chinese civilization, its development could be narrated by its intellectual development to answer the perennial question. For the Western civilization, a similar narrative exist as well. We have mentioned in section 2.1.2 that there are two unsolved problems for humanists after the disintegration of the old order: the first is political, and as having been narrated, has led to a new order that is our current political institutions and international norms; the second is intellectual: the humanists had the formidable challenge to answer the perennial philosophical questions.

As could be seen in the previous samples, the answers to the problems, regardless they are from theology or humanism, are more reactive to social conditions, than based on solid reasoning based on observations in the sense of that in natural science. This observation is not new, and in contrast, the Age of Enlightenment was characterized by the awareness of the possibility that these answers could be answered through observation, hypotheses, reason, and verification. The age was milestoned by Newton's Law that the laws that govern the heavenly body are the same with the laws that govern the early body, which replaced the Ptolemy paradigm with the Newton paradigm, fundamentally altered the ontology that earthly life is imperfect projection of heavenly life, and changed the outlook of men's worldview.

However, this possibility of a science of societies never materialized, and in the following, we briefly review the development of this cause of enlightenment.

2.3.1 Humanism in early Renaissance and the age of enlightenment

The early humanism in Renaissance was inseparably blended with theology, and the development was mostly to re-discover the humanism in the ancient Greek, and Roman times. The outlook of the humanism really started to become modern since the prospering of natural philosophy that later transformed into science. Since then, humanists stopped to look up to ancient sages for wisdom, or to seek divine revelation, and started to look into nature, into men's own experience,

and into the societal phenomena to seek for regularities that could lead to the understanding of the world, and guide men's behaviors. The outlook was crystallized by Francis Beacon, whose settled the dispute and stated that

> the ancients can no longer be invoked as authority, because we know more than they did: we are the ancient and wise, they were the young and ignorant.

And the message passed down to our times was simplified to a simplistic statement:

> Knowledge is power.

The endeavor was finally crowned a valid approach to the perennial problems by the discovery of Newton's law, which for the first time in human history demonstrated the possibility of fundamental understanding of the world of men through observations, hypotheses, reason, and verification. This event milestoned the Age of Enlightenment.

The achievement of natural philosophy, now known as science, provided a capable alternative to theology, and the practical applications, i.e., technology, of this philosophy fundamentally changed the mode of production, and the outlook of the world. This intellectual, economic and social changes led to the Industrial Revolution and then Informational Revolution that transformed the agricultural societies into industrial societies then to informational societies, accompanying by the change of the political and cultural landscape. Chronologically, the transformed Western civilization became technologically and economically superior to the rest of civilizations, and under the transformed political organization, the West went to conquer the rest of the worlds, through either direct occupation, colonization, or puppet regimes. Then, the further development of science lied the foundation of the prosperity of our contemporary world: wealth creation was transformed from exploiting natural resources to the exploration of talents and intellectual inventions; mutual understanding of the populace in different nations was increased by the transportational and informational infrastructure; mutual deterrence was established by the planetary-scale weaponry. These fundamental changes transformed the interaction among nations from dominance and wars, to (mostly) cooperation and trades. And from the perspective of materialistic prosperity, our time is unparalleled in history (Pinker, 2018).

2.3.2 The dynamics of science and the unrealized cause of enlightenment

The success of natural science to understand nature was accompanied by the efforts to understand humans and societies, however, before we discuss them, we need review how science really progresses. Science does not progress with well-defined goals in mind that would be reached in an orderly fashion. Instead, it progresses more by insatiable curiosity, adamant searching for social progress and eternal truth, or practical improvements on existing technology, that are guided by ambiguous intuitions, fuzzy goals, and punctuated by arduous, persistent and systematic investigation of accidental or unexplained discoveries. The process was strongly influenced by economical and social prosperity or lack of it, and impeded or stifled by political atmosphere and ideology/theology. The factor that decided the success or failure of the enterprise is typically determined by wise choices of appropriate problems that are solvable within existing theories, experimental instruments and the available resources, especially time. The clarity, unity, and rationality of science comes later after a large amount of disparate problems are solved, and unifying patterns among these problems are identified. The great scientists are mostly mad scientists, though not in the way understood by the public, and "eclectic" might convey some of the connotation—and they are not to be confused with the majority of "scientists" today, who are mostly knowledge workers; and the analog of the situation might be the philosophers and the sophists in Greek during the classic civilization.

Consequently, the more easy problems were solved first, and the achievement of modern physics is a prime example. Physics accumulated a reputation of solidness not because there are fundamental difference in epistemology and methodology between physics and the "soft sciences", but because a particular category of phenomena known as *conservative symmetries* that

exist in physical phenomenon, such that spatially and temporarily invariant observable phenomena that could repeatedly verified by experiments. More specifically, in statistical physics, this stability is the consequence of two characteristics of constituents of a physical system: the timescale and symmetry/repetition of their behaviors. The timescale for molecules' movement typically is more than millionth of a second, and the their macroscopic behaviors are coarse-grained/averaged of movement of all the molecules, which manifests at the timescale of human perception as very stable phenomena. This short span of timescale required for the systems to reach equilibrium, and stability of such equilibrium enabled repeated observations that could be theorized and made into science, in the sense of statistical mechanics of physical systems.

On the other hand, these efforts to understand humans and societies progresses by identifying solvable problems under different contexts, and were categorized into disciplines of psychology, anthropology, economics and sociology, which we shall not further discuss. Those disciplines have a very different characteristic compared with the "hard" science, e.g., physics: the phenomena in the soft science depend on history and context, and thus are very difficult to set up control experiments to isolate cause and effect as those done in physics—it is not even possible to experiment at all in many cases.

As a result, despite the marvelous understanding and controlling of natural world, the initial optimism that the world of men is intelligible did not materialize in the 300 hundred years since Age of Enlightenment. By 1900s, the humanities were regarded as a superior form of knowledge with respect to science. And General Omar Nelson Bradley, chair of the Joint Chiefs of Staff, address to an Armistice Day Luncheon of the Boston Chamber of Commerce on Nov 10, 1948 (Stavrianos, 1991, p. 760):

> We have too many men of science; too few men of God. We have grasped the mystery of the atom and rejected the Sermon on the Mount. Man is stumbling blindly through a spiritual darkness while toying with the precarious secrets of life and death. The world has achieved brilliance without wisdom, power without conscience. Ours is a world of nuclear giants and ethical infants. We know more about war than we known about peace, more about killing than we know about living.

2.3.3 The epic and failed quest for the foundation of science

To generalize science to phenomena beyond hard science, scientists needed criteria to definitely determine what is true, and thus what is knowable. Consequently, as science progressed, this problem became increasingly urgent because as we have discussed previously, although science posed as an alternative to the authority of religion, it was yet to answer the perennial questions. As the initial enthusiasm cooled, the unsettling reality crept in. This dynamics led to the epic investigation into the foundation of science.

A particular feature that distinguishes science from previous intellectual systems is the language it uses that is known as the *formal language*. It provides an unparalleled precision that was not available in natural languages, and describes unambiguous phenomena that are supposed to be measured by experiments. However, it is not clear whether all phenomena could be described by this language. This is the problem of *axiomatic consistence*, and was posed by David Hilbert at the International Conference of Mathematics at 1900.

A philosophical movement in the first half of 20th century called *logical positivism* that attempted to answer the question, which involved the eminent figures such as Bertrand Russell, Ludwig Wittgenstein, Kurt Godel and Karl Popper (Sigmund and Hofstadter, 2017). B. Russell reduced mathematics to logic, and thus under the philosophy of language of L. Wittgenstein, ordinary languages could be broken down into logic statements composed by logic syntax. Then, the statements could be verified by observations. However, K. Godel proved that such a system is not self-consistent, implying not all phenomena could be decomposed and verified in the system.

This led to K. Popper to proposed the criterion of science that the science are not verifiable, but only falsifiable; that is, a statement is stated in a way that could be verified by experiments to determine it is true or not.

This incompleteness of science prompted Thomas Kuhn to study the history of science, and concluded that the development of history was not the accumulation of facts and theories where science became increasingly true as it developed, but accumulative development interlaced with episodic revolutions that revised the incompleteness of the previous theories. This reconceptualization tarnished the objective and disinterest public image of science, and demoted science as another intellectual systems that are shaped by various subjective interests groups: this is particularly true at the timescale of years, perhaps even decades—science is said to proceed a funeral at a time by Max Planck—although in long run, at the timescale of centuries, either the civilization built on reason collapses, or the progress of science keeps the faith in reason.

2.3.4 The epistemological crisis and the emergence of postmodernism, or the post-truth world

As described previously, the stake of the investigation into the foundation of science was whether science could be an alternative intellectual system that could substitute theology and guide humans conduct and societies' organization. The failure of this undertaking resulted in an epistemological crisis: it is not clear what is knowable by science. At this stage, the cause of enlightenment looked completely failed to the general public, and the picture painted by science looked unsettling, which eventually led to the emergence of postmodernism.

To get a snapshot of this times, at the seventh Vienna Secession exhibition in March 1900 Austrian Government commissioned Gustav Klimt to depict *The Triumph of Light over Darkness* to "deliver an optimistic glorification of progress". Klimt instead delivered a painting (shown in fig. 3), titled *Philosophy*,

> that presents a group of figures, that symbolize the beginning of life, fruition, and decay, respectively, revealed by dim emergence of light that symbolizes knowledge. The painting presents a dreamlike mass of humanity, referring neither to optimism nor rationalism, but to a "viscous void" (Wikipedia, 2018).

Fig. 3 *Philosophy* by Gustav Klimt.

The tension depicted by *Philosophy* dates back to the onset of the Romantic age, for science's abstruseness and abstract, and perhaps more importantly, for that the simplistic message it delivered to the public sounded that man is not "the center of the universe" in primitive mythologies, not even "the measure of all things" in the Renaissance, but animals developed in a trial and error fashion, that seems to follow the law of jungle, in perhaps a corner of the vast, violent, lonely, impersonal universe. The tension gradually developed into the disillusion with science, and the failure of the logical positivism was the last straw.

The uncertainty of truth caused by the failure of logical positivism, the cold picture of humanity

depicted by science, and the bust of the Utopian dream milestoned by the World Wars (caused by institutionalized political expression of individualism, i.e., institutionalized liberalism) resulted in the transition of societies' mentality from modernity to postmodernity. The failure of the philosophical system based on logic cleared the intellectual safe valve that prevented the tension between science and the perennial questions from surfacing to the general public. As a result, the postmodernism ascended and became the mainstream mentality of the society. Postmodernism depicted truth and value systems as contingent or socially-conditioned, framing them as products of political, historical, or cultural discourses and hierarchies. Thus, the concept of progress was discarded, and personal and spiritual needs were considered to be best fulfilled by improving social conditions and adopting more fluid discourses that promotes diversity but also relativism. Naturally, the lack of objective ground for discourses accompanied an attitude of skepticism, irony, or rejection toward what it describes as the grand narratives and ideologies associated with modernism, often criticizing Enlightenment rationality and focusing on the role of ideology in maintaining political or economic power. Consequently,

> postmodernism resigns to the alienation, ephemerality, fragmentation and patent chaos of modern life and places individualized aesthetics over science, rationality, politics and morality. — Harvey (1989) *The Condition of Postmodernity*

Postmodernism was very shortlived because a philosophy, that only aims to break down the status quo, perishes as the status quo is no longer. It did not answer the perennial questions that have been left as void in humanism. Thus, after postmodernism gained popularity in 1980s and 1990s, the talking of *post-postmodernism* started to emerge in 2000s. Then, the world still faces a crisis of epistemology: that is, what is knowable, and what is not. And the efforts to answer the perennial questions ran into a seemingly fundamental impasse.

However, the answers to the perennial questions are basic ingredients of human life, without which life would run into animistic chaos. This has been discussed by Jürgen Habermas, Thomas Nagel, Ronald Dworkin and etc. (Watson, 2014). As a result, the default state of individualism crept in, continuing its institutionalized struggle with authoritarian religions or governments, and with conservatives that long for a non-existent idyllic past. This led to the state of the world depicted in section 2.1.4.

Meanwhile, statistically speaking, the lost of vision reduced the once truth-seeker scientists to simply knowledge workers who serve interests groups, which arose anti-intellectualism in the general public. In this sense, the world is not unsimilar to the atmosphere in the Dark Age, where great personal sacrifices were needed by Giordano Bruno to fight with inquisitors for truth: the inquisitors now are the establishments who control the resources, and inquisitions are some prolonged pressures for livelihood and social reputation.

3 Analysis, or natural philosophy of civilizations

> Humans' search for permanence, and fabric of civilizations: two things fill the mind with ever new and increasing admiration and awe, the starry heavens above me and the moral law within me.

3.1 The search for permanence among human transience

As discussed in section 2.1 and section 2.2, respectively, the Era of Individualism and the Era of Societism decayed not because they failed, but because they have achieved what the early men set out to achieve. Individuals in the industrialized nations now are immensely more empowered to do their own things; and in the good though transient times of ancient China, there were no jungle laws, and people lived in a peaceful, tranquil, prosperous, just and loving society.

However, an idea took to its extreme became its own demise—we shall speculate the scientific root of this problem in next section 3.3. This had happened to the ancient Greek city polities, to Dynastic ancient China, to the Roman empire, and to the Christianity civilization; and this has been happening in our contemporary times. The

ultimate ideal form of society envisioned in these eras did not materialize—we also discuss why these ideas might not be possible in section 3.4 later: the Western civilization envisioned an ideal society referred as Utopia, which also had taken the various names such as communism, or "End of History"; and the Chinese civilization did so as well, in the name of *Da Tong*, or *Great Unity*.

> The intellectual problem left to us is, what is next?

To answer this question, we need to first understand what we as humanity are seeking.

3.1.1 The seek for theological permanence in stars and planets

We have seen the dawn and decadence of three eras in section 2, which interlaced and interacted with one another. An era started with a vision of future by philosophers, and the instruments that supported the prospering of the vision; here, instruments are meant in the denotation of Carroll Quigley, such as the commerce that supported the development of science and technology in the era of enlightenment. And when the vision of the philosophy was fulfilled, which often did not end up exactly with the one envisioned by philosophers, and the instruments became institutionalized, the era came into an end.

Among this passing of eras, we could find the noblest heroes and also the most despicable humans, the burst of optimism over new possibilities and also abyss of pessimism when it seems all hope had been lost, the transient and cherishing prosperity and also the equally transient and disheartening chaos. And in the end, all things ended. In this ebbs and flows of history, it seems that,

> nothing lasts forever, and everything changes.

The earliest known civilizations in all major regions in our planet existed before 1000 B.C., and the earliest civilization, Mesopotamian civilization, already existed by 5000 B.C. These thousands of years' ebbs and flows of humanity must have made an indelible mark on the psyche of the first men. prompted them to search for permanence, and led to the era of theology.

> After countless of eventful lives, the one the first men lived, the one their grandparents lived, the ones their ancestors lived, after living through naivety and cunning, honesty and deceit, lust and tranquility, love and loss, glory and defeats, brutality and peace, confusions and perseverance, at each episode in their lifetime, they looked up to the sky, and found that the stars did not even move, and the observant ones might even found that a few of the them move in regular patterns. This permanence and slight regular movements of stars must inspire awe in the first men, as the stars still inspire us.

Theology was always associated with astrology because the stars in the sky seemed to be the only thing that were permanent, and at the same time could be seen by every ordinate man to be a vehicle of persuasion. Thus, the order of humanity were always illusively associated with stars.

And the association is illusive after all, and for a sufficient long period, when the order built around theology institutionalized, the revolt against theology would happen, and an intellectual system whose foundation was humanism would be established. This happened to Chinese civilization around 1000 B.C. at the transition period between Shang and Zhou Dynasty, and to Christianity civilization around 1500 at Renaissance—the Western civilization is the Renaissance of the classical civilization which again emerged from a dark age.

