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Groping the next stages of technology development & human society:

A metaphor from an Iranian poet

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Abstract

So far, the human society has experienced four stages of development namely: Hunter-gatherer age, Agricultural age, Industrial age and Information age. Many researchers have tried to explore some scenarios to envision where human being is going in the future but the question is still unresolved and there is no unique answer. This paper aims to probe the next stages using a metaphor of an ancient Persian poem from Attar Neyshaburi (that is one of the famous Iranian poets and mystics, lived around 13th century A.D.). In this poem, Attar argues that the wayfarer must traverse seven valleys to achieve perfection. In this paper, it is hypothesized that these valleys could provide a fruitful source of vision -as a metaphor- to think about the evolution of human society. The results suggest that the next three stages which human society would experience might be: Technological convergence age, Intelligence age and Post-humanity age. These results could be helpful in providing vision for the process of technology policy design and social development.

Keywords: Human society; technology development; future waves; metaphor; Attar; Simurgh (Roc).

1. Introduction

Although forecasting the future of human society is an appealing topic, it seems to be unreasonable to address it as a whole in one paper because of its diversity and complexity. Thus the solution could be abstraction. Any discussion about the future of human society is about its important aspects, which affect some limited features of the life [1]. In fact, futures studies try to make an integrative ‘big picture’ by thinking about trends and visions of probable, possible and preferable future [2].

Hideg (2002) categorized futures studies into two main paradigms including [3]:

1. *Evolutionary futures studies*, which believe in the difficulty of forecast because of the uncertainty. This paradigm tries to examine development trends and their completion in order to develop some subjective visions of the future. This approach provides its own snapshot of the future and allows other scenarios to develop their own interpretation on how the future unfolds.
2. *Critical futures studies* hold that future can be interpreted as something that already exists in the people’s thoughts and emotions. This paradigm distinguishes different time categories including the sequence of past, present and future and claims that the future shapes the present through anticipation.

In this paper, from an evolutionary point of view, we have used a metaphor from an ancient poem by Abū Ḥamīd bin Abū Bakr Ibrāhīm, also known as Attar (born 1145 A.D., Died 1220 A.D.), a famous Persian poet and mystic. His words express the sublime essence of more than

5000 years of Iran's history and mysticism. In his book, – *The Conference of the Birds*- Attar used the story of birds as a symbol of humankind's efforts to achieve perfection. He used a symbolic method for presenting his thoughts in order to make it easy for illiterates to understand the implied ideas in his poetry. We have taken Attar's seven valleys of love –which a wanderer must cross to achieve perfection- as a metaphor for technological development, which human society has experienced or might face.

To do so, the rest of this paper is organized as follows:

In section 2, the existing literature on studying futures using metaphors is reviewed. Furthermore, some explanations about the “*conference of the birds*” are presented in this section. Section 3 is dedicated to linking the valleys of love to the states of human society. To do so, 7 tables have been used. Inside these tables, firstly a brief introduction of each valley is presented. Secondly, the existing literature about the relevant wave of human society is reviewed. Furthermore, the similarities between the valley and its corresponding technological state are described. Section 4 concludes the paper and introduces the technological aspects of proposed next the state.

2. Research background

In this section, some previous works on the usage of metaphor for futures studies are presented. Afterward, we present a brief biography of Attar and an introduction to his great book - *The Conference of the Birds*.

2.1. Studying the future using metaphors

Among different ways of analysing the future, one way is providing prospective and desirable images that steer stakeholders' actions and interactions. Vision assessment, science fiction analysis

and metaphor assessment are the main methods in this type of future investigation [4]. Metaphors are used in futures studies in order to help us to understand the main characteristics of the future and obtain an understanding of its complexities [5]. Specifically, metaphors try to explain the relationship between different concepts and entities in a simplified way [6].

Aristotle was one of the first authors who used metaphors in scientific context about 2000 years ago [7]. Miller et al. (2006) described metaphor as “a conceptual system that allows us to understand and experience one type of thing in terms of another” [8]. Hellsten (2002) defined metaphor as “a cross-domain mapping between the source (secondary) and the target (primary) domains” [9]. In this mapping process, some - but not all – features of the source are used to highlight some features of the target using a holistic, abstract approach [4].

