

The Digital Age and Humanity 2.0

Ahmet Kucuk 

Kocaeli University, Faculty of Education, Mathematics Education, Kocaeli/Turkey

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*Corresponding Author: **Ahmet Kucuk** | Email Address: ahmet.kucuk@kocaeli.edu.tr

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Abstract

The digital age is the period in which digital technologies (e.g., computers, the internet, smartphones, artificial intelligence, cloud systems, etc.) have begun to play a central role in people's processes related to information, communication, and production. The digital age is the latest stage of the information society. Looking at historical processes, it is seen that the first steps towards the information age date back to approximately 12.000 years ago, beginning with the agricultural society. In these years, people learned to farm and settled down for the first time, and the agricultural society emerged. The agricultural society is the form of society in which people transitioned from a nomadic lifestyle based on hunting to a settled life, where the first grains were planted and cultivated, animals were domesticated, and an economic and social order based on agricultural production was established. Therefore, the agricultural society is the most important turning point in human history in the transition to the information age. Because the foundations of settled life, social structures, states, art, and science were laid with the agricultural society. This process continued until approximately the beginning of the 18th century, along with state formation, increasing population, the development of writing, and the need for production and management. After the 17th century, with the introduction of machinery for production, agricultural society gave way to industrial society. Industrial society is a model where production is carried out by machines, and industry and factories replace agriculture, shaping the economic and social structure. The rise of industrial society, along with migration from rural areas to cities, and the need for education and technical knowledge, led to the development of engineering, science, and technical professions. The industrial revolution, which began in England around 1750, spread throughout the world by the end of the 19th century. After the 1950s, industrial society was replaced by the information society, where people constantly need to learn, access to information is easy, and a lifelong learning culture exists. The information society is a societal structure built on the production, sharing, and use of information. In this society, information forms the basis of economic, social, cultural, and political activities. Unlike industrial society, the information society develops through the production of information and the use of technology, rather than physical labor and material production. The information age, or digital age, has also marked the beginning of Humanity 2.0. This study evaluates the effects of digital technologies, which have developed alongside the information society, on humans and presents some conclusions.

Keywords: Digital age, artificial intelligence, Humanity 2.0, reverse engineering, augmented reality, synthetic biology.

Introduction

Digital technologies have changed people's lifestyles, ways of communicating and interacting, and have become a new subject of research from a sociological perspective. Today, technology is not only a tool but also a force that changes the cultural and biological structure of people. Therefore, in the 19th century, the theory was put forward that humans, like other animals, could change through natural selection and that human behavior; mental and cultural developments are based on evolutionary foundations [1]. If the time from the existence of humanity to the end of the 19th century is considered Humanity 1.0, then the developments that aim to change humanity using the most advanced technologies, starting with the creation of the first computers after 1950 and the emergence of the concept of artificial intelligence in the 1950s, and the transition to a superhuman dimension, meaning that the current state of humanity is not final, and aiming to eliminate the limitations of humanity through digital developments such as synthetic

biology, genetic engineering, cybernetics, artificial intelligence, nanotechnology and android devices, can be considered Humanity 2.0. In short, Humanity 2.0 is the process of human evolution with the development of technology.

These technological advancements are, in essence, aimed at enabling humanity to achieve a higher quality of life and a better society. However, in the 21st century, we are witnessing technological advancements with artificial intelligence that, for the first time in human history, raise concerns about the irreversible consequences for humanity if these developments are not controlled and intelligently directed. Artificial intelligence (AI), developing alongside digital technology, is not merely a technological advancement; it is also seen as a cultural, social, and economic development that will affect humanity and our future, and whose impact we cannot foresee. As artificial intelligence develops, there is also curiosity about how humans, physically and mentally empowered by AI, and societal phenomena will change.

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Especially with the integration of technology into the human body, that is, with the partial digitalization of humans, changes in human behavior, mental and cultural development are inevitable. This digitalization of humans pushes the physical and mental limits of humans, and the radical change in human behavior with technology and the question of what kind of being humans might evolve into in the future are subjects of curiosity. Transhumanism, which attempts to change humans using the most advanced technologies and transition to a superhuman dimension, is a school of thought that aims to eliminate the limitations of humans through developments such as synthetic biology, genetic engineering, cybernetics, artificial intelligence, nanotechnology and android devices, as the current state of humanity is not final [2]. We see that the first steps of this thought were taken in the 12th century, and in this century, the first steps of cybernetics were taken in the history of science, the first robot was made, and automatic machines formed the basis of today's mechanical and cybernetic sciences [3].