3.1.2 The failures of humanists' quest for human permanence

However, the desire for permanence did not varnish, and this desire led to the seek for the answers to the perennial questions. The Western civilization converged to Individual Rights, while the Chinese civilization converged to Morality, but as having been shown in section 2, both were not adequate, because they are derived properties of social conditions, and not the first cause

that would maintain those conditions. Though this seek for ancient Chinese civilization and the Western civilization ended in two different civilizations whose fundamental intellectual systems are dialectically opposed, they ran up against the same intellectual wall eventually.

The *Book of Change*'s role in the ancient Chinese civilization was like the Bible in the Christian civilization: it aimed to devise a system that could explain the order on the changes of human societies, and anchor the order on the heaven, which is not an perfect place in the Christian theology, but is something similar to Deism where coherence of nature exists, and humans are a part of this permanent order of nature. However, the Christian system gave a very precise answer to the cosmic order; that is, the Ptolemy system. The Ptolemy system obsessed with perfect cycles, while the system of *Book of Change* obsessed with certain exponentially interaction of processes divided according to certain number system: the Change was divided itself into sixty-four constituent processes, each subdivided into six stages and all interacting upon one another.

However, divination in the *Book of Change* was from the theology of Shang dynasty, and the abandonment of this theology reoriented intellectuals to study what might be called a science of society today, which we would explain in section 3.2 that it is perhaps the most difficult problem of science that could not be approached until the science of physics, chemistry, and biology matured. The difficulty and ambiguity of this system made the authority of this system very difficult if not impossible to refute. And many derivative systems based on the basis idea of *Changes* were developed, but none of them led to a system that investigated nature in the sense of modern science. Thus, this created an intellectual wall that prevented the emergence of modern science in the ancient Chinese civilization.

Meanwhile, the precise prediction of the Ptolemy system made it possible to refute by observing the motions of the heavenly bodies. And the what was required to demolish the Ptolemy system was retrospectively surprisingly simple: it is a simple quadratic equation. This discovery by Tycho Brahe' s meticulous, comprehensive astronomical observations, Johannes Kepler' s laws of planetary motion, Galileo Galilei' s theorising based on optically improved observations, and Isaac Newton' s law of gravitation, was a powerful proof of concept, which demonstrated that the possibility of modern science based on observations and reason—and this process still took 144 years.

The desire for profits was considered an inferior social behavior, both in the Chinese and the Christian civilization; and this was for good reasons, which could be appreciated by the exploitative capitalism in 19th century and the fetish capitalism in our times. The Newton paradigm overthrew the theological shackles, and enabled the development of capitalism societies where commerce and science reinforced each other, while despite large market economy actually had existed in Song Dynasty in ancient China, and it was kept being socially inferior to agricultural economy. And Newton paradigm crowned the Age of Enlightenment.

Nonetheless, as narrated in section 2.3, despite the marvelous achievement unleashed by Age of Enlightenment, the problem of finding the scientific answers to the perennial questions still persisted, and the epic quest of the logic-positivism movement ended up in negative results, which are rather artifacts of the flawed logic system than discovering an epistemological impossibility—we shall expand on this in section 4.2.1.

In a book named *End of Science*—which is a book written by journalist Horgan (2015) that consists of interviews with prominent scientists and is about the stalled progress of science—the eminent intellectual Noam Chomsky stated the opinion that scientists have made absolutely no progress, for example, investigating such issues as consciousness and free will, "we don't even have bad ideas".

3.2 The beginning of civilizational transition, from metaphysical to scientific

Despite the zeitgeist of the ages had shifted, the people who believe in the spirit of Enlightenment still continued and continue to work on it: the coming of a new era has been a repeated calling in history since Enlightenment. And in very recent times, the mind, and the evolution of civilizations started to become intelligible, and the pieces developed in the past 200 years suggest a sense of a beginning, that makes one speculate that our

times is a transition from the Era of Individualism to some next era as distinctive as our current era is distinctive from the ancient civilizations. In this subsection, we review this concentrated efforts of scientists, inventors, and entrepreneurs in the past 200 years.

3.2.1 Positivism: the scientific study of societies

When the Age of Enlightenment came to its end towards the middle of 19th century, there were ideas that the evolution of civilizations were in three stages, the theological, the metaphysical, and the scientific. This doctrine is known as *positivism*—the logic positivism described in the section 2.3.3 aimed to develop a foundation for it based on logic. The positivism was initialized by Auguste Comete, and developed into what is called sociology together; that is, the study of societies through scientific methods.

Though the political, economic, social and cultural system of our times are the manifestation of individualism (which is a metaphysical system), the infrastructure of the digital society that we have today is directly the result of positivism, in which the word "digital" was emphasized. As discussed in the section 2.3.2, the positivism approach to societies had not reached a stage as solid as physics because biotic-social systems were yet to identify a characteristic known as symmetry, and thus the law-like abstraction of societies seemed to be impossible. And the logic positivists' quest for a foundation of positivism had failed. However, the failure instead created our digital society. The axiom inconsistency proved by K. Godel prompted Alan Turing to ponder on what is reducible to logic and what is not, and now it is now known as what is *computable* and what is not. The computability problem led A. Turning to devise a formal system to characterize computability called *Turning Machine*. From the formalism of Turning Machine, John von Neumann designed the first Von-Neumann architecture of computer, and built the first well known computer, ENIAC (Electronic Numerical Integrator and Computer).

The positivists took too grand a task to start with, and the success of science had proceeded only by first understanding the basic consistent of a system before reaching an understanding of the whole system. We clarify that this is not exactly reductionism, but something that is referred as *analysis*: reductionism emphasizes that the whole could be decomposed into constituent, and the understanding of the constituent's behaviors alone could deliver the understanding of the whole—that is, the whole is the sum of the parts; and analysis refer to the understanding of constituent, and then proceed to understand the whole. Thus, to understand societies, an adequate understanding of the constituent of societies, i.e., humans, and more generally, biotic systems, is required first.

Thus, although the vision of Enlightenment faded away, science lived on in more practical pieces, or more technically, disciplines, and inched towards the understanding of biotic systems. There are two threads of development: the theoretical-science thread that inched towards scientific understanding of biotic systems, and the technology thread that inched towards building life-like machines and society superorganism (which is also known as globalization). We describe them next.

3.2.2 Development of science in the past 200 years

The theoretical thread developed in parallel in several disciplines.

1. Roughly at the same time A. Comete developed his positivism, Charles Darwin published *The Origin of Species* at 1859, which also developed from accumulated efforts of forerunners, including Darwin' grandfather. And Darwin hoarded the manuscript for decades in fear of the Christian order before it was safe to publish it. Though there were many unsolved mysteries, it gave an elegant and simple explanation on the origin of different biotic systems (i.e., species), and laid the foundation of biology. The search for the molecular foundation of evolution had been ongoing, and a series of discoveries finally led J. Watson and F. Crick at 1953 to discover the molecular structure of genes. Only since then, the idea, that life is a natural phenomenon and is not a shell animated by a spirit or a soul, became well accepted in the general public.
2. Meanwhile, also around the time positivism was being proposed, driven by the development

of the steam engine, Nicolas Carnot laid the foundation of thermodynamics in 1824, which became well known only after Carnot's death, decades since its publication. The macroscopic theory later was provided by Ludwig Boltzmann with a microscopic statistical-mechanical model of gases at equilibrium in the late 19th century, which was also under deep philosophical confusions—and it is a famous rival story between Boltzmann and Mach. The statistical mechanics of Boltzmann led to the field of statistical physics that matured in the late 20th century, and characterize and explain the behaviors of liquid, solids, glasses, superconductors, semi-conductors and etc.

3. Again, also around the time of positivism, James Maxwell published at 1861 and 1862 an early form of equations that characterize the electromagnetic phenomena, now known as Maxwell equation. The science of electricity led to the development of communication and control systems (e.g., phones). The scientific understanding of these systems led Norbert Wiener to develop Cybernetics and Claude Shannon to develop information theory in the middle of 20th century. Cybernetics is the reason why we call the Internet cyberspace, and information theory perhaps needs no further introduction.

Around the late 20th century, these development of biology, physics, computation and information converged to give a scientific yet speculative characterization of biotic phenomena: a biotic system is a non-equilibrium thermodynamic system, that constantly intakes energy and infers information from the environment through a feedback loop, both in evolutionary scale in the sense of genes, and in the lifetime of the system (i.e., morphogenesis); the interactions with the environment are implemented by biological circuits, which are expression of genes, that compute coarse-grained variables that have fitness consequences; and the interactive process is also a symmetry-breaking process, where the components (e.g., cells) differentiate in response to feedback signals from the environment.

The current understanding of biotic systems is still rather incomplete and speculative, and has major obstacles to further progress. However, it does suggest the understanding of life, or biotic systems, is viable science project. And it was this enthusiasm that made people call the 21st century the "century of biology".

3.2.3 Development of technology in the past 200 years

Theoretical science provides understanding of nature, and the application of this understanding to instrument-making is known as technology. Technologies are augmented organs of humanity, and would fundamentally alter the infrastructure of societies, which are organisms composed by humans. This practical thread was intricately intertwined with the progress of theoretical science.

1. The steam engine, which replaced human labor with machine labor, provided an ideal experimental test bed that allowed for repetitive observation and hypothesis verification, and also the social condition to do so because an improvement in efficiency implied the improvement in profits. This positive reinforcing loop let to the development of thermodynamics and statistical physics in the coming 300 years since the first steam engine was invented in early 18th century.
2. The formulation of Maxwell equation and the technology of alternating phase electricity enabled generation and the long-distance transmission of electric power, which replaced steam power. The commercial use of electromagnetic phenomena to transmit messages enabled the establishment of a "high-tech" company, Bell Telephone Company, which set up arguably the greatest commercial lab in history, Bell Lab. In Bell Lab, the simple and restricted setting of message transmission through telephone lines let Claude Shannon formulated the information theory restricted to communication science, which in the general setting is rather complex and has not been completely understood yet now. As explained previously, the negative result of the logic-positivism movement led to the computer science. The electrically powered, informationally connected, and computationally processed society preconditioned the emergence of Internet.

3. The attempt to explain the mechanism of the brain through logic led to the first computational neural network model, the McCulloch-Pitts model. Pitts could be considered as B. Russell's student, and thus was part of the logic positivism movement. The efforts to let the model handle uncertainty resulted in the multilayer neural network model in early 1980s. A statistical-physical model known as the spin glass model inspired a memory known as the Hopfield network, which in turn inspired the neural network model known as Boltzmann machine. The widespread adoption of Internet accumulated a large of amount data that preserved a projection of the real world. Meanwhile, the accumulative increase of computational power created some rudimentary information computing in silicon-based computational system. The synthesis of the big data, the computation power, the Boltzmann machine, and multilayer neural networks at the beginning of the 21st century, which is our times now, led to the blossom of Artificial Intelligence (AI).

At this time, parallel to the possibility of cracking the mystery of life in the theoretical thread, despite the exciting new emerging solutions to societies' problems offered by AI and biotech, the societies are confused, alarmed or fearful at the development of artificial intelligence and biotech. At the rational side, we have ethic problems due to the possibility of gene editing, or human clone, and the economic problem of labor displacement; at the speculative side, we worry about a singularity moment at which the emergence of a super intelligence that would destroy humanity.

3.2.4 Social-system transition between eras

As we lengthily discuss previously, the decadence of the era of individualism calls for intellectual breakthrough for a new era. This theoretical development of biology, and technological advances of AI and biotech are pieces of this intellectual puzzle. And according to the theoretical and practical progress so far, we might speculate that the so called singularity is not the super intelligence that captured the imagination of the general public, but that the humanity currently is in a transition of social system where a globally interconnected society that resembles a superorganism.

This kind of social system transitions happens every hundreds of years. The transition from the Era of Christianity to the Era of Individualism took about 500 years from 1200s to 1700s, if we take the stabilization of Europe around 1200s and the Age of Enlightenment as the milestones. The transition from the Era of Primitive Theology of Shang to the Era of Societism took perhaps almost 1000 years, if we count from the late stage of Shang around 1000 B.C. to the establishment of Confucianism in Han Dynasty around 100 B.C.. This acceleration of tempo resulted from the improvement of technologies that speed up the propagation of ideas and social restructuring.

As the Renaissance took 300 years to gather momentum, similarly is the next era, and 200 years had been past if we consider the positivism as the start. And in the next subsection, we speculate the science and characteristics of this transition.

3.3 Evolution of civilization as adaptive-symmetries breaking

The development in the past 200 years enabled us to at least formulate plausible hypotheses on the nature and development of civilizations. Thus, in this subsection, we present a hypothesis, although we note this should be considered as natural philosophy (Dodig-Crnkovic and Schroeder, 2019), or speculations that experiment with future visions to guide further science—we shall discuss how science of civilizations could further proceed based on the hypothesis here in section 4.2.

As mentioned in section 2.3.2, physics is the testimony of the success of science because a characteristic known as *conservative symmetries*, that allows for repetitive experiments. And in section 3.2.2, we have also described the emerging study of symmetries in biology. The symmetry in biology is a different category of symmetry with the conservative symmetries in physics: the conservative symmetries refer to a symmetrical transformation of states in a physical system (e.g., rotation or translation) that would conserve the free energy of the system. An example would be that if a system is translated from New York to

Paris, the properties of the system would stay the same. The symmetry in biology is rather different. It is a non-equilibrium state that poses to take symmetrical pathways in response to feedback signals from the environment; the symmetry means the equal tendency (technically probability) to take these pathways in absence of signals. A biotic system was composed with repetitive units (e.g., cells) that would break the symmetry in different ways according different environmental signals. These symmetry-breaking enables the system to adapt to the environment, and thus we refer them as **adaptive symmetries**.

In this subsection, we shall speculate a hypothesis that explains the life cycles of civilization with the single fundamental concept of adaptive symmetries.

3.3.1 Complexity from adaptive-symmetries breaking

The concept of adaptive symmetry is not an orthogonal concept that is independent with existing concepts in biology, but a concept that could thread together existing concepts in biology that are now disparate fragments, which we have briefly outlined in section 3.2.2.

To begin with, we briefly summarize the concept of adaptive symmetry, and then proceed to introduce it in details.

> A biotic system is a non-equilibrium thermodynamic system in a feedback-control loop that constantly intakes and dissipates energy to maintain the functions implemented in biological circuits, and form new circuits in response to feedback signals. The behaviors of the circuits are heterogeneous, and some circuits are of adaptive symmetries, and some circuits' adaptive symmetries are broken (to form new circuits). The circuits of broken symmetries collectively compute variables at all gradations in the hierarchy of coarse-grained spatiotemporal scales that maintains the fitness of the system to the current environment. The circuits of intact broken symmetries maintain the capability to adapt to changing environment. The gradually accumulated broken adaptive symmetries manifest as complexity, in the sense of complexity of complex systems.

We introduce the concept in more details in the following, and end with an introduction to the reason why ecosystems become more complex throughout evolutionary history.

The physical foundation of such adaptive symmetries could be speculated from a phenomenon known as frustration. More specifically, a frustration phenomenon of DNA molecules at the evolutionary timescale might be the physical foundations of evolution. As in a frustrated system, the differences in free energies of DNA molecules with different nucleotide sequences are orders of magnitude smaller than the total energy of covalent bonds in these molecules. These different metastable states separated by these low energy barriers among DNA molecules are gnomes of different organisms. The drifting among the metastable states is rather symmetrical because of the similar level of free energy among those adjacent state, and creates a population of organisms with diverse survival hypotheses; and the competition among these hypotheses manifests as evolution by natural selection.