Metaphors play two main roles in science and technology context. Firstly, they help the public to understand science and technology characteristics. For instance, people use metaphorical personification –such as it “reads”, “catches viruses”, etc.- to describe and understand the complexities of computing technologies [10]. Secondly, metaphors have stimulating effects on scientific and technological development by providing new ideas, strengthening ideas, helping scientists to communicate more easily and legitimizing the research projects to financial supporters [9]. Klagge (1997) claimed that metaphors can “create realities, guide future action and reinforce experiential coherence” [11]. Finally, Cornelissen (2005) believes that metaphors are capable of sparking productive investigation and leading researchers to discover links that would otherwise remain obscure [12].

Despite all the benefits of using metaphors in technology forecasting, few researchers have used this method in technology future analysis and most of them focused on using metaphors within a discussion around a technology [12].

It is essential to note that there are some traps in using metaphors that should be taken into consideration [5]. It is important to select metaphors, which are appropriate to the situation being described by them. It is also essential to remember that metaphors have some ambiguous meanings: Not all people may be able to gain the same understanding [13].

2.2. The conference of the birds

Born in Neyshabur (an Iran's historical city), Fariduddin Mohammad ibne Attar Neyshaburi, the famous Persian poet and mystic, lived around 13th century A.D¹. His mysticism was very commendable so that Rumi² (one of the greatest Persian poets) says that:

“Attar roamed the seven cities of love

While we have barely turned into the first street”

Attar has left behind many poetic works and "*The Conference of the Birds*" (Manteq At-tair) is his masterpiece. This book is sung in iambic hexameter and is about a journey of the birds for seeking the Master of Creation or Simurgh³ (Roc).

¹ For more information see: http://en.wikipedia.org/wiki/Attar_of_Nishapur

² For more information see: <http://en.wikipedia.org/wiki/Rumi>

³ For more information see: <http://en.wikipedia.org/wiki/Simurgh>

Like a learned guide who has travelled the tempting road many times, representing himself as a hoopoe, Attar guides the birds and points to the stages of the path. In this book, birds are the symbol of wayfarers who are seeking perfection [14].

The Conference of the Birds describes a journey of thousands of birds, which are trying to fly high and high towards Mount Qaf, which was supposed to be the highest peak in the world in search of the invincible Simurgh (the mystical bird phoenix). After much wrangling about the difficulties of the path, the birds set out and crossed the seven valleys of love. At last, out of thousands fowls, only thirty birds arrived at the court of the Prince of the Universe (Simurgh). Here, the Simurgh's herald keeps them waiting for Simurgh long enough for the birds to figure out that they themselves are the Si (thirty) Murgh (birds)⁴. They saw an enormous phantom mirror, which reflected their own image [15].



⁴ In Persian language, “Si” means “thirty” and “Murgh” means “bird”. Thus Simurgh , which is the name of the mystical bird can be defined as both “Thirty Birds” and “Simurgh”.

Figure 1. Si (thirty) Murgh (birds) shape Simurgh

In this paper, the seven valleys which birds have passed are used as a metaphor for characterizing the states, which human society has passed and might pass in the future. These valleys are described in section 3⁵. It is important to note that, in Attar’s book, every valley is described using about 18 verses in average but in the following section, about 3 verses are excerpted for describing each valley⁶.

3. Using the metaphor for groping the future

In this section the description of each valley and its corresponding wave are presented. In order to provide better understanding of the relationship between each valley and its relevant state, we will use a table with two columns. In the left column, we provide a description of the valley and in the right column the characteristics of the corresponding state are presented. Subsequently, we discuss the similarities between the valley and its relevant state.

<p>3.1.1- The valley of Quest: This valley is the first, the longest and the hardest valley to be passed. Attar says that: “When you descend into the valley of quest A hundred difficulties will assail you in that empire; Here for years you must endeavour, you must try Because in this field elements inverted lie ...”</p>	<p>3.1.2. Tribal age: There is no unanimity between archaeologists on the longevity of tribal age. Some researchers believe that tribal age lasts about 80,000 to 70,000 years [16] while some others estimate its longevity between 200,000 to 500,000 years [17, 18]. People in this age were mobile hunter-gatherers who didn’t know how to produce food by domesticating plants and animals. Their tools were made of wood, stone and bone. Gradually, they found out how to light fire, melt metals and produce weapons and they began a trend toward increasing efficiency in technological evolution [19]. This age was the longest and hardest era for humankind [18].</p>
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⁵ Alexandrian’s book (2003) has been used for the translation of verses.

