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The Driving Forces of Human Society Main Transitions

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Abstract. The four main steps of human evolution: hunting-gathering, farming-livestock herding, industrial era and conception era are considered here as distinct phases parted by dynamic phase transitions. Comparing these social phases enables us to deduce the driving forces occurring during these transitions. At each transition the laymen lost some previous advantages, these losses had to be balanced by some counterweights, the transition driving forces. For instance, the first transition is shown to result from an equilibrium between efficiency and power, social partition and religion. Other transitions are similarly analysed with evidence for driving forces leading to deep social reconstructions.

1 Introduction

The complexity of the objects which are considered in physics, particles, atoms, molecules, grains, is quite different from the complexity of human behaviour and of collective human behaviour. Moreover, there is no equilibrium at all in human society. Human society can change drastically and also admits coexistence and vicinity of completely different social organizations, i.e. phases in the terms of physics. However, when looking at the four main steps of human society evolution: hunting-gathering, farming-livestock herding, industrial era and conception era, the differences in life conditions are so huge, so obvious, that these life conditions can be analysed in simple terms and that the driving forces of these transitions can be understood.

The partition in three or four phases of human society has been largely developed by the specialists of "World History" or "Global History" [1]. The origins of such a holistic approach of our history are very old [2] and have been largely revisited since that time [3]. A basic point about their differences was already studied a long time ago by Ibn Khaldun (1332-1406) [2], about the first transition, i.e. between hunting-gathering and farming-livestock herding, the only one at that time. Ibn Khaldun compared the society based on hunting-gathering, H in the following and the society based on farming-livestock herding, F in the following.

The permanent search for new food forces H to move with a consequent nomad life. Such a nomad life restricts the size of this moving community to a small mobile tribe. At the contrary the more or less regular production of food from agriculture forces F to stay with a sedentary life in well-chosen optimal sites with both water and rich soils, i.e. close to large rivers. The large production of agriculture suffers from many causes of strong fluctuations, climate variations, storms, insects, epidemics. These fluctuations as well as the necessary time for growing from seeds to plants and fruits lead, F to the necessity of large food stocking barns. These stocks must be saved within stable buildings and protected against thieves. So, F leads to a complete heavy social organization in villages with farmers, builders, soldiers, hand workers producing the required tools for so different uses. A high level of language is required to communicate between so many different workers. Moreover, these specialized works must be understood and practised. So, schools were necessary for these different learnings from the very beginning. Practically it means that F leads to a full city organization as observed in a "roman villa".

At the opposite H is organized in independent tribes of a few tens each, as observed by ethnologists about such tribes still existing [4, 5]. The differences between H and F are obviously quite strong and numerous. So, the transition between H and F cannot be reduced to a mere change. This so strong social transition deserves full attention.

Other similar strong transitions occurred later among human societies. They deserve also to be considered as phase transitions from the same reasons as for H-F since they involved a so deep change in human life condition. The understanding of the main lines of development of such transitions, of their driving forces which can be deduced from the detailed balance between these statuses is the goal of this paper. So, it is convenient to shortly introduce these different "phases", after looking at their rather continuous way of occurrence.

The development of sciences and techniques was already a necessary tool for H, with the knowledge of wild edible or inedible plants, as well as the progressive learning of improved hunting techniques. Such improvements followed in a rather continuous way. The transition from H to F, i.e. mastering the way to use good seeds and mastering the choice of domesticated animals, occurred also by steps, especially with the introduction of new domestic animals from their usual living places to new

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other ones. Such progresses followed a more or less continuous way, with numerous improvements such as the different uses of land set-aside [5] according to local optimization trials. The development of sciences and techniques was always useful. It opened new opportunities for social organizations.

In the transition from F to industrial era, I in the following, the part of sciences and techniques was also essential for this creation of new opportunities. Numerous main progresses within the long F era occurred by transmission between different societies through trade exchanges and through invasions. With such ways, there was a rather continuous exchange between Europe and Asia mainly by terrestrial ways. The necessary fight against Moroccan invaders from sea led Henri the Navigator (1394-1460) and others to develop ships such as "Caravels" which can face the most serious storms without real trouble and so, can reach finally any place on the sea, in the world [6]. This very decisive step was soon followed by a full series of discoveries of unfound lands, continents, "A new world". The discoveries of new civilizations, new foods and large amounts of materials like gold or silver completely shifted the European equilibrium in favour of the new emerging Southern nations Portugal and Spain.

This sudden accumulation of rich newness later obliged people to change even their minds and uses, with a real hope which was put on scientific and technical research. Even philosophy was reached by this wave of new thinking with the coming soon of the enlightenment shortly after the Spanish "Golden Age" which was directly issued from the discoveries. This enormous intellectual activity was later followed by a complete society change with the developments of the beam machines which brought a large disposal of energy for all uses, under the condition of coal mining. These new possibilities allowed to induce the social transition from F to I, the industrial era.