When a system is very large and is adjacent to a large number of almost symmetric states with similar free energy, we might speculate that statistically there is no preference to transit to any of the adjacent states as a result of fluctuations, and consequently, the system poses in a state that would be of equal probability to transit to a large number of adjacent possible states, and the evolution could be understood as natural selection on the random talk on these adjacent possible states. That is, an **adaptive symmetry** whose breaking is selected by the feedback signals from the environment. Unlike the symmetries in physics, which formalizes a conservative law that conserves the free energy of different states related by certain

transformations and thus characterizes the invariant of free energy, the adaptive symmetry is the conservation of change of free energy; or in other words, *the invariant of change that emerges as a result of the increased sophistication and quantity of symmetries.*

An adaptive symmetry is a stochastic, heterogeneous, composite symmetry. Each unit (e.g., a cell) in a biotic system is statistically similar in structure when it is undifferentiated (e.g., the stem cell), but of heterogeneous behaviors because the immediate environment that each unit contacts is different. And the units compose hierarchically to form a large system; for example, cells compose to form an organ. These characteristics are referred as stochastic, heterogeneous, composite. The adaptive symmetries of different units break in response to feedback signals, such as the differentiation of stem cells in the embryo. Meanwhile, the breaking is also heterogeneous: some units would maintain their adaptive symmetries until very late in the developmental stage of a biotic system, such as the immune cells that only differentiate when pathogens are detected. The broken symmetries led to the functional structure of the system, and the intact symmetries maintain the adaptability of the system to process unknown variations in the environment.

As a result of stochasticity and heterogeneity of adaptive symmetries, complex behaviors could emerge from simple originally identical units. This characterization is rather abstract, and we provide a simple speculative example (which means a scientific model of this example has not been established, and it is described for demonstrative purpose). The body temperature of a biotic system could be a coarse-grained variable with fitness consequences, which is the average kinetic energy of molecules in the body. To keep the body at appropriate temperature for the chemical reactions in the body, the system needs to break down reserve glucose to release heats. And there are many ways glucose could be broken down: the muscle movement, the temperature decrease of terminal limbs due to exposure to cold environment, or the energy required by computation in the brain, etc. Each of these ways corresponds to a circuit that involves glucose molecules, and some of the multitude of circuits would break when the temperature of some body regions is decreased. When the system is exposed to a cold environment, which is known by the information transmitted from the skins, a symmetry of the circuits is broken to decompose the glucose (which was energy stored early by digesting food from the environment) to adapt to the cold environment, which could be broken in some other ways to utilize the glucose if this exposition to cold does not happen.

In addition, the DNA molecules not only encode functional structure that we call the body of organism, but also the spatiotemporal behaviors. This could be seen rather clearly by look at the meaning of the word "animal", which literally means an animated automaton that follows a dictated pattern by a "creator". Though nowadays, we know that there are rich emotions and even rudimentary intelligence in animals, the patterned behaviors of them are still rather clear.

Meanwhile, the composite characteristic of the adaptive symmetries could enable exponential leap in complexity. An example would be the cooperation/composition between mitochondria (the organelle that generates energy for cells) and eukaryote (a technical name for a type of cell). Mitochondria contains their own DNA, transcriptional and translational machinery, and their mitochondrial ribosomes, transfer RNA molecules, and components of membrane are similar to those of bacteria. This phenomenon let Lynn Margulis to speculate in 1970 the symbiosis between mitochondria and eukaryote: the former gets reliable source of good from the host cells, and the latter gets a reliable mechanism to produce energy. This phenomenon could be understood as a form of composite adaptive-symmetry breaking. Imagine that a mitochondria was free to move around to anywhere that contains food source, and ended up in an eukaryote. And the eukaryote was also free to get the energy from any available sources, and accidentally acquired a reliable mechanism from the mitochondria. In this particular case, the freedom, which was adaptive symmetries of these two systems, was broken. This symbiosis had better fitness, and thus as time passed, this broken symmetry froze, in the sense that these two systems increasingly depended on each other, and the other mechanisms were evolved out. This symbiosis composition happens throughout the chain of hierarchy of biotic systems: multicellular organism from single cell organism, organs from a population of cells, etc.

Therefore, the intact and broken adaptive symmetries manifest in both the developmental process (morphogenesis), and the evolution of biotic systems. And the accumulation of extra adaptive symmetries (by forming a symbiosis relationship with other systems), and the broken of these symmetries leads to the increase of complexity.

Consequently, although natural selection does not have a directionality that selects for the more complex systems, as the time passes, more and more complex systems gradually emerge because the spiral process gradually explores this interaction space. As a result, throughout the evolutionary history, the envelope of complexity increases, and the more complex and less complex systems form a symbiosis network that constituents an ecosystem.

3.3.2 The evolution of early civilizations

To understand evolution of civilizations through the concept of adaptive symmetry, we start with the more well received hypotheses that could be subsumed in the coming hypothesis.

In *Guns, Germs, and Steel, The Fates of Human Societies*, Jared Diamond presented a theory that explains why the Eurasian civilizations were much more advanced than, and conquered the civilizations in American continents, Australia and Africa. The fundamental concept was that the vast and diverse geographical features of the Eurasian continent led to a high degree of diversity of species, and the ease of spreading and interaction of these species as a result of the east-west axis orientation of the continent—which created similar environments across the continent because of the same temperature zones—in turn led to the emergence of more complex societies: the diversity of species enabled more wild plants and animals to be domesticated to crops and livestock; the advantage in domestication resulted in better food production, and the accumulated surplus enabled the early emergence of political organization that support specialists who developed technologies and invented writing, required the politicians and priests who worked on the abstract ideas to lead and unify population, and maintained standing arms to explore and conquest. The more complex societies are more capable of utilizing materials (e.g., steels to make swords) and energy (power for guns and coal for engines) from environment, and even harbor more germs that cause diseases. Thus, when the more complex societies came in contact with the less ones, the less ones are conquered.

Now we restate the phenomenon fully in the language of adaptive symmetries. As introduced in section 3.3.1, the breaking of a large amount of adaptive symmetries results in complexification of the environment, or the ecosystem, which consists of a large number of biotic systems. And the emergence of complex societies could be stated in this language. The diversity of species in the Eurasian continent is a large amount of coexisting intact and broken adaptive symmetries that are existing function structure encoded by DNA molecules known as biological species; here function structure not only means a particular three dimensional structure, but the spatiotemporal structure that includes the propensity to prefer certain behaviors. There were particular wild species that were posed to form symbiosis relationship with other species such that collectively they could increase the fitness of both species. For example, dogs could scavenge food in the wild, and also accept food from humans, thus these could be understood as a spatiotemporal adaptive symmetrical behavior, and this degree of freedom in the behavior allows for the domestication of dogs. By forming this symbiosis, humans got, for examples, shepherd dogs, and dogs got sustainable source of food. Meanwhile, wolves do not have such capacity, and cannot be domesticated. The breaking of such adaptive symmetries led to a more complex system consists of dogs and men. This example is a symbiosis between species similar to the symbiosis between mitochondria and eukaryote described in section 3.3.1, but at a higher temporal and spatial scale. This complexification resulting from broken symmetries happened also between humans and wild species, and among humans. The energy/food surplus accumulated from this complexification in early tribes was a reservoir of adaptive symmetries whose breaking was the specialization of soldiers, priests, politicians, farmers and etc. The more diversity existed in the ecosystem, the complex the ecosystem became. This circular causality extended diachronically led to dynamics described previously, and to the emergence of more complex organization known as civilizations.

3.3.3 Biotic evolution as self-rejuvenating process

Before describing the evolution of civilization through adaptive-symmetries breaking, we describe the evolution or life cycle of biotic systems. This non-equilibrium diachronic adaptive-symmetries breaking described in section 3.3.1 could be succinctly summarized as a word "self-rejuvenation".

Recall the characterization of biotic system given in section 3.3.1, a biotic system is characterized as a system in a non-equilibrium process that constantly intakes energy from the environment to infer information from the environment that has fitness consequence. The consequence eventually means that it could self-rejuvenate itself; here self-rejuvenation has two layers of implications: first, self-replication in an informational sense that a spatiotemporal structure perpetuated over time, which is not only restricted to self-reproduction, but also the self-repair and thus the renewal of itself within its life cycle; second, self-betterment in the sense of utilizing energy more competitively than the previous ways.

The non-equilibrium process unraveled through space and time is a developmental process where, adaptive symmetries are gradually broken, and for example, an embryo develops into an adult. Some of the symmetries breaking are dictated by genes, for example, the orchestrated maturing process of body structure from the embryo to the adult stage, and is evolved to adapt to the environment that the system are to be embodied. Some of the symmetries breaking are conditioned, and their breaking is to seek for spatiotemporal behaviors that would have better fitness, such as the function of the immune system. In addition, some adaptive symmetries, for example, manifested as the freedom of body movement that enables the exploration of new environment or new ways of utilizing energy and materials from the environment, and thus the expansion and the increase of population of the species when the time and place are ripe. This exploration behavior informationally could be the mutation of genes, or the reorganization of nervous systems through learning.

During the developmental process of a biotic system, each operation of self-rejuvenation would require energy and have a varnishingly small but nonzero chance of erring. If the energy is depleted, or the accumulated unfixed damage over time caused by errors from self-rejuvenation is critical, the system would die—the accumulation of errors is also the current speculation of scientists on how aging happens. Therefore, if a system could not find sufficient energy to self-replicate, either in the sense of self-renewal, or of self-reproduction, it would disappear, which is called death.

3.3.4 Evolution of civilization as self-rejuvenating process

After the warm up with something that was more well received, we move on to describe the evolution of civilization through the concept of adaptive symmetries.

A civilization is also a non-equilibrium process that constantly intakes and dissipates energy to self-rejuvenate in an physical-informational sense. The self-rejuvenation has two goals that one is the continuation of the another: the first is the self-perpetuation of the existing physical-informational structure, which if fulfilled, would next lead to the evolution of the existing structure to better fit to the environment such that it could utilize energy to self-perpetuate in a way more competitive than the ones previously, which typically correlates utilizing increasingly a large amount of energy in a sustainable way.

Although this implication sounds cold and impersonal, this connotation is misunderstanding. A bacteria could only self-rejuvenate itself by feeding on nutrients, cloning itself, and occasionally muting some of its genes. However, when a system became sufficiently complex through evolution, the quantitative accumulation of complexity led to qualitatively different self-rejuvenating behaviors. In a colony of bees, a worker bee is a female bee that has exactly the same genes with the queen, and forgone its capacity to reproduce, such that as a collective whole, the genes of the colony self-perpetuate. This phenomenon could be mathematically formulated, and is known as *inclusive fitness*. More generally, this cooperative behaviors within a species is referred as *group selection* in evolution. And in the system composed by trillions of cells that we call human, love is a complex suite of adaptations that are exquisitely honed set of psychological devices that for humans has served critical utilitarian functions in highly

specific contexts (cf. *A New Psychology of Love*, Yale University Press). These functions are sufficiently numerous to give credence to another aphorism that gets closer to the truth: "Love is a many-splendored thing."

More specifically, to maintain existing social organization, each civilization needed instruments to utilize energy from the environment to renew its structure; for agricultural civilizations, the energy utility were agriculture that utilizes energy ultimately from the sun, and the renewal of the structure were the maintenance of political institutes such as priesthood, armies for defense and conquest, infrastructures such as irrigation systems, education systems that teach existing survival strategies, and rituals for the abstract idea that unify populations.

The existing spatiotemporal structure of the social system resulted from previous broken adaptive symmetries, such as the example of dog domestication previously given in section 3.3.2. And the instruments also accumulated a surplus of energy, e.g., in the form of food, resulted in the reservoir of free people that were open to other behaviors; this is a reservoir of adaptive symmetries. The broken of these symmetries into professional specialization led to the increasing occupational complexity of the social system. The broken of symmetries into territory expansion led to the expansion of the spatial span of the civilizations.

Similar to biotic systems, social system could deplete or destroy its instrument to utilize energy, or accumulate errors when it self-rejuvenates. This is what called by institutionalized by C. Quigley. It could manifest as overpopulation such that the social system cannot self-replicate itself by existing instruments. It could manifest as over-exploitation of farmers/workers by the ruling class/capitalists such that the self-replication of farmers/works malfunctions in term of diseases or alienation; this case resembles cancers where a specific groups of people in the system become self-serving in their self-rejuvenation, and bring down the whole social as a result. It also could manifest as the emergence of destructive energy utility such as nuclear fission. It also could manifest as the over-exploitation of environment such that existing instruments stopped being effective, such as drought and flood caused by climate change.

Therefore, we have characterized the life cycle of civilizations with a single concept of adaptive symmetry. To summarize succinctly,

> when a large surplus energy and materials exist, a civilization would possess a large amount of adaptively symmetrical instruments to employ these surplus to prosper, and the broken symmetries form the spatiotemporal structure of the civilization. And when the adaptive symmetries of instruments exhausted in the sense that they could not the social system, the civilization collapses.

3.3.5 The permanence of humanity

From this characterization of civilizations, we could infer what is permanent for humanity, or why the seeking exists in the first place.

The adaptive-symmetries characterization of civilization given in section 3.3.4 implies that a civilization exists to self-rejuvenate itself. Thus, civilization-wise, this capacity to self-rejuvenate becomes something that we call desires, which individually manifests as the desire for prosperity, which is a combination of security, social bonding and individual realizations, and socially manifests as the desire for a prosperous and just society. And the desire ruminated by philosophers became visions for the future.

To appreciate this condition of humanity, we discuss below how it subsumes the two dialectical opposed sides of humanism, the individualism of the Western civilization and the societism of the Chinese civilization.

The development of a civilization could be appreciated as a dynamical process, and there could be more than one attractors that attract the motion of the system and prevent it from escaping. The social system developed by the two civilizations could be understood as two attractors. The desire for individual realizations, reacting to theological burdens and corruptions, and supported by commerce, science and technology, is referred

as individualism, and eventually led to the Theory of Justice by John Rawls, which expresses a desire for a social system with equal opportunity such that individual realizations should not be constrained by the environment that one was born into, but without providing an effective means to permanently maintain, or even reach such a social system. The desire for group prosperity, reacting to theological brutality and supported by agriculture and morality, is referred as societism, and eventually led to Neo-Confucianism that aspired for the Great Unity where every segments of the society is secure for everyone in the sense of free of violence and starvation, the ownership of shelters, and the material abundance to form family and pass on legacy, but, again without providing an effective means to permanently maintain, or even reach such a social system.

This synthesis also reveals the shortcoming of these two intellectual systems. The ineffectiveness of the instruments to reach and maintain the ideal society resulted in the posterior paradoxes-resolving apparatus, manifesting in the concept of time in these two civilizations: the Western civilization has a linear view of time, where the civilization is supposed to progress, such that the ideal society could be reached eventually; the Chinese civilization has a cyclical view of time, because the will of heaven would leave to the emperor when morality corrupts. The linear time now is collapsing as the civilization went into the postmodernity, since the Newton paradigm and the apparatus of logic was proved to be incomplete, and the progress was not considered indefinitely possible or necessarily desirable. And the cyclic time obfuscated the true cause of the dynasty collapse with morality, and led to the eventually collapse of the ancient version of the civilization. However, the true cause of the problem is and was the institutionalization of the intellectual systems and the instruments that support them, which we have discussed respectively in section 2.

Back to the main narrative, this characterization of civilization implies a human condition such that the permanence of humanity does not lie in a definite physical-informational structure, or in other words, a particular life or social system, but a spatiotemporal dynamical process that extends over decades or millenniums where one could self-rejuvenate. This desire creates a loose hierarchy of psychological behaviors that overlap with one another; a description that is most well known to the general public is the Maslow's hierarchy of needs. Thus, there is the saying: even one provides all the things a human needs, he will still be unsatisfied. Similarly, the Utopia does not exist in an exact form, so is the Great Unity. Instead, humans strive for the perpetuation of their social systems, which is a cooperative endeavor, and the betterment of these systems, which always started with some heroic individuals forming a small group. The Chinese civilization was the ultimate embodiment of the desire for self-perpetuation, while the Western civilization is the ultimate embodiment of the desire for self-betterment. These strives are captured and Immanuel Kant's words, which I first learned from by Lizhi Fang, the former president of my university:

> Two things fill the mind with ever new and increasing admiration and awe, the more often and steadily we reflect upon them: the starry heavens above me and the moral law within me.