⁶ More information about each valley can be found here: http://chippit.tripod.com/seven_valleys.html

3.1.3. Similarities between the valley of Quest and tribal Age: The valley of Quest is the first, the longest and the hardest valley to be passed. This is a critical phase for wayfarer in his path toward perfection. In this valley, the wayfarer must endeavour to abandon everything in his past life in order to feel the divine glory in his heart. He would be restless until he passes this stage to find his beloved.

The tribal age is also the first, the longest and the hardest period of human existence. People were nomads mobile hunter-gatherers.

In both the valley of love and the tribal age, the wayfarer and the society are at the beginning of a path toward perfection and they almost know nothing about their destination and the path they should pave.

3.2.1. The valley of Love: In Persian dictionary, love means “adhesion to something”. In his *Symposium*, Plato argues that love is the progeny of need. Lovers need to attain what they want or protect what they have. Likewise, Attar believes that the lover only thinks about his love and doesn’t care about anything else. He says that:

“Next the tempting valley of love displays itself
 Whoever enters that field burns in the furnace;
 A true lover stakes his cash and his head
 For union with his beloved and his mate;
 Others are content with another day’s promise to
 wait
 But the lover finds his beloved here ...”

3.2.2. Agricultural age: Following the development of agriculture, hunter-gatherers have been displaced by farming or pastoralist groups in most parts of the globe. Some researchers believe that agricultural revolution began about 10000 years ago in the fertile crescent of Middle East [1]. Durant believed that beginning agricultural activities could be considered as the first social revolution and the dawn of civilization [20]. In early phases of this era, everyone made their own products for their own consumption and there was little or no trading between households. The people transitioned from nomadic wandering and hunting to clustering of villages and developing of social culture. The most important aspect of this era was the dependence of humankind on earth so that the land was the basis of economy, politics, culture and son on [21]. The emergence of Feudalism divulges the importance of land in Agricultural age.

3.2.3. Similarities between the valley of Love and Agricultural Age: In the valley of Love, the wayfarer only cares about his beloved and finds his perfection in attaining the beloved. Since love is the progeny of need, the lover needs to attain what he wants or protect what he has. While others are content with another day’s promise to wait, the lover thinks only about today and attaining his beloved. Note that in Persian theosophy, love is divided into two categories ranging from earthly love to divine love.

These characteristics are consistent with those of agricultural age that the most important aspect was the dependence of humankind on earth so that the land was the basis of economy, politics, and culture. Farmers were mostly concerned about their farms and tried to keep or extend it. They had almost found their earthy love.

3.3.1. The valley of Knowledge: Paths in the valley of knowledge are abundant and because of this abundance, every wayfarer can gain knowledge based on his capacity. No path is similar to another

3.3.2. Industrial age: Commencing in mid 18th century, the next wave described an industrial society where machine expressed its muscles to begin Industrial Revolution and urbanization around factories which

path and therefore, there could be a total difference between the pathways of different wayfarers. Attar says:

“No one can find a fixed road in this place
Because there are many roads and different destinations;

And since many paths the wanderer sees
Each rise as his wisdom guides or foresees;
Each person marches till he attain his own perfection

Yet moods dictate friendship and one’s action ...”

changed the way of life of millions [21]. Many historians believe that the industrial age begins in England and after the invention of steam motor in 1765 [22].

This wave brought machines together under a single roof, called factory and attacked every feature of agricultural era. Standardization, specialization, maximization, centralization, etc. are the most important changes occurred during this period [21]. The growth of scientific knowledge was intense in Industrial age and man felt the thirst for knowing more [23]. In spite of intense scientific growth in some countries (such as USA and Western Europe), many other countries were still in their agricultural age.

3.3.3. Similarities between the valley of Knowledge and Industrial age: In the valley of knowledge, after traversing the valleys of Quest and Love, the wayfarer tries to know more about his beloved and gain more wisdom. However, because of the abundance of the paths, different wayfarers would experience different pathways and everybody would gain knowledge based on his capacity.

On the other side, one of the main characteristic of industrial age is the intense growth of scientific knowledge. After experiencing previous waves, man was enthusiastic to know more about his environment and himself and many scientific trends commenced in this era. Nevertheless, different regions and countries experienced different pathways and while scientific growth was intense in some countries (such as USA and Western Europe), many other countries were still in their agricultural age.