The next society transition is coming now under the simultaneous influences of an easy and fast communication with everybody anywhere, of a dangerously increasing pollution and simultaneously of an expected lack of mineral resources which follows the full development of the industrial era I. In this coming conception era C, anything can be conceived and discussed with anybody anywhere, but the full realization of this concept must fulfil rigid constraints about pollution and mineral resources. The new global character of C at the world size means a full transition.

This already classical picture of the four states of human society shortly introduces the real points to be analysed here. What are the advantages and disadvantages of each of these states for the layman? And how these disadvantages could have been circumvented in order to stabilize the emergency of such states? These questions are still open, but the main goal here is to introduce this transition problematics with the beginning of an answer for each transition. The basic tool for this analysis is a large scale view, a coarse grain approach, which enables us to just focus on the main differences between these civilizations.

2 The H to F transition.

The advantage of the farming-livestock herding F over the hunting-gathering H is obviously the great increase in food production since hunting and gathering are still occurring within F and that agriculture and cattle can provide a considerable amount of food, quite larger than that just taken according to H. And the general and obvious result of the transition H to F is a change from a small nomad tribal society to a large collective sedentary society which can be fed by this considerable amount of richness [2]. This is a collective view.

At the individual level, for the "layman', the result is different as observed in tribes still living according to H [4,5], with an obvious happiness and with a real art which is discovered now in many museums devoted to primitive arts [7]. For these H tribes the amount of work needed for collective survival is about 3 hours a day per working people, leaving a large place for other cultural centres of interest such as art. This ethnological observation [5] is confirmed by many simple facts. Gathering mushrooms or fruits in an unexplored rich part is easy to perform, as well as fishing or hunting. There is also the pleasure of the discovery and of the observation of nature in its wildness which makes this activity an easy duty. These observations easily confirm the ethnological feeling of a rather happy life in H.

As a result of this old H happiness, the collective memory of the hardness of the transition from H to F and of the loss of these happy days, is deeply felt everywhere. Numerous traces of these mythic days are still obvious. The garden of Eden, or the garden of Hesperides keep the trace of this Golden Age H. Similar observations result from the numerous representations of trees of life, full of fruits, birds and animals, in Latin America as well as on oriental carpets or on prime arts. This H way of life was obviously thought as one of full happiness, of easy life, even with risks. This reference was opposite to the next status: F. And this strong opposition was the reason for this deep mythic memorization.

The life condition in F is sedentary since workers are linked to their cultivated land by necessity. Animals require a regular care and an everyday help. The time spent in farming works varies strongly with seasons, so a direct comparison with the time spent in H cannot be done. As already noticed before and well observed [2], F requires a strong collective organization in cities and an urban organization with many tasks. So, a more or less heavy occupation time occurs for average people, with some specializations and a natural feeling of the loss of free time and for some of them of the loss of a direct contact with nature.

Because of this heavy work constraint for most of the population, the opposition to this new way of life must be balanced by some stabilizing action introduced by the

active leaders of such a change. Since this transition occurred in many places at quite different times, the overview of "Global History" enables us to observe the large variety of means that helped these leaders in achieving this basic goal. Of course, brutal force was a means, with soldiers, "knights", in a distanced way [8], for inducing such a transition. But such a brute force cannot occur alone during a long time without rebellion, other better persuasive means were used for that purpose. On one side religious feelings were useful for people to agree with this new way of life. For instance, the fear of the unknown, the mythic "snake", which was already present in H as a permanent danger, helped to stabilize F. Another useful trick was linked to the necessary specialization which occurred in F. So, the partition into working casts also helped in stabilizing F, in India for instance [9]. These two tricks were associated together in different ways. Some F societies are known to disappear by themselves after a more or less long existence, as some Maya civilizations [10]. This is a proof of this deep general instability and of the care needed for stabilizing F. This transition from H to F took time, more than centuries.

The difficult stabilization of F gave a considerable weight to soldiers, "knights" in a mythic view, and to social organizers, "priests", so to call them, who played both with fear and with hope in order to organize a consistent society. Knights and priests are the words used by specialists of middle-aged history [8,11]. It must be added that this long-time transition occurred in many different places. This long and large extension with numerous local versions enabled the so-called "priests" to mix experiences from different eras and different places in order to find some optimal convincing arrangement in a more or less common "religious feeling". Numerous studies evidenced such long-time efforts to develop a common, worldwide religion in some sense, even if local roots were strongly different from one place to another one [9]. Finally, from this long optimization process, a rather stable solution appeared.