As humans, we build our homes, and we reach out to the stars.

3.4 Human conditions, humanistic ideals and Project Humanity

As explained in section 3.1, the perennial questions are humans' search for permanence in question form. The permanence of humanity described in section 3.3.5 thus has corresponding answers to the perennial question, which implies the human conditions and a *Project Humanity* that has been unconsciously being executed since the advert of Homo Sapiens. We describe them in this subsection.

3.4.1 The origin of life: what is life?

As discussed in section 3.1, to search for permanence among human transience, the first humans attempted to associate humanity with the sky in all kinds of ways. Though the story did not end up with what they had in mind from the perspective of science, they were somehow right: life is a

fundamental process of the Universe, not just in living organisms but everywhere, at every level. This view of life has been known as *Big History*, and could be summarized as one sentence:

> Universe makes galaxies, galaxies make stars, stars make planets, and planets make life.

The current theory of science states that the universe started with a Big Bang from a singularity with immensely large and slightly uneven density. Since then, the universe had been undertaking a cooling process. As temperature decreased, the symmetries in this immense mass of materials broken down, and formed all kinds of subatomic particles. The fluctuations in density resulted in various centers of gravity that formed the galaxies and stars in the early universe. The stars were nuclear reactors that would convert lighter atoms into heavier ones, e.g., from hydrogens to carbons. When the early stars died, the atoms manufactured was exploded into the universe, and eventually formed the smaller stars, and the planets that surround them. This is a still ongoing process in the universe. The radiation of a star created an energy gradient surrounding it, excited the molecules in the early planets to let them form bonds with one another, and thus created more complex molecules. This preconditioned the planets to create life.

> In March 2017, putative evidence of possibly the oldest forms of life on Earth was reported in the form of fossilized microorganisms discovered in hydrothermal vent precipitates in the Nuvvuagittuq Belt of Quebec, Canada, that may have lived as early as 4.28 billion years ago, not long after the oceans formed 4.4 billion years ago, and not long after the formation of the Earth 4.54 billion years ago (Dodd et al., 2017).

Though it is still not known exactly how life emerged, a sensible hypothesis exists. Recall that a biotic system is a non-equilibrium thermodynamic system. At the statistical-physical level, the system is an aggregation of molecules that are excited by the energy from the environment, and use the metabolic pathways that are infinite loops to dissipate the energy. Jeremy England argues the these infinite loops originated from random groups of molecules that were excited by the energy gradient to self-organize to more efficiently absorb and dissipate heat from the environment, because the non-equilibrium process that dissipates the most energy is the one that utilizes the energy to self-replicate, which dissipates energy indefinitely.

After this bootstrap process, the early life forms started to explore the interaction space to form all kinds of organization, by staying alone, or forming more complex organism with other life forms.

> The more complex organisms in turn terraform the earth system, which in turn allows for even more complex organism. This process goes circularly.

As a result, though being more complex does not imply being more superior in the sense of evolution, the envelop of complexity of the earth system increases. The complex molecules evolved into cellular organisms, which were bacteria and the less known domain of archaea that also exist in our digestive tract facilitating digestion. One particular kingdom of these small invisible organisms evolved with photosynthesis, and terraformed the atmosphere of Earth by converting CO_2 to O_2. The emergence of O_2 sped up the metabolism and thus the evolution of eukaryotes. Eukaryotes are an domain of organism with complex organelles and enclosed nucleus, and thus are of more complex behaviors and capable of exponentially exploring the interaction space by swapping genes with other eukaryote (e.g., sexual reproduction). Thus, eukaryotes, this domain of organism, evolved into multicellular organisms. The cells in multicellular organisms specialized such that the cooperation led to more complex organism with larger biomass. The ones that got its energy from the sun were not selected to be mobile, and ultimately evolved into plants. The plants terraformed the land by weathering the rocks, and thus increased the diversity of the nutrients that

were previously sparsely available in areas such as volcano eruptions. Meanwhile, the plants were food of a larger size, and thus preconditioned the evolution of larger multicellular organisms that fed on them. These organisms needed to be search for energy sources from plants and evolved into animals. The atmosphere and the land, the bacteria and the archaea, the plants and the animals constituent the ecosystem that we call Earth.

Through the evolution of complexity and cosmic contingency, the history of life finally reached a stage that we call human civilization. The more complex system consists of more number of molecules, and typically dissipate, or in this case that we might say utilized, more energy in its lifespan. For example, Kleiber observed in 1930s that an animal's metabolic rate scales to the 3/4 power of the animal's mass; this is known as Kleiber's law. Therefore, the arm race of complexity and energy perhaps led to the increasing size and power (which also means energy-intensive) of plants and animals. And perhaps the animals with the most raw power on earth were dinosaurs.

> We might even speculate that without the meteo rock, dinosaurs might well be the dominant species on earth for another 6.5 million years, and mammals do not have a chance. However, that cosmic contingency changed the outlook of earth. A different way to complexify and utilize an increasingly more energy evolved, and that is called *group cooperation*.

As introduced in section 3.3.2, initially small scale cooperation emerged where Homo Sapiens cooperated with one another, and with plants and animals. And this spiral process ultimately let the civilizations emerge.

> Human social existence, unlike animal sociality, is based on the genetic propensity to form long-term contracts that evolve by culture into moral precepts and law. They evolved over tens or hundreds of millennia because they conferred upon the genes prescribing their survival and the opportunity to be represented in future generations. We are not errant children who occasionally sin by disobeying instructions from outside our species. We are adults who have discovered which covenants are necessary for survival, and we have accepted the necessity of securing them by sacred oath (Wilson, 1999).

3.4.2 Human conditions: what is life for?

The self-rejuvenation characterization of biotic systems and civilizations correspondingly implies a set of human conditions that form a hierarchy in term of the spatial and temporal span, from individual survival to civilizational rejuvenation.

First, at the lowest of the hierarchy, as an autonomous individual, a human needs to satisfies imminent self-rejuvenation at the timescale of hours by finding matters and energy source (i.e., food and water) to sustain the daily metabolism. After hoarding a sufficient amount of energy (e.g., stored food or money) and acquired a protective shell (a cave or house), the individual would possess a sufficient number of adaptive symmetries to break to mate with another individual, such that informationally, the human system could self-rejuvenate beyond the timescale of decades. This reproduction process happens at the timescale of decades.

This category of life cycles are the most fundamental and also the most rudimental category of life cycles. It is fundamental because this is the only way biotic systems self-rejuvenate. It is the redimental because it is not very different from animals until emergence of civilizations. It is at the lowest of the hierarchy of human condition because this reproduction process happens over a time span of around two or three decades, and restricted in a spatial region a few houses large.

Manifold varieties exist in pursuing this individual self-rejuvenation in a complex society because the existence of hierarchy. In these societies, a number of signals are computed collectively to surrogate the fitness of an individual, money, status, power, network and etc. A higher

place in the hierarchy implies more access to matter and energy, and thus a higher chance of successful self-rejuvenation over multiple generations. This journey of self-rejuvenation creates a mind that is "continuously and kaleidoscopically shifting in mood—variously proud, aggressive, competitive, angry, vengeful, venal, treacherous, curious, adventurous, tribal, brave, humble, patriotic, empathetic, and loving" (Wilson, 2014).

This fundamental self-rejuvenating process occupies the mind of the great majority of the population throughout history, and leaves little room for anything else. And it might be argued that this alone suffices for a good life, and it is indeed what the most people ask for throughout history.

> It was and is an aspiration to live an idyllic life that is peaceful and plentiful, that sees the growth and maturity of offspring and contents that they have find their places in the world.

This aspiration is the fundamental attraction of the middle class life that now is the foundation of our current civilizations in absence of a complete humanistic system, and is stated in the language of individual rights in Western civilization, and in the language of national rejuvenation in Chinese civilization.

Second, a number of individuals form a group, which has a particular group organization that we might call group norm, and typically has one or many leaders. The self-rejuvenation of individuals are meshed in the social relationship within a group: physically, this relation could be understood by Karl Marx's relation of production, the sum total of social relationships that people must enter into in order to survive, to produce, and to reproduce their means of life; informationally, this relation could also be an aspiration or vision of life that individuals in it find an identity. The self-rejuvenation of individuals in the group results in the self-rejuvenation of the group, which manifests as the replacement of individuals in certain group roles, such as the replacement of leaders. A neighborhood could have a retail shop where people buy groceries, a community center where people discuss communal matters, and an elder or charismatic leader who arbitrates disputes. When any of those roles are vacant, they tend to be replaced over the time, unconsciously or by plan.

A very cohesive group would have a strong force to self-rejuvenate, and the life span of such a group could last up to hundreds of years—it dies in the sense the local group loses its group organization. In prehistory, a local group was a tribe that carried a long line of legacy. And in ancient history, this could be a village organized by descendants from a common ancestor (a typical local group under societism in China), or a local pariah established by a respectable priest (a typical local group under Christianity). In contemporary times, there are manifold kinds of groups: a living community bonded by neighborhood, a for-profit corporation boned by common interests, a unit of political party, a special interest group for international standard making, or academic group for a specific discipline. A powerful example would be emergence and the disappearance of the village in the magic realism novel, *A Hundred Years of Solitude*.

> At that time Macondo was a village of twenty adobe houses, built on the bank of a river of clear water that ran along a bed of polished stones, which were white and enormous, like prehistoric eggs. The world was so recent that many things lacked names, and in order to indicate them it was necessary to point.
>
> ...
>
> Úrsula' s capacity for work was the same as that of her husband. Active, small, severe, that woman of unbreakable nerves who at no moment in her life had been heard to sing seemed to be everywhere, from dawn until quite late at night, always pursued by the soft whispering of her stiff, starched petticoats. Thanks to her the floors of tamped earth, the unwhitewashed mud walls, the rustic, wooden furniture they had built themselves were always dean, and the old chests where they kept their clothes exhaled the warm smell of basil.
>
> ...
>
> Even though the trembling of her hands was more and more noticeable and the weight of her feet was too much for her, her small figure was never seen in so many places at the same time. She was almost as diligent as when she had the whole weight of the house on her shoulders.

...

Colonel Aureliano Buendía did not recover his calm for a long time. He abandoned the manufacture of little fishes, ate with great difficulty, and wandered all through the house as if walking in his sleep, dragging his blanket and chewing on his quiet rage. At the end of three months his hair was ashen, his old waxed mustache poured down beside his colorless lips, but, on the other hand, his eyes were once more the burning coals that had startled those who had seen him born and that in other days had made chairs rock with a simple glance. In the fury of his torment he tried futilely to rouse the omens that had guided his youth along dangerous paths into the desolate wasteland of glory. He was lost, astray in a strange house where nothing and no one now stirred in him the slightest vestige of affection. Once he opened Melquíades' room, looking for the traces of a past from before the war, and he found only rubble, trash, piles of waste accumulated over all the years of abandonment. ... One morning he found Úrsula weeping under the chestnut tree at the knees of her dead husband. Colonel Aureliano Buendía was the only inhabitant of the house who still did not see the powerful old man who had been beaten down by half a century in the open air. "Say hello to your father," Úrsula told him. He stopped for an instant in front of the chestnut tree and once again he saw that the empty space before him did not arouse an affection either.

"What does he say?" he asked.

"He' s very sad," Úrsula answered, "because he thinks that you' re going to die."

"Tell him," the colonel said, smiling, "that a person doesn' t die when he should but when he can."

...

He was so absorbed that he did not feel the second surge of wind either as its cyclonic strength tore the doors and windows off their hinges, pulled off the roof of the east wing, and uprooted the foundations.

Macondo was already a fearful whirlwind of dust and rubble being spun about by the wrath of the biblical hurricane.

Before reaching the final line, however, he had already understood that he would never leave that room, for it was foreseen that the city of mirrors (or mirages) would be wiped out by the wind and exiled from the memory of men at the precise moment when Aureliano Babilonia would finish deciphering the parchments, and that everything written on them was unrepeatable since time immemorial and forever more, because races condemned to one hundred years of solitude did not have a second opportunity on earth.

Third, move a further step up in the hierarchy, a large number of groups form a society. Therefore, a society is characterized by the cooperation and competition among various social groups. A society is typically an implementation of a civilization—which is discussed last in this subsection—and thus has dominant social norms and a system of institutes that maintain the complex cooperative among individuals and groups. Social norms could include a set of explicitly or implicitly accepted social conducts, and a dominant and well perceived way of life. And the institutes could include the political system to govern the society, the educational system to educate people, the monetary system to run the economy, and the court to resolve dispute and carry out jurisdiction. These institutes to a society are the equivalence of social roles to a group, and an institute is operated by a social group. And thus a society self-rejuvenates physical-informationally in the sense of perpetuated and evolving norms and institutes, in a way similar to the self-rejuvenation of groups, but at a larger scale, both spatially and temporally.

Societies are the drama stage for groups, as a group is the drama stage for individuals. The group of a middle class families that happily live in their neighborhood, and are satisfied with the government would actively participate the community service, and be a good citizen, because this image of community and the government of the society is part of their identity, and the betterment of the social system is also the betterment of themselves. However, a marginalized group would not contribute to the betterment of the society because it does not bind its identity with the society, and thus is not obliged to rejuvenate it. Meanwhile, a group would fight to preserve its legacy even if it does not fit in the contemporary society anymore because a group is evolved to so do. When the society is sufficiently decoupled into two or several societies that each has its own societal norms (which implies these groups

do not have a cooperative but a competitive relationship), these groups would fight one another for dominant or simply to survive. This is both a defense mechanism to exploitation, such as the workers' union to defend against capitalists or the Great Wall of China against the nomadic civilizations, and a mechanism to dominate and thus acquire more matter and energy, such as the proletariat's revolution against the capitalists or the conquering of Huns by the First Emperor of Qin Dynasty. Therefore, at a time, a society could be good for one social group, but bad for another, and Dickens wrote,

> "It was the best of times, it was the worst of times, it was the age of wisdom, it was the age of foolishness, it was the epoch of belief, it was the epoch of incredulity, it was the season of light, it was the season of darkness, it was the spring of hope, it was the winter of despair." — Charles Dickens, *A Tale of Two Cities*

Lastly, many societies under the same vision and instruments for self-rejuvenation are refer as a civilization, whose temporal span could last thousands of years. The life cycle of civilizations have been the central focus of this essay—the life cycle of Western and Chinese civilizations are described in section 2, and the self-rejuvenation of civilizations is the topic of section 3.3. Here we expand on the human conditions in the life cycle of civilizations.

In *a broad stroke*, ever since the emergence of consciousness, human condition became the struggle between good and evil.

> This struggle, in theological age, had acquired a mythological mantle and was depicted as the battle between Satan and God, while in metaphysical age, had been depicted as the defense of values or Dao (Way).

The good is roughly the cooperative structure that sustains the complex societies that we call civilizations, and is known largely under the umbrella concept of morality. The appreciation of the good lies in the acceptance of the collective identity under such a society, and could only be acquired by people who have been meshed socially into the society through years of interaction with positive feedback (and the negative feedback from deviating from such practices), and form a materially and spiritually symbiosis with the society. This symbiosing process does not happen for people who are exploited by the social system, or the marginalized group, or people who have seen the long term negative consequences in the current social norm (who are typically intellectuals). When this "other" group degenerates, in the sense it degenerates into behaviors that run against the complex cooperative behaviors that make civilizations possible, such as behaviors that we refer as criminal (which exploits the production of the cooperative structure without contributing to it), small clique groups that form a coherent but despotic group, or the revert to tribal killing (e.g., fascism) pre-civilization behaviors. This tension is the struggle between less complex systems and more complex systems, and is the major theme in human's history.