3.4.1. The valley of Independence: After passing previous valleys, when the wayfarer comes to this valley, he feels freedom from everything and everybody but God. In his point of view, the world and its components are very small comparing with the endless magnificence of beloved. Attar says:

“Seven oceans here in one breath turn into a pool
Seven burning globes turn here to a fire ball, the whole;

If a part or the whole system perish here
It seems that a straw is lost in the sphere ...”

3.4.2. Information age: Some researchers believe that this era commenced in late 1970s by inventing personal computers and soared in early 1990s by developing the Internet [24]. Unlike the previous ages, the information age is based on mind rather than muscle and its most powerful driver is information technology. The key characteristic of this wave is flexibility. People can receive goods and services and do their works when they want, where they want and from whom they want [21]. In the Information age, people are becoming independent of everything but connecting to the network. In fact, citizens are transforming to citizens of Networks or Netizens [25]. The usage of Information and Communication Technologies (ICT) is helping the global village to be a dream come true [26].

3.4.3. Similarities between the valley of Independence and Information age: As shown in its name, in the valley of independence, the wayfarer is independent of everything but his beloved. The world and its components are very small comparing with the endless magnificence of beloved.

This is similar to one of the main characteristics of the Information age that people are becoming independent of everything but connecting to the network. They can work, communicate, trade and so on through the Internet

whenever and wherever they want. In fact, network in Information age plays the role of beloved in the valley of Independence.

3.5.1. The valley of Unity: The meaning of this valley is conspicuous in its name. In the valley of Unity, everything comes into one. Attar says:
“When faces are turned to this desert and wake
All heads are raised from a single neck;
If many you behold or few in the valley
They are all but one, they are one wholly ...”

3.5.2. Technological Convergence age: The world is undergoing a global technology revolution - namely technological convergence- at an accelerating pace [27]. Different fields of science are unifying based on unity in nature and we would experience a new renaissance in science and technology [28]. The phrase ‘Convergent Technologies’ refers to previously distinct technologies which are moving toward stronger synergistic combination, integration and unification in order to achieve similar goals [29]. Nanotechnology, Biotechnology, Information technology and Cognitive science (NBIC), are the most popular converging technologies, which are supposed to lead to revolutionary scientific discoveries such as extension of human sensory abilities, expanding brain functions through technical aids, retardation of aging, etc [30]. The convergence of these technologies may result in outcomes, which in performance surpass the sum of their parts [31]. The conjunction of NBIC with developments in mathematics, system approach and computation, lays the ground for the first time to comprehend the natural world, human society and scientific research as closely coupled complex, hierarchical systems. Expanding human cognition and communication, improving human health and physical capabilities, enhancing group and societal outcomes and reaching sustainable development using NBIC tools can be considered as some of potential outcomes of technological convergence [28]. From another point of view, Linstone (2004) believes that the next wave will be Molecular Age, which encompasses the convergence of biotechnology, nanotechnology and material science [32]. He states that custom designed materials of all kinds (such as custom tailored drugs) and extension of human capabilities would be two of the most intriguing aspects of this age [33].

3.5.3. Similarities between the valley of Unity and Technological Convergence age: In the valley of Unity, as mentioned above, everything comes into one and everything is a phenomenon of beloved. This is consistent with the main aspect of Technological Convergence that different technologies come into one to achieve similar goals.

3.6.1. The valley of Bewilderment: In this valley, the wayfarer experiences pain and regret. When he enters this valley, it is similar to a new world for him where he is wondered and bewildered. Attar says:

“Behold! The next is the valley of bewilderment
Here pain and regret ever rave and thunder;
When the pilgrim in this vortex descends
He loses the path in amazement and awe;
He will say ‘I know nothing of such riddle,
I know not this or that, I’m blank in the middle’ ...”

3.6.2. Intelligence age: Perhaps the idea of inventing a machine that can far exceed all the intellectual activities of any man however clever, was articulated by Good (1965) for the first time. He called that machine an “ultraintelligent” machine and argued that [34]:

“Since the design of machines is one of these intellectual activities, an ultraintelligent machine could design even better machines; there would then unquestionably be an “intelligence explosion” and the intelligence of man would be left far behind. Thus the first ultraintelligent machine is the last invention that man need ever make...”