This is a rather unexpected result of this short analysis: religious feelings which are already common to H [4] because of the necessity of facing an unexplored hostile nature, appear as well as work specialization as the main stabilizers for F. These extended religious feelings, including different local shapes, are the main social bricks of F. This complex and locally variable religion leads to a social organization of F with priests and knights naturally located at the top of the society [8, 11]. So, during the later human society evolution, the part of religion which is so directly connected to the stabilization of F becomes questionable when the society model becomes no longer F but I or C. In other words, religion has been contingent to F during thousands of years. Even if the natural optimization process of religions ensures them some adaptability as social institutions, religions remain strongly and definitely linked to F and its social organization.

The next question to deal with is obviously the life conditions with I or C, more exactly the differences in life conditions between F, I and C. As already noted here, the life conditions to be considered are not that of leaders, which can easily manage themselves in order to enjoy a favoured life condition in any society, but these are the average worker's life conditions. The changes of the layman life during social transitions are interesting for that study. The effective leaders of these transitions, the generalized "knights" and "priests" must be able to realize these changes both on basic conditions and also on human and social transitions in a new equilibrium.

3 The F to I transition.

The life conditions of both F and I evidence for strong local and temporal variations, since the transition from F to I took place through several centuries, with a localization which was far from being uniform. So, here only the general tendencies can be focussed for both societies, beyond nations and centuries which appear here just as local variations within a global evolution observed at a coarse grain level. This very coarse grain approach softens most of the irregularities within such large statistics. So, only main features remain.

For workers in F, the contact with nature remains quite strong, even if some specialization occurs, nature stays quite close, in the farm and around. The basic agriculture work is far from being uniform or monotonous during the whole year. In spring and summer, during crops, a lot of work must be done in a hurry, while during the rest of the year, agriculture is just a part time work. Other works in F follow this seasonal rhythm with a few intense times followed by rather long less intense ones, even with nearly no work at all, but just survey, during some periods. This time schedule was a good opportunity for introducing locally complementary artisanal works in order to produce improved necessary tools for agriculture and livestock or everyday life. For instance, flax culture was useful to produce everywhere clothing with the help of local work. Such processes of complementary work occurred rather early on a very local level with a resulting nearly autonomy of each village [12]. So, the farmer work was quite diversified and open to many techniques and thus, more generally to new techniques. This ability made the first steps of the transition to I rather easy ones.

In the industrial era I, main attention is devoted to mining and industry, which are practised on a large scale with the newly powered engines. There is nearly no seasonal effect for such productions. So, I era induced permanent works, more regular work than F, also with the danger of a full-time specialized employment without any leisure time. The model to come for the civilization I of mines and industry was that of large factories and so large towns, with a more collective life for workers in cities than in F villages. This large-scale effect of industry and cities means strong investments and so powerful investors. For the workers this new era potentially created a conflict with

these new investors and managers, because of this strong social change from land and country to cities, from nearly independence and freedom to a quite dependent status, from agriculture to industry. Naturally industrial workers organized themselves in labour unions in order to face this potential conflict. So, instead of knights and priests, the social organization in I belongs to "investors and managers" on one side and to "labour unionists" on the other side. The effective goal of this completely new team was to reach a practical social dynamic equilibrium between apposite partners.

Another main point must be underlined in the transition from F to I. In F, workers have a permanent contact with nature in its different forms, while in I, because of industrial specialization, high schools are necessary in order to learn how to work optimally in these new factories or mines [12] and finally the traditional link with nature is nearly lost. There have been many social ways of reintroducing such contacts such as the creation of worker gardens or the starting point of tourism with the connections to sea and mountains by means of railways [12], but this loss was deeply felt, and a resulting lack of equilibrium occurred at many internal levels in mind. So, the emergence of psychoanalysis [13] was one of the cures which were necessary to balance such a lack of a direct contact with nature and the different psychologic shapes of disease which result from this lack in a highly differenced industrial society under severe constraint.

The complete change from F to I induced also a deep thinking about this transition. This intellectual activity reached philosophy, arts such as literature or music or painting as well. On one hand this new situation was appealing for creation as a mirror of this new state of life, as a help to process with it. On the other hand, a large lot of educated people were ready to enjoy this new "Golden Age of culture" which was open now to a large social class which could observe itself in this mirror. This new way of life gives a strong place to a new man, a hero, investor or unionist, main actor of this new life. In arts, this is the appearance of Romantism, everywhere, with also a revival of previous authors like Shakespeare for instance who felt in advance such a reality. Numerous studies are devoted to this deep change in the world of art and culture and to its future evolution [14-16].