> Meanwhile, as intended in the phrase "in a broad stroke", this struggle actually results from a feature, not a bug.

To see the value of the "other" group, we could look at the society built by ants, which is another form of group cooperation. No marginalized groups exist in the society of ants, and all the members of the societies work to perpetuate the only way of living: the worker ants gather food, the soldier ants defend the nest, and the queen reproduces the next generation of ants. If we compare this society with human society, we might say that the worker ants are exploited by the system, and the queen lives in inhuman luxuries. But from the point of self-rejuvenation, the system simply is trapped in a very stable attactors, and ants have been living this way for millions or billions of years—the species evolved from ants and do not live like ants are not called ants.

A dogmatically stable society is like an ant colony, despite it has the security and stability to perpetuate itself in a definite time, the system

does not move forward in the sense of exploring alternative ways to self-rejuvenate. Though it would over-simplify to state and the subtlety could be found in section 2.2, the ancient Chinese civilization was trapped in such an attractor, and ultimately decayed.

On the other hand, the innovative individuals always live as outsider, as the "other" at the seed stage of social transition. Confucius traveled from kingdom to kingdom with his disciples in his prime years, and ended up compiling classics and histories late in his life. Socrates was an annoying individual who would wonder in the wild covered with snow barefooted, and was ultimately executed when the democracy of Athens fell. Erasmus was a vagabond hopped among universities and royal patrons while writing the translation of Bible that unified the Greek and the Latin traditions of the New Testament in early Renaissance. Einstein worked as a patent worker outside the academics before he worked out the theory of relativity. And as well known, the legacy of these individuals transformed the respective civilizations and science.

> This struggle between individuals and societies is a key of the mechanism where the system evolves, and is not possible in the ant society. A blend of star gazers and moral guardians are the ingredients for conscious evolution.

This concept of good and evil also generalizes to civilizational interaction.

No difference exists between good and evil from the perspective of the civilizations themselves, and thus when two civilization with different visions and instruments of production meets, they tend to clash unconsciously, because the perpetuation of a civilization's own cooperative structure is the nature of a civilization. Each would have their own rationalized good and evil, and the narrative for a short time typically dictated by the winners. This nature of civilizations waged the most and the cruelest wars, and committed the most crimes in human history. The most salient example is the clash between the nomadic civilizations and agriculture civilizations, which had been the dominant theme throughout human history until the modern times.

The only lasting solution is to form a more complex civilization that is supported by superior infrastructures and more complex cooperative institutes, and this is the realization of Good. Conquests could never be the resolution to the civilizational clashes, because after the conquest, the incompatible vision and instruments of production of the two civilizations, which are nurtured by different ecosystems, would cause the fissure again unless the ecosystem is complete transformed; conquests without realizing this fact is the playbook of the Evil. To see this emergence of more complex civilizations, the clashes between nomadic and agriculture civilizations only ended when the mode of production and commerce between these civilizations have surpassed a threshold, such that the benefits of trade between these two types of civilizations make the wars meaningless.

> This struggle of good and evil in the sense of the tension between the more complex versus the less complex gives a higher ideal in human condition.
>
> People live to see their ideals to be passed onto the next generations, and this self-rejuvenation of ideals—the instrument of production could change—are what we call the evolution of civilizations.

Throughout human history until very recently decades, except very few exceptional individuals, humans were not consciously aware of this struggle, which were typically cloaked with metaphysical clothes and mystified.

We typically refer a set of characteristics, such as loving, solidarity, honesty as humane, and refer another set of characteristics, such as brutality, selfishness, deceitful, as inhumane. In reality, people are capable of doing both kinds of things, and all these characteristics are humans'. Without a process that is roughly known as "culture", a human would choose by their instincts one set over another when the environment changes. In this sense, humans are a species of sentient

animals, which means they are animated by a pre-determined set of behaviors acquired through biotic evolution.

> To conclude, this hierarchy of human conditions imply that all normal humans are both ignoble and noble, often in close alternation, sometimes simultaneously.

3.4.3 Project humanity and humanistic ideals: what is humans' duty and destiny in face of death?

This cosmic epic origin of humanism and the hierarchy of human conditions in the sense of complexity imply a duty and destiny of mankind that had been discovered under theological and metaphysical intellectual systems in the past, which we might refer it as *Project Humanity*, is where the permanence of humanity is embodied, and is incarnated as varieties of *human ideals* in history.

From the level of individuals, to groups, societies, and civilizations, and ultimately the whole earth system, all of these systems are in a diachronic process of self-rejuvenating. The progress of this process manifests in the increasing complexity, such that the units in the system as a whole would collectively access to an increasingly sustainable supply of matter and energy.

This complexity previously is under the name of greater good (see section 3.4.2) in history. And this process of self-rejuvenation had been summarized as **the ideals of humanity**, and embodied in the life of intellectuals and moral leaders. In a theological context of Christianity culture, it was written as

> Do you want to have a humble share in perpetuating wisdom among men, in gathering up the inheritance of the ages, in formulating the rules of the mind for the present time, in discovering facts and causes, in turning men's wandering eyes towards first causes and their hearts towards supreme ends, in reviving if necessary some dying flame, in organizing the propaganda of truth and goodness? — Sertillanges and Ryan (1998), *The Intellectual Life*

And in a metaphysical context of ancient Chinese culture, it was written as

> 为天地立心，为生民立命，为往圣继绝学，为万世开太平。—— 张载《横渠语录》

We would not translate them, and it states an ideal that has been roughly explained in section 2.1.3.

Civilizations built around these intellectual foundation were the most powerful ones in history, and the times where the ideas emerged are referred as *Axial Age* by German philosopher Karl Jaspers in the sense of a "pivotal age", characterizing the period of ancient history from about the 8th to the 3rd century B.C.. During this period, according to Jaspers' concept, new ways of thinking appeared in Persia, India, China, Palestine, and the Greco-Roman world in religion and philosophy, in a striking parallel development, without any obvious direct cultural contact between all of the participating Eurasian cultures.

Most might find this ideal too demanding for ordinary individuals, however, this is a misunderstanding. This ideal conceptualizes the ideal at the highest level of humanity, and in support of this ideal, a civilization is built through a hierarchy of human conditions (see section 3.4.2) that collectively as a whole is fulfilling this ideal—the one that abandons the ideal would decay and collapse eventually, which is discussed in section 3.3. And for people who regard this ideal bookish, idealistic, impractical, or unwanting are because they are still pursuing the lower parts of the hierarchy of self-rejuvenation. And thus when their pursues are fulfilled, which might not even happen for a lifetime depending on circumstances, they typically became bored and then confused, and by being in this state for a sufficient long time, they would eventually seek for permanence. This is why the older people, the more likely they are conservative, religious, or deeply committed

to family, or go vagabond or mad. In this sense, people do not really have free will, but only the consciousness to judge different paths in this process of self-rejuvenation in a timescale of decades, and are unconsciously or consciously a part of this **project of humanity**.

4 Prediction, or the vision of Era of Planeterization

> The philosophers have only interpreted the world in various ways, the point, however, is to change it.
>
> Karl Marx

> The vast distances that separate the stars are providential. Beings and worlds are quarantined from one another. The quarantine is lifted only for those with sufficient self-knowledge and judgment to have safely traveled from star to star.
>
> Carl Sagan

> The ideal scientist thinks like a poet, works like a bookkeeper, and, all too rarely, writes like a journalist.
>
> E. O. Wilson

Section 3 developed a concept or instrument referred as adaptive symmetry that analyzes the life cycle of civilizations. In addition to attempting to answer to perennial questions of humanism, an analytical instrument is sought to guide future actions and make predictions. Section 2, section 3.1 and section 3.2 narrative the main observation that we are at a transitional junction between eras of humanity. In this section, we investigate the what the next era of humanity might look like through such an instrument, and the obstacles that stand in the way of such a future.

First, in section 4.1, we describe the core characteristics of the next era, which we refer as the *Era of Planeterization*. However, this section does not aim to give definite answer, but a speculation that is a vision in the sense, for example, of the one given in section 3.1.1, or of the vision of individualism or societism or enlightenment in the historical eras given in section 2. More importantly, the analysis in section 3 is something that in the Age of Enlightenment would be referred as natural philosophy, and the adaptive symmetry as analytical instrument. And most philosophies in history are at most partially right. Therefore, in section 4.2, we discuss how this natural philosophy could be turned into science. This is where artificial intelligence comes in this big intellectual picture: we might be approaching a science of mind and societies in the coming decades. Lastly, we clarify possible confusions in section 4.3, which includes the concept of intelligence singularity, privacy in the organic societies, and the possibility of unemployment as a result of massive automation.

4.1 Era of Planetarization

In section 2, the picture painted there is rather bleak. Contemporarily, we live in stalled times. The era of societism and of enlightenment might be too remote to recall, the prime year—a civilization could have several prime years through periodical rejuvenation—of the era individualism still resides in the recent memories: when Neil Tyson, the astrophysicist and the narrator of the science documentary *Cosmos: Possible Worlds* (the sequel to the *Cosmos* of Carl Sagan), recalled his first marvel over science, it started with his question to a computer in the World's Fair, which answered by printing a paper tape with words. The brief period between the end of WWII and 1970s might be the best period of humanity so far, although only the part of world known as the Western liberal alliance has lived through it. Despite, or perhaps because of the atrocious fascism, the Cold War and the Damocles Sword of nuclear weapons, the Western world had never been that egalitarian. We have depicted this world in a broad stroke in section 2.1 and 2.3, and here we might point to the specific example of higher education: the elite private schools took the initiative to transform from the social club for the young of the rich to pursue a meritocratic ideal of equal opportunity (Karabel, 2005), and California developed a tiered system of higher education where the talented were transferred to the most elite university wherever they initially attended (Rothblatt, 2012). But the period did not last.

By the analysis in section 3, we would reason that the age of progress in the post WWII era resulted from an orchestration of the instrument of self-rejuvenation and the humanistic ideal of

greater good: first, the potential of growth materially thanks to perhaps the most prolific period of science so far, and second, the morality to achieve greater good in response to the black horror of WWII, which regulated the growth to the whole society. And the age ended because after the cold war was over, the hubris of "End of History" and the disappearance of Damocles Sword dismantled regulation that democratized the growth under the neoliberalism with the catchphrase, "the business of business is profit", while at the same time, the derivative fruits of the scientific discoveries around the turn of the century had exhausted—the standard model of physics has not changed since 1970s, and no discoveries as fundamental as the ones at the turn of the 20th century have been made. The downsizing of governments and liberalization of markets was accompanied with the aftermath of the failure of logic positivism, which created a world with no truth. The lack of truth reverted the system to default state, which was the inertial movement of individualism depicted in section 2.1.4. And the age of progress ended, and the civilization decayed.

In this subsection, we analyze the reason of such decay through the analytical instrument given in section 3. The message is that the informatization and digitalization of societies have decreased the timescale of social development, and thus the lifecycle of growth and exhaustion of economic sectors. As a result, the assumptions made in liberalism and socialism to run economy that were approximately valid previously became obsolete in this new society condition, and the institutionalized old way of thinking caused the current social illness. A synthesis of liberalism and socialism is discussed, and if this way of organizing economy matures, the consequence might be a planetary civilization. And we might call this era, the **Era of Planetarization**.

4.1.1 The society condition of postmodernity

As discussed in section 2.1, the decadence is not because the cause of individualism failed, but because it succeeded, yet this intellectual system does not suffice to solve the problems that our contemporary system is facing and the system institutionalized. The fundamental reason might be rather simple: the shortening of self-rejuvenating timescale obsoletes socialism and liberalism, in their strict senses respectively. This is the society condition of our contemporary times, which we explain in this subsection.

First, we analogize societies as bacteria and the planet as a petri dish, a shallow transparent lidded dish that biologists use to hold growth medium to grow bacteria. A bacterium is free to do its own things, which implies that it self-rejuvenates by breaking adaptive symmetries (for example of motions) to follow nutrient gradients, self-replicating and occasionally mutating to better utilize existing nutrients. It would consume as many as nutrients as possible, self-replicate exponentially into a colony when there is no predators (which is the case in a petri dish), eventually exhausts all the nutrients in the dish, and then the colony dies. This is how the green patches of fungus appear when you put your winter clothes in a humid environment for a summer. In another scenario, suppose that the bacteria would generate acid when it metabolizes, and the dish system could not neutralize or dissipate the acid. In this case, even before the nutrients in the system are exhausted, the colony of bacteria would collapse as a result of the environmental change.

Now we change the spatial and time scale of previous system: we substitute bacteria with humans, a petri dish with a planet, a summer with a century. A human is free to do its own things, which we have discussed in section 3.4.2, and implies that one self-rejuvenates by breaking adaptive symmetries to secure energy and matter in a complex hierarchical society such that either the human, or the group the human belongs to, or the civilization the human identifies itself with, would self-perpetuate and explore better self-rejuvenation strategies. The success of individualism means that the science of the environment (which includes the universe and the planet) and the technologies derived from such science exponentially increase the spatial and energy scale of an individual's action, such that a persevere and talented individual could be in a position to influence the society in his lifespan—in previous eras, this could only be done by political leaders in a very limited way. This empowerment of individuals increases the spatial and energy scale of the societies also exponentially. Previously, we are like bacteria that live in an infinitely large regenerative dish, and contemporarily we are like bacteria

that live in a petri dish, such that the timescale of resource exhaustion and environment degradation could happen at the timescale of decades. This is called the Anthropocene, where existing fossil fuels could run out within decades, and the carbon dioxide generated by the burning of fossil fuels could cause irreversible climate change that collapses the civilizations even before the fuels run out. This analysis could hardly be novel, and scientific evidence had shown (Randers, 2012) that this could happen, but the current social systems are under great inertial to take actions to avoid the civilization collapse.

The root of the problem is that the timescale of social system life cycle has changed. Previously, the pace of societal change is slow. In this case, both socialism and liberalism work if they are under visionary leadership. Socialism works by identifying the major sectors of growth, and regulating the energy and matter into the sectors. This is how Soviet Union industrialized within decades after it established. And liberalism let individuals and groups explore the sectors of growth by providing and maintaining the infrastructure—this is simplistically how the U.S. worked between the New Deal and the disintegration of the Bretton Woods system. These two social systems worked because the timescale of social change was slow: for socialism, centralized planning could work because it would take decades to a sector to finish its life cycle, and thus give adequate time for the government to plan the next sectors; meanwhile, for liberalism, distributed groups could work towards societal good because a sector would not exhaust in decades, and the incentives for individuals to join the sector would stably transfer to social progress in these decades—the "equilibrium" supply and demand plot in the (now classic) neoliberalism economics is actually a non-equilibrium self-rejuvenating curve extended over decades being zoomed in at timescale of months, and looks like a straight line but is actually a curve (just like Earth is actually round but looks like flat at people-scale). However, sector-wise, both the two systems periodically institutionalized after a sector exhausts, which if handled inappropriately, would cause economical crises, and even social disorder—examples would be the collapse of Soviet Union, and the political chaos during the Great Depression.

When the timescale decreases, both socialism (in the sense of strictly national centralized allocation of energy and matter) and liberalism (in the sense of strictly free market) societies, cannot effectively address the periodical crises that turn continuous crises. The problem could be characterized as the rapid exhaustion of adaptive symmetries that exceeds the response time of the social system, which manifest as the institutionalization of instruments for self-rejuvenation.

Socialism has the problem of information bottleneck, which makes the precise identification of the local problems difficult, and when it fails to do so in a large scale, the system would collapse. The Soviet Union initially focused on heavy industry, which was healthy when there is no heavy industry, and built the industrial infrastructure and enabled the nation to fight the WWII. However, when these tasks were finished, this instrument was institutionalized, and the agriculture and service industry, especially the informational technology was not possible to grow in this top-down system because the management could not see the potential of the system when it had not manifested. This created deadlocks to societal progress. After the deadlocks existed for a sufficiently long time, and when the leadership tried to transform the system, it would attract attacks from all segments of the society: the elite themselves, whose interests were vested in the old system, and the mass, who had spent their youth struggling to find a way of living and already lost the trust to the system, would not want to abandon the way of life built within such hardship, and to experiment with a new way of life that was unknown previously. Consequently, the system collapsed.