Bostrom believes that there are some prerequisites for developing an ultraintelligent machine and “uploading” is the most important one. Uploading refers to the technology utilization for transferring a human mind to a computer [1]. Uploading a human mind to a computer depends mainly on scanning and simulation technology and the degree of neuroscience insight. Whenever uploading becomes technologically feasible, it would provide an enabler for an intelligence explosion and exponential growth in science and technology.

It is important to note that the first steps toward developing brain-inspired machines have been already taken and IBM has produced cognitive computers which can learn through experiences, find correlations, create hypotheses, and remember - and learn from - the outcomes [35].

As mentioned in the preceding section, Linstone (2011) stated that in the Molecular Age, converging technologies would result in the engineering for the human mind and this could amplify the intelligence of human beings [33]. Thus in the intelligence age, both human intelligence and machine intelligence would be increased dramatically.

3.6.3. Similarities between the valley of Bewilderment and Intelligence age: In the valley of Bewilderment, the wayfarer imagines that he is a new world. After experiencing previous valleys and gaining divine wisdom, he discovers that he didn’t know anything so far.

In the Intelligence age, man would face a period during which rapid technological change will change human life radically. By experiencing these changes, the whole world would be similar to a new world to the bewildered humankind and he would find out that he knew very little before.

3.7.1. The valley of Deprivation and Doom: The seventh valley is the valley of mergence where the wayfarer loses his previous identity and becomes one part of a whole. In Attar’s words, the wayfarer drowns in absolute sea of bliss and sees by revelation. Attar says:

“He who is drowned in the absolute sea of bliss

Forever is lost, forever is in peace;

And if he manages to emerge from the ocean
He will be gifted to see by revelation ...”

This is the valley in which out of thousands of fowls, only thirty birds arrive at the court of the Simurgh. Here, the chamberlain keeps them waiting for Simurgh long enough for the birds to figure out that they themselves are the Simurgh. They see an enormous phantom mirror which reflected their own image as Simurgh.

3.7.2. Post-humanity age: Zarathustra⁷, an ancient Persian prophet, had argued that the destiny of humankind would be something beyond man, namely “Superman”. In his book, Nietzsche tried to describe the Superman according to Zarathustra’s arguments [36]:

“I teach you the Superman. Man is something that is to be surpassed. What have ye done to surpass man? All beings hitherto have created something beyond themselves: and ye want to be the ebb of that great tide, and would rather go back to the beast than surpass man? The Superman is the meaning of the earth. Let your will say: The Superman SHALL BE the meaning of the earth!”

Anderson (2003) provides three different scenarios for the future of humanity including: Augmentation, Symbiosis and Transcendence [37]. In the Transcendence scenario, he claims that the world would experience an ‘Omega point’, a time in which everybody will be a part of a larger entity, a “global brain”. He asserts that countless connected individuals would work together in order to advance our evolution and build upon what has been learned around the world in an incredible, efficient, and productive manner [37].

Bostrom has enumerated some characteristics of post-human conditions. He believes that post-humanity refers to condition in which population is greater than 1 trillion persons, life expectancy is greater than 500 years, human psychological suffering is becoming rare occurrence, etc. He believes that humankind may enter the post-humanity age in two different ways: a slow gradual growth or a radical transition. Fig. 2 shows these two ways [1].

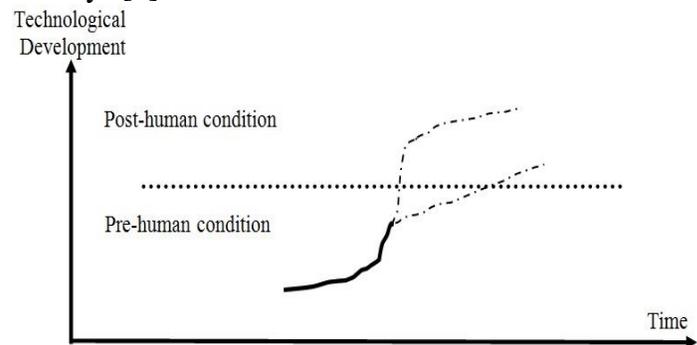


Figure 2. Transition to post-humanity (Bostrom, 2009)

⁷OrZoroaster, Persian religious reformer and prophet, founder of Zoroastrianism and Parsiism. For more information see: <http://en.wikipedia.org/wiki/Zoroaster>

In the post-humanity age, because of the previous developments in science and technology (especially cognitive science), man would experience the highest cognition capacity ever. In addition, by implanting invisible super-thin chips under the skin, everybody would be connected to a global network. The existence and identity would be defined within the network and everyone outside, wouldn't be formally considered alive. It is important to note that scientists have already invented electronic chips called "epidermal electronics". These chips that stick to the skin like a tattoo, has the mechanical properties of the human skin and are being used for medical monitoring [38].