Method

In this study, an evaluation of the effects of digital technologies, which have developed together with the information society, on humans was made using the descriptive research method.

The Digital Age and Humanity 2.0

The digital age is based on the information society. The information society is a societal structure built on the production, sharing, and use of information. Unlike the industrial society, the information society develops through the production of information and the use of technology, rather than physical labor and material production. The industrial society, on the other hand, is a societal model where production is done with machines, and industry and factories, replacing agriculture, guide the economic and social structure. The most important difference between the industrial and information societies is that in the industrial society, the main principle is that everyone can sustain their lives with their own labor. In the information society, however, it is predicted that some professions will disappear and the number of unemployed will increase with the development of technology.

In the information society, a limited number of skilled people, along with machines and cheap labor, can produce everything the world needs. However, the most important characteristic of industrial society is creating a sustainable workforce. This raises questions such as: What will happen to the unemployed and the increasingly cheap workforce in the future? Is the information society a threat to industrial society? With the information age, our civilization has reached a point where humankind not only dominates nature but also holds the tools to shape biological nature. We live in an era where radical changes are being planned for the human body and mind. The rapid advancements in life sciences, cognitive sciences, and artificial intelligence, particularly in the 20th century, form the scientific basis for the idea of "humanity transcending its own nature." The rapid changes and developments in technology in the 20th century have caused significant changes in the biological structure of humans, as in all other fields. The decoding of the codes in human DNA (deoxyribonucleic acid) and the CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats) revolution in genetics form the basis for transforming human biology.

Scientists can use this system to cut, remove, modify, or replace specific genes in DNA.

This method can be used to treat diseases that have very serious negative effects on humans, such as genetic diseases and cancer, thus increasing human lifespan and quality of life. This system, which alters the human genome structure, is the conscious and systematic alteration of human biological limits through synthetic biology and genetic engineering [2, 10]. In other words, Humanity 2.0 is the partial digitalization of humans with advanced technology.

With advancing technology and digitalization, the following questions will be addressed in the future: Can human life expectancy be extended?

Is it possible to make humans more intelligent?

Is the digital age dangerous for the future of humanity?

The Mathematics of the Brain

The brain is described as the most complex biological structure ever discovered in the universe, with hundreds of millions of cells forming trillions of connections between them. The entire process of processing information in the brain is called "thinking." Because of the importance of thinking, information and the brain are phenomena that make each other meaningful and give each other value. According to neuroscientists, it is estimated that there are approximately 100 billion neurons (nerve cells) in the human brain [4, 5, 8].

Neurons are the basic units of the brain and nervous system. They are responsible for receiving sensory input from the outside world, sending motor commands to our muscles, and converting and transmitting electrical signals at every step. Approximately 10^{11} nerve cells, most of which are formed during the development of intelligence and are estimated to have billions of connections, are connected to each other by nerve fibers called "axons." Each cell also has short external extensions called "dendrites." Each cell in the part of the brain that corresponds to approximately the middle of the brain is called a "neuron" or "thought cell". The outer cells surrounding the thought cells in the brain have a structure similar to other cells in the body, except that they perform life-sustaining activities such as bringing and taking away blood, nutrients, and oxygen; one can do the job of another. Even if a small part of the brain is removed, the remaining cells can still perform the functions of the removed cells [5].

We can liken a neuron to a tree. A neuron has three main parts: dendrites, axons, and the cell body or soma. These can be represented as the branches, roots, and trunk of a tree, respectively. A dendrite (tree branch) is where a neuron receives input from other cells. Dendrites branch out as they move toward their ends, just like tree branches, and even have leaf-like structures called spines on them. The axon (tree roots) is the neuron's output structure; when a neuron wants to communicate with another neuron, it sends an electrical message called an action potential along the axon. The soma (tree trunk) is where the nucleus is located, where the neuron's DNA is located, and where proteins are transported along the axon and dendrites (Figure 1, [6]). However, approximately 100 billion neurons are in close interaction with other cell types, generally classified as glia.