Liberalism has the problem of societal polarization and cancerization of social groups. First, as discussed in section 3.3.1 and section 3.3.4, a social system is a non-equilibrium process that constantly breaks adaptive symmetries to self-rejuvenate in response to feedback signals. We could characterize a sector of growth as an amount of intact adaptive symmetries that could be explored to self-rejuvenate, and in a slow paced society, the life cycle (discovery and exhaustion) of a sector is at the timescale of the life cycle of one or multiple generations of humans. In such a social system, when a sector exhausts, the people (which are symmetries already broken) associated with it have retired as well, and thus it is a part

of the aging groups that would ease away along with the old institutes that have grown around the sector. However, in the contemporary world, the life cycle of sectors could be shorter than ones' career span, and thus a sector could be exhausted, which causes unemployment of people and the disappearance of business in the sector, consequently destroys the social groups and even societies resolving around the sector, and ultimately incites social unrest and political instability. Second, as discussed in section 3.4.2, individualism unleashed since Renaissance transformed the less complex agricultural social system to our more complex commercial social system. In a commercial society, despite the the over-simplification, money is the signals that enable the social system to self-organize. In a slow paced society, when a sector is exhausted, people could be redirected to other sectors by transferring the money to new sectors. Previously, this transition syncs with generation transition, and when properly managed would not cause social disorder at a large scale. However, the transfer of money has an inertial that could best be seen in the real state or financial markets: when seedling sectors first emerge, little money would be infused into the them; and when it matures and ages, people still pour their resources into it, and in bad cases could break down the market when the sector collapses. In this case, a large amount of money would concentrate in a small social group that is at an ambiguous edge between the rapidly growing organs and a cancer in a biotic system, and if unwisely managed could easily grow itself and detach from the whole society. In most cases, the group is not even aware of the cancerization of its own group, and even if it wants to transfer the money back (e.g., through philanthropy), it is rather difficult to do so because of the social structure—effective change of social system needs to create other adaptive symmetries (e.g., through scholarship endowed to universities), is a difficult and slow process, and simply transferring money does not help.

These fast-timescale societies without a competent leadership that is aware of these structural force are dangerous because the mass, driven by the group instincts that promote internal group cooperation but also alienates the outsiders, tend to blame the "other" group for the crises emerged seemingly randomly but regularly. This mud-slinging in better cases would create social frictions that waste energy and matter, at worst cases would induce militarism that leads to civil wars or nationalism that leads to international wars, which has been discussed at the end of section 2.1.4, and might be the end of any civilizations on earth, leading to a dark age for hundreds of years.

4.1.2 The beginning and the perils of contemporary social system transition

This society condition is not something that is a cause of dissents or marginalized groups who want an alternative, but a social transition that a modern society would develop itself into, regardless of the political-economical system, and is already well on its way. And the transition either ends in success, or collapse. In this subsection, we describe the ongoing transition and its perils.

To begin with, we still analogize the situation to bacteria. As briefly mentioned in section 3.4.1, the primitive consumption-and-reproduction life cycle of bacteria described in section 4.1.1 continued in the proto-soup of early earth's ocean for billions of years, until Earth was terraformed with oxygen that enabled the eukaryotes to form the more complex multicellular organisms, which are of better mobility and thus have access to energy and matter at a larger spatial span. The forming of this complex cooperative system of cells acquired more agency to seek for energy and matter when the local ones are exhausted, and in comparison, the bacteria were largely at the mercy of geological forces (e.g., wind) to seek for new energy and matter. This mobility was enabled by nervous systems, whose signals are chemical or electronic. Overall, these multicellular systems utilize energy and matter in a more sustainable way, and self-rejuvenate at a longer timescale.

A similar evolutionary process is also happening to the human system. An example that has involved a large amount of people would be the ride-hailing service offered by tech companies. Each car is a small cell that moves around the city system, and looks for people needing a ride (which ultimately transformed into money that could buy energy and matter). Before the service was available, the cars would drive around the city with preference to the places that would have demand according to the past experience, an

advanced form of random motions, to look for people. The wires, fibers and electromagnetic waves interlinks are the nerve fibers of the city system, ride-hailing apps in the smartphones are the sensors of the system that signal the whereabouts of the resources, and the cloud servers run by the companies are an information process system, which in a biotic system would be called a nervous system, that directs the movement of the cells to the resources in a way that maximizes the gain and minimizes the expenditure. The nerves, the smartphones, and the processing system form an organism that overall reduces the waiting time of the people and the energy wasted in the random motions of cars, and increase the income of the car owners and the aggregated passenger load of the taxi system. Overall, this system provides more stable and also higher income for the taxi drivers, and more stable and perhaps also cheaper service for people; in the terminology of this essay, the system self-rejuvenates at a longer timescale, and thus and is more sustainable: the interconnection among the cars and people induces a more complex network, and in this network, the supply (of cars) and the demand (of ride hailing) are more stable because it is an aggregated behavior of the whole city, instead of isolated regions previously.

We might understand these phenomena—which not only exists in the ride-hailing service, but also in the e-commerce service, supply chain management, and etc.—in the informational society as a primitive form of intelligence, which we mean a large number of tightly informationally coupled units that form a cooperative system and interact with the environment at a slower timescale, and in other words, in a more sustainable way. And the process is ongoing: as the early multicellular organism would gradually complexify into a spectrum of organisms that we know as animals and plants, these early human systems would gradually permeate into all segments of society, and ultimately the interaction of these systems would form a complex social system at the scale of something that we call liberalism or socialism today—that is, a system that manages the political economy of societies. The scale of this new economy has already large enough and started to interact with governments: it has participated in the presidential election in U.S. since the Obama times, nation-wide regulations are being made in U.S., E. U., P. R. China, Internet has become the major channel of political messages, and the list could go on. And this is the social-system transition we mentioned in section 3.2.4.

However, the "primitive" qualifier before intelligence previously is meant in a big way. Our current informational system is more like a swarm of blind bacteria than a cooperative of cells. The information system tends to over-amplify a particular tiny niche of supply and demand, instead of promoting a cooperative social structure. This could be seen clearly from some now well perceived pathology: the e-commerce platform tends to be dominated by a few brands that have the weight to dominate the information bandwidth of people (which is known as marketing) and in turn these brands themselves are dominated by a tiny fraction of products that they made; the social network services tends to over-incentivize the more primitive psychological instincts of people, and induce social bubble of the users (which previously does not exist because such interaction is spatially sporadic, and the temporarily slow), instead of promoting mutual understanding; the educational product also tends to self-select, which means that people are not prompted to reach out their comfort zones, but to seek for what they are already acustomized to—in other words, the wise become wiser, and the stupid become more stupid.

These phenomena result from our inadequate understanding of these complex cyber-social-technological systems, and consequently, the faster timescale in these systems ends up amplifying the faster and less complex characteristics of the system, and could not promote a slower, and more complex cooperative system. An example would illustrate the message. In current technology of recommendation systems, which include social network service, e-commerce platform, entertainment service and etc., users are incentivized to tittytainment, where people are pushed to contents that are sensational, sexual or petty, or promote quick success, or packs short distorted life advice without contexts, or stir hatreds. However, the things that are called good are resulted from complexity (cf. human ideals in section 3.4.3), are of a slower timescale, and thus long-tailed and context-specific. The current recommendation algorithms are essentially

sophisticated linear algorithms (despite the incorporation of deep nonlinear models) that could only handle fast-scale information because the slow-scale information is canceled out in the linear algorithms and only the fast-scale information manifests in the average, and simply unable to handle this complexity. This is also why despite the money and resources the current social network service companies have, they cannot fix their recommendation algorithm to avoid hatred, misinformation, erotic contents and all those fast-scale information.

To conclude, we already have the nervous system, but we do not have the mechanism to operate it.

4.1.3 Organism: the synthesis of liberalism and socialism, and managing complexity through intelligence

In this rapid-changing and interconnected age, our societies need a social system that resembles an organism, such that the situations at any segments of a society could be effectively signaled to the rest of the segments, and the social groups in the systems would self-rejuvenate to the new situations timely. Under this ideal scenario, the information bottleneck problem of socialism and the polarization and signal institutionalization problem of liberalism could be resolved. We sketch this intellectual system in this subsection, which might be summarized as, *managing complexity through intelligence*.

This emerging intelligent social system that organizes energy, matter and information would be fundamentally different from previous systems—we have discussed previous systems in section 4.1.1. To appreciate the fundamental change, this organizational structure is conceptually similar to the "relation to production" of Marxism: the agricultural societies obtained their energy from agriculture, and thus the societies organizes themselves through a hierarchy of landlords and tenant peasants; the commercial societies layer over the agricultural societies, and organize themselves through a hierarchy of cooperative and competitive natural and juridical persons—here the hierarchy is not a strict order as in the agricultural societies in term of subjugation, but the share of market they influence. The market self-organizes through a signal implemented as money, and thus if an intelligent social system that explicitly regulates the supply and demand (cf. the ride-hauling service in section 4.1.2) in all segments of a society, which is another layer of structure on top of the commercial system, we might reason that the social system would be fundamentally transformed as well. We refer this social system as **organic societies**.

It would be way beyond this space of this essay to elaborate this new order of social system would be like, and here we would only like to speculate a vision what this society would be like by outlining the rough characteristics through the analytical instruments in this essay.

Recall that in section 3.3.1 and section 3.4.3, we have outline a trend of civilization development where the social system becomes increasingly more complex, and this complexity is of fitness-benefits that provide a more sustainable access to energy and matter. This organic social system would be further developed in this direction. The agricultural societies are more sustainable to hunter-gather existence by providing crops and livestock sustainably, instead of seeking for fruits and preys in a nomadic lifestyle. The commercial societies are more sustainable to agricultural societies by forming a large scale cooperative system where the deficiency or disasters of one region could be mitigated by the diversity and production from the rest of the regions in the system. The organic societies would be more sustainable to the commercial societies by organizing supply and demand in the whole system at the timescale of minutes, days and mostly months, instead of the normally years in the commercial society, and by connecting a large number of distributed small productive and consumptive cells that do not previously exist because the barriers of operation is more costly than the benefits—this trend could already be seen in the on-demand shelving algorithms used in Walmart and the small international business made possible by the e-commercial platforms. This might be how the societies look like when the sustainable transition being executed by United Nations finishes.

A mature organic society would be like a science-fictional scenario, where energy, matter

and information are organized by a planetary system that anticipates the supply and demand of each regions in the network and delivers products at the timescale of hours—this concept has been referred as *Global Brain* (Heylighen and Lenartowicz, 2017), through it is slightly misleading because it does not characterize the organic system of perception, information processing and action, and acquired its name perhaps largely due to Internet before the wide use of machine learning algorithms.

Although to reach this scenario, there are social, political and cultural obstacles to overcome, the technologies are already in their primitive form. The Open Source and Open Science movements are the planetary organization of information packages that could be freely used to improve one's life on the condition that one is educated to understand them. The solar and wind electric energy generators are an integral part of the sustainable development transition to address climate change, and are by nature distributed. When an planetary microgrids are established, the surplus energy from concentrated energy generators such as the nuclear generators, and from other distributed cells could be transferred and traded with the places that are in demand, and thus a energy network would be formed. The additive manufacture (i.e., 3D printing) enables the materialization of the information packages, and when the templates are sufficiently rich and the printers sufficient cheap, we could print and assemble appliances by ourselves, and even print houses. The transportation that delivers the material products are also developing through e-commerce companies, which have developed an elaborate delivery system that could deliver goods within days. Overall, this is a primitive matter-energy-information self-organizing complex system.

This informatization and digitalization process is unraveling in all segments of societies now under the neoliberalism language of efficiency, yet it is an unconscious development of different versions of organic systems that would be ultimately (in the timescale of decades) selected by their fitness to generate the most number of products with the least amount of energy and matter sustainably. To see the challenges ahead, we could see how the food system in our current societies could be improved. As a result of natural disasters, diseases, unstable weathers, mismanagement, there are a chronic problem of local yet distributed food shortage (e.g., meat, fruits, vegetables) that causes price surge, and of local yet distributed food over-supply that causes the loss of farmers. The transportation of the over-supplied products to the local shortage regions would significantly improve the collective good of both regions. However, the regions in shortage and the regions that oversupply only show up seemingly randomly and for each region in the whole nation, only sporadically. The transportation system needs timely and minute information of the supply and demand in every region, and to be cheap and efficient. Meanwhile, the profits of building such a system has a low margin of profits because daily products could not be very high because people's livelihood depends on it. Therefore, a system might only be operational when the following components mature: the production of food needs to be highly automated and thus quantified such that the production quantity could be accurately estimated; a sophisticated system that resembles the metabolism in organism is needed to precisely pinpoint the supply and demand in each region, and to deliver the food in time; in future, regardless whether a society is in the developed nations or the developing nations, human labors would be in shortage, and robotic delivery would be required.

This challenge is not specific to the food system, but is a general challenge to all types of complex systems exist in the society that are energy-matter-information multi-scale networks, which include energy grids, traffic system, taxi or car sharing service, food system, waste recycling and etc., and the automation in those networks requires another level of robotics. Overall, *these systems are multi-scale networks where units perceive and effectuate actions on other units and are perceived and effectuated by actions by other units, and the interaction leads to self-organization that optimize certain surrogates to fitness.* For example, the traffic system described in section 4.1.2 consists of car cyber-systems that perceive other units in term of possible congestion and collision avoidance, and act to reach to their destiny in a way that is at least not very slow. The time span required to travel could be understood as a proxy for fitness. Overall, the system consists of cars whose behaviors could be optimized to minimize energy and time consumption. The digitalized behaviors are datasets that are observations of

the social system of cars, and are subject to theorization similar to biotic systetms—recall that in section 3.2.2, we have discussed that biotic systems essentially are adaptive-symmetric systems responding to feedback signals. In other words, it requires the understanding of the biotic intelligence that operates through non-equilibrium thermodynamics and the nervous system, or summarizing succinctly,

intelligence is to be understood
to manage complexity.

When this economic system has been built, we might wishfully imagine that any products in any regions could be deliver to any other regions that are in demand. This system would be a synthesis of the antithetic economical systems, liberalism and socialism, where the economy is regulated by an intelligent system, and at the same time, is an efficient market where signals of supply and demand are promptly propagated.

4.1.4 The synthesis of individualism and societism, and Era of Planeterization

We shall discuss how this seemingly too good utopia-great-unity organic system could be approached in section 4.2, however, prior to that, we would like to discuss the consequences of such a system, supposing it has already been forged. Similar to the consequences of the emergence of agriculture and commerce, this fundamental change of the way that energy-matter-information is organized would lead to another fundamental change to social cultural norms and political structure. However, we would not plan to cover that much breadth in this essay, and instead, we focus on the possibility of the synthesis of individualism and societism, and the consequence of such a planetary organic social system.

To begin with, we review the standpoints of this natural philosophy of humanity. As discussed in section 3.3.5 and section 3.4.3, the permanence of humanity is to self-rejuvenate, which manifests two major modes of existence: the first is to maintain the inherited complex cooperative social system (i.e., an informational structure) that provides energy and matter to self-perpetuate, and the second is to explore alternative cooperative and more complex social systems that would provide energy and matter at the larger scale and in a more sustainable/slow timescale. The first mode of existence incarnates itself as individualism, and the second incarnates itself as societism.