3.7.3. Similarities between the valley of Deprivation and Post-human age: In the valley of Deprivation and Doom, the wayfarer will be gifted to see by revelation. He loses his previous identity and becomes one part of a whole. This is where thirty (Si) birds (Murgh), become Simurgh. Similarly, in the post-human age, man loses his previous identity becomes one part of the global society. In this era, by previous developments in science and technology (especially cognitive science), man would experience the highest cognition capacity thitherto.

4. Conclusions

In human history, there were eras when the unconscious action of a few could make a profound difference in historical development. However, in today's world, a move toward conscious evolution is required [39], in the sense that it is not enough to wait patiently while science and technology find their own developmental path. Rather, the full advantages of scientific and technological developments may be achieved by making special efforts to break down barriers between fields and to develop the new intellectual and physical resources that are needed [28]. We need to think about our future and answer the questions about our long-term goals. These answers might help in developing intelligent policies [40].

Since the world is a complex changing system, it is necessary to develop alternative scenarios for building the future. These scenarios can help to be better prepared for uncertainty. Thus, this study tried to provide an evolutionary scenario using a metaphor.

In this paper, firstly we introduced Attar and briefly described his work, “*The Conference of the Birds*”. Afterward we presented each valley and its corresponding state of human socio-economic development. Based on the metaphor we used, we stated that the next waves of human society might be ‘**Technological convergence**’, ‘**Intelligence**’ and ‘**Post-humanity**’.

We mentioned that Convergent Technologies refers to previously distinct technologies, which are moving toward stronger synergistic combination, integration and unification in order to achieve similar goals. Nanotechnology, Biotechnology, Information technology and Cognitive technologies are the main elements for convergence. These technologies could help humankind to build a convergent human society [41]. The efforts have been already begun to exploit the methodologies for promotion of technology convergence in order to gain sustainable development and competitive advantage [42].

Intelligence age refers to a future period during which rapid changes in machine intelligence could radically transform societies. Uploading a human mind to a computer and creating machines, which are as intelligent as human, would be the first step of this era. Scientists have already taken the first steps toward developing cognitive computers, which can learn through experiences, find correlations, create hypotheses, and remember - and learn from - the outcomes.

Post-humanity might be an era in which the previous developments would enable humankind to surpass the man. In this era, everybody will be a part of a larger entity, a ‘global society’. Countless connected individuals –with higher cognitive capabilities- would work together in order to advance human evolution and build upon what has been learned around the world in an incredible, efficient, and productive manner.

In summary, we tried to determine the main pillars of a society and provide the characteristics of each wave of human society in the following table. According to Parson's AGIL model, society is composed of four main subsystems including: political, economic, cultural and social subsystem [43]. In addition to these subsystems, MacIver (1970) argued that technology is one of the pillars of each society [44]. Held (1999) considered politics, economics and culture as the main pillars which affect global transformation [45]. Based on these works, in this study political, economic, social, cultural and technological elements are considered as the main pillars of a society.

From a historic approach, futurists can be divided into three categories including "Technologically Oriented" (such as Herman Kahn), "Sociologically Oriented" (such as Alvin Toffler) and "Globalistically Oriented" (such as Dennis Meadows) [46]. Since some researchers believe that technology has been the main driver of change in different eras [1], in this study, a technologically oriented approach has been used to provide a foresight for the future. The following table shows the characteristics of the main pillars of society in each wave. Note that only technological characteristics of the possible next waves are presented and the columns related to other pillars are filled by a question mark.