A new feature of I is its relative delocalization, its abstract nature while F is strongly linked to land and to its specificity. Mining is located in places without any social history, and industry has no strong obvious localization. Industry is usually located close to cities which can use these products, i.e. old traditional cities, as well as new mining cities or cities well connected to other centres by railway and roads, and finally it can be in any place [12]. This lack of natural localization induces the possibility of a choice, a severe competition between potential sites, between industry owners, i.e. between society leaders, heroes of this transition. This competition spirit reached early a very high level since investors and managers have no real history, no past, no strong links, they just play an efficient game. Everything can happen. With such a large freedom, competition, concurrence lies everywhere, fighting spirit dominates. Quite obviously, modern sports also appear at that time simultaneously with the development of industry. Multi faced heroes appear also with fears since generalized competition can lead to more active and dangerous processes.

A main step in the evolution of this competition spirit was the search for all kinds of mines everywhere in the world. And colonial wars soon happened as a finally rather common way of taking the potential mining richness of less developed foreign countries. Then the competition between industrial nations increased and occurred at such a high level in a next step about mining and also industry. Well-developed industrial nations tried to extend their leadership even upon industry on neighbouring countries, which seemed less developed than them. The climbing process of competition did not stop. These local wars were soon followed, in a next higher step, by world wars, since industrial nations easily found friend nations as partners to share their interests, against other ones, even up to wars. So, the limits of such a war extension were easily reached, with a catastrophic result in terms of human losses, with the awful development of new efficient weapons. This terrible result stopped for a while such open wars which can reach anybody. Then the competition was restricted to a cold war, spying information, with high tension.
During this evolution, just as before in the F to I transition, the development of sciences and techniques was a quite useful tool in this neither achieved competition since it brought new powerful opportunities for all partners. Of course, with the competition spirit of I era, which can be also observed in sport, an invention of I, the development of sciences and techniques was also a key for the future, and natural limits are approached now both from the point of resources and of pollution.
The new conception era C must take care of these strong limits in earth richness in pollution, even if each idea can be easily realized because of the high technical level which is reached in so many countries and of robotization. Real action is becoming dangerous because of these easily reached limits.

4 The I to C transition

From the natural extension of the previous chapters, it sounds clear that the leadership of the new C society will be shared by "investors" on one side and on the other side by "warning people" who will try to define a safe future for mankind. Once more a new class of human leaders is appearing in this series of transitions, in a regeneration process. And new problematics appear.
From the experience of the I civilization and its last trends, it sounds that the number of large factories must be quite restricted in C and that quite numerous more or less independent creation units must appear, with coordination for information and for founding. Silicon Valley sounds as an example of such a creative area with a corresponding

new architecture and urban organization. Information is propagating faster and faster in a nearly fully connected world. In such a way, new events are early anticipated, and risks reduced. Since, in this coming C society common information reaches a high level as well as risks, it can be deduced that real action will be going slower for taking time for safety. Leaders will wait for general agreement between quite numerous partners before acting. That means a high level of fluctuation to come in this near future and so a general slowing down in spite of a fast information!

The recent pandemic story of coronavirus provides a good example of the new civilization to come. A very fast propagation of both disease and information occurred. As a result of confinement, a deep behavioural change happened at all levels with for instance a strong questioning about the common use of travels, the new revisited nomad life of H! And a new computerized version of homework, which was the common use of F reappeared! In other words, the tracks of the previous civilizations remained still vivid and could be quite useful to face the future. In this Darwinian approach, the richness in possible states, in possible behaviours is required. So, the memory of previous civilizations can be useful to diversify the possibilities of the future.

5 Conclusion

As a conclusion of this short synthetic view, it seems that a simple global view is reached here, while infinite variations occurred in real history [16]. This is the advantage of this very coarse grain approach to forget so many details which were so crucial in reality. So, this long-distance approach based upon the physics of phase transition experience opens the way to such coarse-grained approach in other fields.

Let us recall briefly the main results which were obtained here from this simple approach. First, religion and its so numerous variations was proved to be strongly linked to the stabilization of F civilization. This contingent situation is clear and gives a strong limit to religion, even if religions have been still active as social institutions through many other situations. Knights and soldiers were the other basis of F.

Similarly, labour unions and psychoanalysis are demonstrated to be strongly linked with the existence and development of I civilization. And I civilization is the fruit of investors and managers as well. The competition spirit which was developed in I reached a so high level that so many sorts of fights and wars occurred everywhere.

It seems rather early to find the same leading structure for C civilization, but warning sounds already to be a major theme, with both positive and negative actors, i.e. creators and people who feel the dangers of such creations.

Another interesting result of this approach is the evaluation of the part of sciences and techniques in these different H-C civilizations. Sciences and techniques have been seen to have a crucial part in the development of each civilization and also of transitions as basic tools for a social reconstruction. Sciences and techniques open new possibilities which are useful for the development of civilizations as well as for their transitions. But the main choices of orientation remain in the power of social leaders which are more or less aware of these possibilities and manage them in their own way. For these different civilizations, these leaders also change, tribe leaders in H, "knights" in F, "investors" in I. Such strong changes are characteristic of phase transitions. This remark validates the method used here.

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