This philosophy has speculated a synthesis of the two antithetic political-economy systems of our times in section 4.1.3, and it also induces a speculation on the synthesis of the antithetic intellectual systems of individualism and societism. The emergence, unconsciously or consciously, of an organic society is to build a complex and cooperative system where the humans in the system collectively provide for one another, such that a thick safety net is an intrinsic feature out of mutual cooperation—this cooperative phenomenon has taken the mantle of *social capital* currently under the language of commercial societies. A high level of morality might be required for people who maintain the system, which would be a natural outcome by the time they reach there—"a great man does not seek to lead; he is called to it, and he answers" (Dune, 2021). For the average people, they only need to be good at what they specialize in this system. Thus, the taxing unrealistic morality in the ancient civilizations (e.g., ancient Chinese, Christianity, or Victoria moralism) would do not exist, and a well maintained system would solve the self-perpetuation part of the problem. Meanwhile, because no coercive control exists in the system—the organic social system are simply superbly efficient market—individuals could do "their own things". The inferior individual creations would die out on their own, and the superior ones ultimately would end up becoming a part of the system—this statement is derived from the standpoint in section 3.4.3 that a more complex system is more powewrful, and sustains itself for a longer timescale.

As discussed in section 3.3.5, humanity never settles. This more complex, powerful, sustainable social system derived from the organism intellectual system would naturally lead to the next item in the never-ending diachronic project of humanity: an interstellar species. Before the emergence of multicellular organism, the ocean might look rather lifeless. This might be the situation of our currently observed universe: the organisms of the human size are like bacteria in the ocean, and the activities of bacteria are restricted in the

spatial range where geological forces allow. And the emergence of large complex cooperative system of cells, such as the system known as a fish, enables the collective of cells to move allover the ocean. A complete form of the organic society would acquire the ability to terraform planets—one of the first problems it needs to address before such a society emerges is the climate change, and this is actually what an organism at a planetary scale means for. It is probable that there is only one form of intelligence, a feedback-control loop composed by biological circuits that compute a gradation of coarse-grained variables through adaptive-symmetries breaking, and the coarse-grained variables are surrogates to fitness. The millions of life forms, including nervous systems, are different ways the symmetries break. Understanding such intelligence would set mankind on its way to understand ecosystems, and thus to reproduce the feat done by early life forms to terraform Earth. And when that feat is achieved, we are well on our ways to terraform Mars, and further beyond the universe at the timescale of millenniums.

This vision has been seen by the Carl Sagan, the missionary of science, who we quote below.

> That' s here. That' s home. That' s us. On it, everyone you love, everyone you know, everyone you have ever heard of, every human being who ever was, lived out their lives...Every king and peasant, every young couple in love, every mother and father, hopeful child, inventor and explorer, every revered teacher of morals, every corrupt politician, every superstar, every supreme leader, every saint and sinner in the history of our species lived there – on a mote of dust suspended in a sunbeam.
>
> Those worlds in space are as countless as all the grains of sand on all the beaches of the Earth. Each of those worlds is as real as ours. In every one of them, there's a succession of incidence, events, occurences which influence its future. Countless worlds, numberless moments, an immensity of space and time.
>
> And our small planet, at this moment, here we face a critical branch-point in the history. What we do with our world, right now, will propagate down through the centuries and powerfully affect the destiny of our descendants. It is well within our power to destroy our civilization, and perhaps our species as well. If we capitulate to superstition, or greed, or stupidty we can plunge our world into a darkness deeper than time between the collapse of classical civilization and the Italian Renaissance. But, we are also capable of using our compassion and our intelligence, our technology and our wealth, to make an abundant and meaningful life for every inhabitant of this planet, to enhance enormously our understanding of the Universe, and to carry us to the stars.
>
> By the time we are ready to settle even the nearest other planetary systems, we will have changed. The simple passage of so many generations will have changed us; necessity will have changed us. We are… an adaptable species. It will not be we who reach Alpha Centauri and the other nearby stars. It will be a species very like us, but with more of our strengths, and fewer of our weaknesses; more confident, farseeing, capable and prudent. — Carl Sagan, *Cosmos*

If this era ever comes, we might refer it as the **Era of Planetarization**.

4.2 From natural philosophy to science

This essay might be put into the category of natural philosophy, and philosophers do not have a very good record in history for being correct. Their visions led mankind forward, yet such visions were constrained by the philosophers' times. Meanwhile, Karl Marx said, "the philosophers have only interpreted the world in various ways, the point, however, is to change it." The critical problem is how to transform this philosophy into science. In this subsection, we discuss this problem—actually the whole essay is to prepare for this discussion, such that the sentences have a context.

To begin with, we need to clarify what science is. Recall that previously in the introduction to section 4.1, we explain that historian gives vision for the past, philosophers gives vision for the future; similarly, scientists give vision for how nature—which includes societies—works, proceed to investigate and implement the vision, and end up with a system of knowledge. For the general public, and even for many of the so-called scientists today, science is considered to refer to a body

of knowledge, instead of an intellectual system that consists of the philosophy (including ontology and epistemology), methodology, and the body of knowledge discovered by applying the philosophy and methodology. And to explain the significance of this system, we have the whole essay up to now to explain its origin, its implication for civilizations, and the current institutionalization of humanism as a result of the stalled progress of this system.

With these background, we could now finally discuss the intellectual significance of AI and Complex Science: they are the continuation of the unfinished cause of enlightenment that attempt to answer the perennial questions, and ponder the implications of the answers and the future derived from them. The study of artificial intelligence, which includes the pattern recognition and logic inference capability, might be key to understand the informational-computational-physical systems that are known as biotic or social systems, in other words, biotic intelligence. The understanding would enable the understanding of the mind and the scientific management of societies. More specifically, this subsection presents the two speculations that serve as the long-term vision of research:

1. an idea that might overcome epistemological impasse, i.e., axiomization inconsistency, discussed in section 2.3.3;
2. a series of manageable problems to work on and to gather pieces that might lead to a general science of societies, or the proof of the lack of it.

These are the most interesting and important scientific problems, excluding the possibility that inter-solar system traveling could be enabled by advances in theoretical physics, which probably won't happen unless we manage ways to safely utilize energy at the scale of the planets, e.g., nuclear fusion.

4.2.1 Science of mind and the continuation of logic positivism

We have summarized in section 3.1.2, that the humanists' search for permanence failed because it had run up against a very formidable epistemological wall guarding what is knowable and what is not. The confusion of mind is hardly being aware by the general public, who would live on with what workable intellectual systems that best suit their life's situation, and the confusions of scientists have left them without a voice because sociopolitically economicaly they are powerless. This let the default state crept in, and we have discussed the consequences in section 2.1.4 and section 2.3.4. Therefore, if the natural philosophy of humans and civilizations outlined in section 3 is to become a science, the first obstacle is to rework the epistemological foundation of knowing. In this subsection, we would outline the basic ideas, and this could be considered as a continuation of the logic positivists' quest for the foundation of science.

The key observation is that the logic positivists took the logic reasoning in Homo Sapiens as a priori, and started from there to derive the foundation of everything, without understanding how logic emerges in human mind. This fact had been aware by the intellectuals, and the philosophical study gradually expanded to the philosophy of language and the philosophy of mind since 1960s. This start point was reasonable at the turn of 20th century considering that the whole edifice of science was built on formal language, and the mechanism of mind only started to be fathomed physiologically.

However, as our understanding of the complex systems developed, this formidable epistemological wall started to become approachable. In the *Probability: the Logic of Science*, Jaynes (2003) describe another layer of mathematical structure underlying the formal logic, which is probability, and discusses that the axiomatic inconsistency identified by Godel is not an inherent property of the proposition or event, but signifies the incompleteness of information. In this sense, the axioms in the axiomatic system is not a priori, but a set of assumptions that are considered axioms in this axiomatic system. Therefore, the inconsistency that confused Russel and proved by Godel is an intellectual confusion between deduction and induction, and the problem is to understand the inference mechanism underlying the formal system. The inference mechanism is of two parts: the first part is the emergence of assumptions, and the second is the inference from these assumptions. The second part has been solved, and is known as the Bayesian probability. The first part is the currently unsolved part, and is equivalent

to understanding the emergence of worldviews in human minds. This realization essentially pushes the problem further down into the rabbit hole: the inconsistency of logic system is a symptom of our inadequate understanding of human mind.

Throughout this essay, we have used an abstract concept referred as adaptive symmetries to thread the whole narrative, from physics to biology and then to civilizations, and this concept applies to mind as well. Recall that this concept is to generalize the epistemology of physics (see section 3.3.1) to seek a stable foundation of biotic systems that is subject to theorization. This concept applies to understanding nervous systems as well because the nervous system is a mechanism of evolution under the same general principle of gnome-based evolution: instead of relying on differential mortality, where less fit organisms die and more fit organism live, strategies could be implemented as neuron plasticity and be tested out in the life span of one generation. Therefore, to study the epistemological foundation of knowing, we need to understand how logic, which implying reason, emerges from a biotic nervous system.

In reality, the relationship might be the other way around; to see this, we discuss the difficulty of developing a biological science that aims at the solidness of physics. Recall that we have discussed in section 2.3.2 that the physics achieved its solid reputation partly because the timescale of physical phenomena is way too small, and they could be reproduced many times within the lifetime of Homo Sapiens. The situation is very different for biotic systems: evolution is a very slow process; for example, it took perhaps billions of years to evolve a neocortex in mammals, and until now, as least based on the results of current science, we only had one life genesis event in the lifetime of Earth. In other words, for many of the relevant phenomena, they are not possible to repeat through experiments. Therefore, the only possible approach is to run simulations in computers. However, the simulations have the problem of verisimilitude: how could we ensure that the phenomena observed in simulations would occur in nature, given that the situation is much more complex, and a simulation is not possible to identically replicate nature?

Consequently, we need to speed up the adaptive-symmetries breaking process to study biotic systems, instead of slowing it down when studying physical systems. This is where DNNs come in, which we recall is the abbreviation of deep neural networks: DNNs are a serendipitously discovered phenomenological model that is in a position to study the organizing principle of nervous system, and possibly biotic systems. Here "phenomenological" means it has been considerably simplified to only simulate some characteristic behaviors of biotic nervous system. If this sounds not scientific, we note that for the phenomena at people-scale, all existing physical models are actually phenomenological models, both because it is not possible to experimentally measure microscopic events precisely when the scale is too small, or the measurements would destroy the phenomena being measured, and because the observable macroscopic phenomena are actually emergent behaviors where microscopic details stop being very relevant. Thus, the mere fact a theory is based on phenomenological model says nothing about the scientific solidness of this science, and the relevant is whether an organizing principle stably characterizes the phenomena, and is verified by experiments. And the task is to investigate whether the phenomenological model of nervous system would be possible to understand the organizing principle of nervous systems without characterizing all the details. This approaching looks promising because this phenomenological model could process information of real-world complexity—it has achieved human-level performance in object recognition and the game of go, can utter speech in human voice, and mimic writing amateurish novels. The serendipitous discovery of object of investigation is critical in the development of science: without the simple ellipse behavior of planets, there would be no Newton's law; without the simple hydrogen atom, there would no Schrodinger's equation.

Actually, the concept of adaptive symmetries are developed to understanding DNNs in Li (2022) first, and later connected to the development of human civilizations, which meshs the science of DNNs into a larger context in this essay. It is a longer and much more hardcore exposition, and the general idea could be appreciated by a collage of Kant, Quine, and Badiou, though the details more grounds contemporary developments in science that are hard to describe shortly here. Kant made a "critique of pure reason" by distinguishing two realms: the things as they are and the things

as they appear to the human mind. We would never know things as they are, and instead our mind formulate the things in space and time in a causal structure. And in criticizing the shortcoming of logic positivism's goal to reduce phenomena into logic, Quine points out that the reasoning in human mind is based on causal inference in a network of concepts, and is not possible to reduce every case to the conjunction and disjuction of logic statements. And Badiou states that events observed by human mind are manifestation of hidden structures in things as they are. In Li (2022) the training of a DNN (which is a multi-layer network of neurons) is formalized as a statistical-inference process that estimates the probabilities of groups of events in the environment that forms a hierarchy, such that the probabilities of certain coarse-grained events with fitness consequences are estimated and could be used to predict future events. Thus, the system learns a Bayesian hierarchical probabilistic model that identifies the causal structure between a decision and a network of neurons, and between the representation of events in the system and the hidden structure of events in the environment.

Therefore, the science of DNNs would be the step stone to understand the emergence of logic in human mind. In Li (2022), the operation of DNNs is Bayesian inference of a multilayer probability graphical model of DNNs, and thus is logic inference in the sense of Jaynes. And its relation to formal logic is falsifiable science: its test would be building a system that is capable of handling logic problems in real world scenario. And if this is achieved, we would overcome the intellectual wall that blockages humanism, and arrive at an intellectual system, and a world where truth exists.

4.2.2 Science of societies and the continuation of enlightenment

As discussed in section 2.3, the logic positivism movement is a part of a larger movement, the movement of enlightenment, which was the enlightenment natural philosophers' odyssey to build a good society with observation, reason, and experiments, in other words, science. Therefore, the seek for truth is not for its own sake, but to understand Universe, Nature, Human and Society, such that the ensuing human and society conditions could guide our behaviors. A speculative natural philosophy of these conditions has been given in section 3, and its implication to the short term (in the sense of decades) future has been given in section 4.1. In this subsection, we outline the basic ideas that might develop the philosophy into science.

In section 4.2.1, we explain that DNNs could be a phenomenological model to understand the mind, and in abstraction, a DNN is an informational multi-scale network. And recall that in section 4.1.3, we have explained that a society is an energy-matter-information multi-scale networks. Thus, we might speculate that a society is an organism at another scale but under a similar organizing principle where the constituent units are humans. This Russian-doll structure is the characteristics of nature. The best known example is the fractal structure of snowflake, but natural phenomena such as trees, rivers are also of fractal structure as well. More relevant but less understood phenomena are the hierarchical nesting relationship between cells, humans and societies. A human cell consists of around 100 trillion atoms that compose organelles that are constructed and regulated by genes. A human also consists of roughly 100 trillion cells that compose organs that are constructed and regulated by both genes and the nervous system, and the behaviors of the nervous system in the DNN phenomenological model is modeled as adaptive symmetries and their breaking. This layered structure of nervous system on top of genes resembles the layering of commercial society on top of the agricultural society. And what's more interesting is the number of humans in a society now: the number of atoms in a simple bacteria would be less than that of a human cell, and currently we have 10 billion people on Earth. An interesting extrapolation is that when we have a civilization spanned over 10000 planets, the system might look like cosmic consciousness, but this is too far away to be relevant. The more relevant extrapolation is this 10 billion humans might be approaching the formation of a simple animistic organism that would be a multi-scale network. And the extrapolation leads to the speculation that the organizing principle that governs DNNs could also be adapted to govern societies.

To see the connection, we first introduce a branch of sociology that is known as the *middle*

range theory, which is the basic idea underlying the analytical sociology (Hedström and Bearman, 2011), complex social system (Helbing, 2012), social physics (Pentland, 2015) or computational social science (Buyalskaya et al., 2021). Recall that in section 2.3.2, we have explained the healthy progress of science relies on the wise choice of problems that could be attacked and solved. Though serving as the vision that cleaned away the fog, the early positivistic sociology (e.g., the positivism of A. Comete) fell because the theories were difficult to ground on experiments, and thus are prone to over-generalization and are receipts for disasters. The middle range theory opines that to understand social phenomena, we should not aim for grand theory, at least at the beginning, but for understand specific social phenomena. A classic example is the understanding of racial segregation through this approach: it is not because strong racial prejudice that causes racial segregation neighborhood, but the minor preference of people to stay with people who are more similar with themselves, which over a long timescale would lead to racial segregation. This approach works by first identifying the causal root (e.g. preference to live with similar people) that might cause a social phenomenon (e.g. social segregation), then building computer models to simulate the dynamics. And if the (simplified) social phenomenon is observed in the simulation, then the insights would be transferred to social or organizational (e.g., corporation) policy.