Table 1: Morphology of human society in each wave

Pillars Waves	Political	Economical	Social	Cultural	Technological
Tribal Age	<ul style="list-style-type: none"> - Deans - Customs rather than law 	<ul style="list-style-type: none"> - Local economy and bartering - Feeding by hunting - Low production efficiency 	<ul style="list-style-type: none"> - Clan as the basis of society - Social interactions around kinship roles - Communities for hunting or fruit gathering 	<ul style="list-style-type: none"> - Belief system based on supernatural, animistic and magical elements - Education through word of mouth 	<ul style="list-style-type: none"> - Domestication of fire - Bone and stone tools - Clothing - Inventing the primary means of transportation
Agricultural Age	<ul style="list-style-type: none"> - Development of political organizations for governing villages and empires - Hereditary monarchy 	<ul style="list-style-type: none"> - Agriculture based economy - Land as the basis of economy - Appearance of agrarian and commercial capitalism 	<ul style="list-style-type: none"> - Appearance of villages and cities - Live and work as a family - Aristocracy and Classification of citizens into nobles, clergy and peasants 	<ul style="list-style-type: none"> - The advent of philosophical and religious thinking - Gradual emergence of educational institution - Emergence of rational thinking 	<ul style="list-style-type: none"> - Agriculture and Plough - Metal and Steel swords and firearms [47] - Printing - Wheel - Sundial
Industrial Age	<ul style="list-style-type: none"> - Parliamentary democracy instead of monarchy - Appearance of Socialism, Liberalism, Communism , ... 	<ul style="list-style-type: none"> - Appearance of industrial capitalism and gradual metamorphosing to financial capitalism - Increased Per capita income 	<ul style="list-style-type: none"> - Migration to towns in search of job in factories - Little family contact because of long working hours - Child labor 	<ul style="list-style-type: none"> - The advent of Romanticism, Realism and Impressionism [48] - Gradual reduction of the power of the church 	<ul style="list-style-type: none"> - Steam engine - Railway - Telegraph and telephone - Light bulb - Machine tools - Radio and radar - Automobile and airplane

Pillars Waves	Political	Economical	Social	Cultural	Technological
	- Increasing the role of Government	- Mass production	- Population increase - Improved quality of life	- Emergence of environmental movements, post-modernism and Feminism [48]	- Nuclear technology - Petroleum and petrochemical technologies - Laser and fiber optics
Information Age	- Decreasing the power of apex of the pyramid [49] - Cooperation between governments in some international affairs - Appearance of global village - The advent of Cyber democracy [50] - Repartition of decision making - E-Government	- Dependence of economy on ICT [51] - Knowledge based economy (Bit as the basis of economy rather than molecule and atom) - Globalization [50] - Increasing quality and quantity of production - Online competition	- Decreased face to face relationships - Dependence of communities and organizations on information flow - Advent of virtual communities and social networks - Isolation [52] - Network leadership of social events - Improved public health [53] - Ethical concerns about privacy, accuracy and accessibility of information [54]	- Emergence of post-materialism values concerned with quality of life, expressiveness, the environment and so on [50] - Interdisciplinary education - Use of technology in art	- Computer - Internet - Electronics - Biotechnology [50] - Nanotechnology - Cell phone - Digital networks - Software technologies - Web 2.0 - Data warehouse - Wireless networks - LED and OLED technologies - DVDs and Blu-ray discs - Robotic Manufacturing and Telerobotics - Global positioning system - Self cleaning clothes [55] - Netizen [25]

Pillars Waves	Political	Economical	Social	Cultural	Technological
Technological Convergence Age	- Improved National security [28] ?	- Prioritization of jobs [56] ?	- Self alienation and depersonalization - Increased life expectancy by slowing down the aging process - Increased social and group outputs [28] - Integration of science and education [56]	- Emergence of post-omanism school [29] ?	- Artificial life [57] - Expanding human cognition and communication through humanized technology [28] - Nanowire sensor biochips [58] - Development of brain-computer interface [59] - Intelligent medicine for targeted drug delivery [29] - Medical nanobots [60] - Perfecting human-machine interfaces - Comfortable, wearable sensors and computers [28]
Intelligence Age	 ?	 ?	 ?	 ?	- Uploading - Cognitive computers - Integration of technology with human mind and exponential growth of technology - Telemedicine [29] - Intelligence amplification

Pillars \ Waves	Political	Economical	Social	Cultural	Technological
Post-Human Age	?	?	?	?	<ul style="list-style-type: none"> - Global network - Improvement of human cognition by dramatic growth of cognitive technologies - Increased human age

4.1. Future research directions

We used a technological approach in this study to characterize the main aspects of the next waves of human society. Using other approaches by the researchers in other fields – such as philosophy, sociology, humanities, etc. – would provide more transparent and plausible image of the future of human society.

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