This approach is not difficult to conceive, but its potential only manifests in the recent decades because of informatization and digitalization. More specifically, social science has the same problem of biologic science, the slow timescale of observations and the verisimilitude of the simulation. The timescale of social phenomena lie somewhere between the biological phenomena and physical phenomena: it ranges from decades to millenniums. Therefore, the practice of sociology was like pre-Enlightenment astronomy: it would take decades of persistent observations to gather data such that they could be intelligible, and the decades of persistent observation of Tycho led to the Newton's laws. However, as discussed in section 4.1.2, the availability of sensors, the interlink of the society through Internet, and the increase of computing power in the previous decades have qualitatively shortened the timescale to enable experiments at the timescale of months.

Therefore, we have a series of manageable problems to work on and to gather pieces that might lead to a general science, or the proof of the lack of it. To see the generality that might be achieved, we could see how this idea of organic societies could provide abstract understanding of phenomena that resemble the middle range theory, to the societal scale economic theory and to the grand social theory, though one should not expect to find exact correspondence because the problem is approached from a different angle as well.

First, as in evolution, a biotic system first occupies a niche in the environment to self-rejuvenate before it cooperates with other systems to form a more complex system. The organic society speculated in section 4.1.3 would first emerge in societal niches, which are the specific cyber-systems that manage a niche of social system, e.g., traffic, food, energy, etc. The situation here resembles a DNN (though the current technology needs to be reworked). Each region in the city system is a coarse-grained description of the supply and demand of human units in it. The supply from other regions are the incoming synapses, and the supply from a region to other regions are the outgoing dendrites. The supply and demand are perception and actions in a multi-scale network. Therefore, an organic management system in the sense the one discussed in section 4.1.3 would become the infrastructure that manages the energy and matter in the social system. These are systems that operate at the timescale of minutes to hours. A science of the cyber-systems, in the sense of the multilayer causal network of DNNs given in section 4.2.1, could be the start of the science of societies.

Second, when these systems at the timescale of minutes to hours are built, the causal-regulating experiments at the timescales of months could proceed, and build a science of these phenomena—it is like the cooperation of multicellular organism that forms a more complex organism where each original organism is an organ in this new organism.

To see the possibility, we could see the works that won the economic Nobel prize of 2021. Economic problems are a part of the social problems that are context and history dependent, and thus

are difficult to analyze scientifically. And for a long time, the classic equilibrium economics states that raising minimum wage would increase unemployment. However, Card and Krueger showed that raising minimum wage moderately did not increase unemployment in the fast-food industry. The prize did not award to them for the left-leaning policy advocate, but for the causal analysis that makes economics from pseudo-science to science in the sense of observation, reason, and experiments. The basic idea is that the effect of an action (e.g., raise the minimum wage of a control group) is checked against a surrogate of fitness (e.g., unemployment) by isolating the causal structural between them by designing experiments that rule out other irrelevant factors.

The statistical mechanics of subsystems of a society is a multi-scale network where the causal structure between the microscopic actions and the macroscopic fitness could be tracked quantitatively in statistical sense, and thus allows for interventions onto the network structure that could increase the collective fitness. To see this, the influence of microscopic actions is similar to the change of neuron synapse weights in DNNs, whose induced change to the overall fitness could be calculated, which would be a surrogate function that optimizes, for example, the energy used. In a more concrete speculative scenario, suppose that we already have such a system in place, and the energy grid system is interacting with the traffic system, which are collectively optimized to minimize energy usage whose cost is measured by money, then we could trace the energy saved by a particular passenger account taking public transportation and transfer it as cash to that account, or correspondingly penalize a social ID (e.g., social security number, driver's license) that causes traffic jam by breaking the traffic rules. It is unlike the amount of cash transfer could be determined precisely in the sense of physics, but is a process of feedback and control, such that the experiments of intervention would lead to a system with better fitness.

This causal management could nurture a sense of ownership that is not possible through the staircase electricity price or the penalty bills: in the form case, regardless how environmentally aware an individual is, the effort of the individual to save energy is faceless because the energy price is fixed regardless of its effort; and in the later case, it let people be aware of the damage done by a traffic jam to the city system, and also avoids the abuse of power by polices because the penalty bill is based on the actual damage done by that instance. This is a speculative example, but the point is to quantify the informational causal interaction and thus to incentize the behaviors that contribute to the greater good.

To see the potential of this system, the super rich in our current system actually serve a societal function: without the superior skills of them to coordinate and steer the organization, the performance would simply disintegrate—this was the dynamics that led to the emergence of aristocrat, and ultimately kings, in agriculture civilizations. However, the downside is that the performance ultimately exclusively attributes to the executives, which is also not possible without the workers, and in long term polarizes the society and is not sustainable—the kingdoms fell periodically in the past, it simply happens faster now. Therefore, if we could trace a company's contribution to the societal prosperity of a region by raising the minimum wage, which would lead to higher consumption, more investment in education, less crimes and reward these benefits to the company, then the corporation would be incentized to improve worker's life. The hypothetical mechanism works like this. Each corporation is a coarse-grained description of a social group in a multi-scale social network. If a corporation adopts a specific minimum wage, it is an action of the corporation on the workers, which would in turn becomes the action of the workers on the others, manifesting as contributions to the commercial economy (e.g., buying more products, which are actions again). Then, the contributions of the corporation' action to the collective production of the society would be tracked, the resulted production gain could be calculated, and traced and rewarded back to the corporation. This could be understood as an upgraded tax, where the benefits of contributing to the public good is rewarded back as money instead of taking away as tax, which could incite disgruntlement, and lead to all kinds of behaviors that evade it.

Overall, the idea is to increase the organicity of the system through an tightly informationally coupled system (which would be a multi-scale network), such that participating in the greater good is beneficial, which is only true in a very

long timescale currently—this could be seen very clearly in the problem of climate change—and only starts to become possible because of the decrease of social changes' timescale. It is through this enactive system, a science of society could be built—enactivism is a position in cognitive science that argues that cognition arises through a dynamic interaction between an acting organism and its environment, and it claims that the environment of an organism is brought about, or enacted, by the active exercise of that organism's sensorimotor processes.

Lastly, we clarify the possible confusions that this possible science of society might be too macroscopic because it only provides analytical insights in term of the raise and fall of civilizations (cf. section 3), or too shallow because it does not have no say about the social and cultural norms, and political systems. To clarify this confusions, we need to clarify what they are under this intellectual system.

First, the legal, cultural and political subsystems of the social system are emergent constraints during the self-rejuvenating process that operates at different timescales. To see this, we might compare it with the social action theory of Talcott Partson, who discovered that a society could be intelligible through the lens of individual actions under the system constraints that we know as the economic, political, legal and cultural subsystems. There are many further developed social theories after and an elaborate analytical instruments within Partson's theory, which we do not have the space and time to discuss. However, if we zoom out the timescale, we might speculate that the subsystems of a society are constraints within the social system developed over different timescales: the economic subsystem is developed at the timescale of decades to utilize energy and matter such that the system could self-rejuvenates; the political subsystem is developed to resolved the social group cooperation and competition, again over the timescale of decades; the legal subsystems are hard regulatory rules, and the cultural subsystems are soft regulatory rules that are developed over the timescale of centuries to prevent, demote and promote certain behaviors of fitness consequences. Consequently, these subsystems are the consequences of the breaking of adaptive-symmetries on how the reservoir of energy and matter is utilized, and could not be predicted precisely in advance, but are emergent behaviors over different timescales, though it does not mean we could not reason its qualitaive form, but this would not be discussed here.

Second, the raise and fall of civilizations is the temporal coarse-grain effect of the multi-scale network that collectively optimizes the fitness of the whole system, which we have referred as the social system. Roman was not built in a single day, and it also did not fall in a single day. The health of a civilization boils down to the diligent maintenance of the social system daily. Thus, the macroscopic observation implies that we need to keep the self-rejuvenating process of the system on a day-to-day basis, which is a quite cliche but timeless conclusion.

To conclude, if this characterization of social system is directionally valid, at the end of the day, we might only have an intelligent system that could be used to manage social complexity such that the self-rejuvenation of the social system would continue, instead of an overarching social system prescribed by the science in the sense of the Newton paradigm of science where everything is deterministic given initial conditions. This long term unpredictability is a likely a consequence of the chaos phenomena in nonlinear science: small perturbations in the initial conditions would cause radically different outcomes; or using the classic example, the adaptive symmetries breaking of the swing direction of a butterfly's wings would cause a tsunami at the other end of the ocean. To manage this complexity, complex biotic systems evolved a feedback-control mechanism, where the local linear change behaviors (e.g., the gradient descent in DNNs) are guided by the feedback signals of the environment, and the systems behave seemingly teleologically—this is the fundamental idea underlying Cybernetics.

In the end, to avoid leaving the impression that this intellectual system is all about disinterest scientific experiments and theories, we note that this system does have a fundamental implication: progress does exist, which refers to a more complex society that moves towards greater good discussed in section 3.4.3. And it provides a directional guidance on our action: are we going to evolve to be a cooperative species that would reach the stars, or are we content with our tribal instincts, claiming who is superior and fighting in

the mud. Or put it more dramatically, using the metaphor of human lives:

> I guess it comes down to a simple choice, really: get busy living or get busy dying. — Andy Dufresne in *Shawshank Redemption*

4.3 Miscellaneous issues: singularities, privacy, and unemployment

This organism conceptualization of societies might get on the nerves of many, but that is mostly because organisms are misunderstood, and get linked with the wrong metaphors or phenomena in the history of ideas. Therefore, in this final subsection, we clarify some of the issues that are the most confusing: intelligence singularities, organic management and privacy, and finally automation and unemployment.

4.3.1 The impossibility and profundity of intelligence singularity

Intelligence singularities that are exponentially smarter than human intelligence will not happen at least for decades, and perhaps forever. But the root that causes this speculation is perhaps as profound as the one that ultimately caused the Newton paradigm at the age of enlightenment. We outline the basic idea here, though the argument is inadequate, needs to be more substantial, and dedicate attention of its own.

The worries of intelligence singularity is a manifestation of classic phenomena in the history of science, that in the early stage, people do not understand the problem, and are yet to get the definition right. People seem to confuse intelligence with the ability to come up with genius solutions to problems in an instant, and a classic example would be the public perception on how Einstein discovered the theory of relativity. However, this is *not* how genius worked in history. Edison said that genius is one percent inspiration and 99 percent perspiration. For every marvelous breakthrough in the history, there were decades if not hundreds of years history where forerunners gathered empirical data, built the instruments, and pondered all kinds of hypotheses that were increasingly close to the ones used nowadays. And only the last one that synthesizes all the efforts was remembered and hailed as the genius in the general public. Translating this phenomenon to a biological and computer-science language, an organism builds coarse-grained descriptions to interact with environment, which is the intelligence definition in this essay, and without environmental feedback, the problem is NP-hard, and thus no matter how fast the computing speed is, it could not grow exponentially simply because of the energy and heat constraints. Then, the complexity of the environment puts a cap on the complexity of the organisms.

The speedup of the technological development is a result that leads to the social-system transition discussed in this work, where the interconnections among all segments of the society would lead to the emergence of organic society, and when that happens, the exponential speedup would stop, and the change rate would maintain at that level, because the exponential speed is a result of modernization that recruits people in an exponential speed, and when everyone is onboard, the process would not keep accelerating exponentially, and we would enter another era where the social system progresses linearly. In addition, it would be capped by the current complexity of the civilization. This happens for every major innovation in the evolutionary history.

However, it is possible that intelligence that is linearly superior to average humans, in term of IQ, could be built. This alone does create serious ethic problem, and perhaps could be a paradigm shift in the worldview of Home Sapiens as profound as the shift milestoned by the Newton paradigm. This is considered a serious future problem, and currently the basic idea is that this is an already scenario in the Earth ecosystem: IQ is not everything, and it is the cooperative among bacteria, plants, animal and humans of all kinds inclinations that make the system work; if we have built human-level intelligence, it would be very like a human, because the cold rational terminator-like robots cannot handle real-world complexity because the problem is NP-hard, and the behaviors and emotions of humans are approximate solutions to those NP-hard problems. The scenario would likely be a human-machine symbiosis, in a way similar to how humans now live with technologies. People get scary over the scenario mostly because they do not

know what they really are, and if they know, they might also be scared of themselves as well, at least at the beginning—this was the shock, in all kinds of versions, that came to every philosopher in history, and had led to the ancient Greek inscription, "Know Thyself". We just have our turn now. To quote Geoffrey Hinton,

> We're just produced biologically. Most people doing AI don't have doubt that we're machines. And I shouldn't say just. We're special wonderful machines. — Geoffrey Hinton

4.3.2 Organicity, privacy and the avoidance of surveillance societies

The organic society described in section 4.1.3 requires digitalization of every aspect of our society, and it has the problem of privacy. In this subsection, we clarify that privacy and this organic society do not fundamentally conflict, but still the tension between them should be judicially managed and is also a future problem that needs its own dedicate attention.

First, the statistical nature of the organic system implies that anonymity could be a builtin characteristic of the system. In section 4.2.2, we have briefly compared the speculated science of societies and the preliminary science of DNNs, which currently is in the form of statistical mechanics. And in a statistical system, the behavior of a single unit does not matter very much, and it is the aggregated behaviors of a huge number of units that matter. Meanwhile, there are many subsystems that interact with one another, and each subsystem only requires the information of a facet of social behaviors. Therefore, individual and inter-system anonymity could be a builtin characteristics of the organic society, though achieving it requires judicial design.

The current invasion of privacy from the big tech companies are more because of the illness of the current fetish capitalism, than the illness of the technology. The motive of the product design currently is to extract as much as profit, and without a clear guidance for social good, such motive could degenerate—and this is what is happening to many companies—into the exploitative behaviors that gather as much as information about users as possible. These data help the product manager to understand users and thus could use that information to improve products for profits. This is an avoidable scenario, and is getting fixed as people are more and more aware of what is happening.

In long run, information is power, and thus if an organic society would be built, it must distribute the power to every stakeholder in the system, otherwise, it would degenerate into surveillance society, and conflict would bring down the society one way or another.

4.3.3 Unemployment and management of social transition

The massive automation that leads to organic system would surely displace many jobs, and without proper management, society would collapse as a result of conflicts as well, and this is already happening. In this subsection, we briefly outline the basic idea why this would not necessarily be a catastrophe, but a transition that needs to be managed. Again, this is mostly an unsubstantial discussion, and is more about clarifying the issue.

First, the transition should focus on the priority that needs fixing, instead of disrupting sectors that work relatively well. In the language of adaptive symmetries, though the situations depend on nations, most of the elders in our society are already broken symmetries that were born into a world where simple-mindedness sufficed for a repetitive job. They are probably not able to handle the upheaval brought about by the social transition, mentally, physically, socially and culturally. And they serve a social function that preserves the social coherence by maintaining the family structure, e.g., taking care of the children. Therefore, we should not upset existing social order too much by introducing new technologies into them, except that it is already a social problem. That is, the pace of social transition needs to be managed, or slowed down, if necessary.

Second, for the people who are willing to learn—that is, there are still intact adaptive symmetries in them—they need to be re-skilled. The automation would not happen in an instant, and in reality, would take decades. Thus, there are still many parts of the system that need human labors.

Existing workforce should be retrained to interact with the new systems, and this should be a goal when designing new technologies.

Third, centers or megacities could be designed to develop the new technologies and the ensuing new organic social system—that is, new reservoir of adaptive symmetries. It would attract people who understand the transition, provide places where the new systems could be experimentally tested, and do not disrupt the old way of living. However, when the system sufficiently matures, an adapted version should be ported to the older places to avoid polarization of societies.

Overall, the discussion here is rather handwavy. The implementation likely needs deep and extensive social analysis, and the orchestration among governments, private sectors, nongovernmental organizations, and universities. This is currently beyond the scope of this work.

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