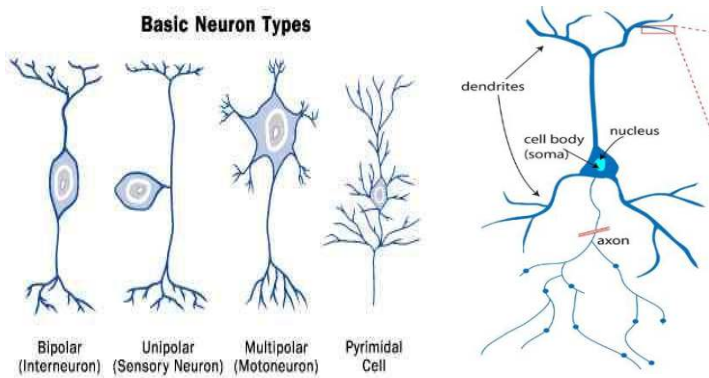
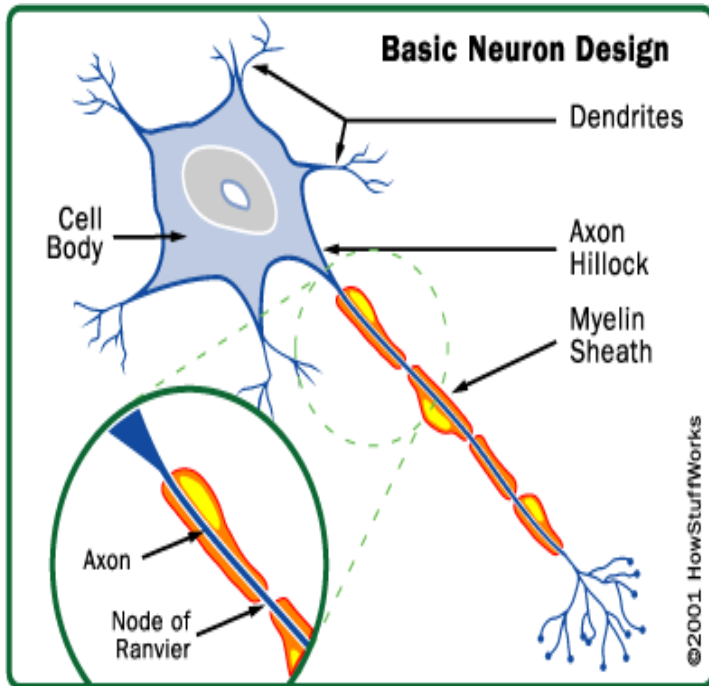


Figure 1: Basic neuron structure

Information is the reflection of objective reality in the human brain. This reflection occurs through changes in the electrical charge that travels from our perceptions to our brain via nerve fibers. Receiving new information means that brain cells acquire a new form of connection, that is, a new chemical state as a result of changes in their relative electrical charges. All the information a person receives from their external environment through their senses is actually an intercellular connection (combination) created in the brain by the electrical charge transmitted by the senses. In short, every piece of information is a reflection of objective reality in our brain, forming a specific form of connection, a specific position, between brain cells. In other words, each different cellular connection in our brain corresponds to another piece of information. When we speak of the form of intercellular connection, we should understand not the arrangement of cells, but a specific position of the electrical charges and chemical properties of the cells. Neuroscientists estimate that the human brain contains approximately 100 billion neurons and billions of connections, most of which are formed during the development of intelligence. The capacity of computers and artificial intelligence is much more limited. The most advanced computers have a capacity of approximately 100 million neurons in their digital brains. Therefore, all studies show that the human brain is the best intelligence center on Earth.

There are billions of connections between brain cells [4, 5]. Mathematically, a connection is a set of ordered pairs established between two sets or within a single set.

If A and B are two sets, a relation R from A to B is any subset of the Cartesian product $A \times B$. That is: $R \subseteq A \times B$ is a subset. If the number of elements in A is $s(A)=n$ and the number of elements in B is $s(B)=m$, then the number of elements in $A \times B$ is $s(A \times B)=n \times m$. Each element may or may not belong to the relation. That is, there are two options. Therefore, the number of all relations from A to B is 2^{nm} . If $A=B$, this relation is called a binary relation. In this case, the relation has some special types such as reflexive, symmetric, antisymmetric, and transitive. For a relation to be reflexive, each element must be related to itself. That is, for the relation $R \subseteq A \times A$; $\forall a \in A$ for $(a, a) \in R$ must hold. If a relation is symmetric, the relationship in one direction also exists in the other direction. That is, for a relation to be symmetric; if $(a, b) \in R$ then $(b, a) \in R$ must hold. For it to be antisymmetric; if $(a, b) \in R$ and $(b, a) \in R$, then $a=b$ must hold. If a relation is transitive, indirect relationships become direct relationships. For transitivity, if $(a, b) \in R$ and $(b, c) \in R$, then $(a, c) \in R$ must hold. If a relation is reflexive, symmetric, and transitive, it is called an equivalence or equality relation [7].

Let $s(A)=n$. Then the number of all relations on A ($R? A \times A$) is 2^{n^2} . The number of special relations is: the number of reflexive relations is 2^{n^2-n} . The number of symmetric relations is $2^{\frac{n^2+n}{2}}$.

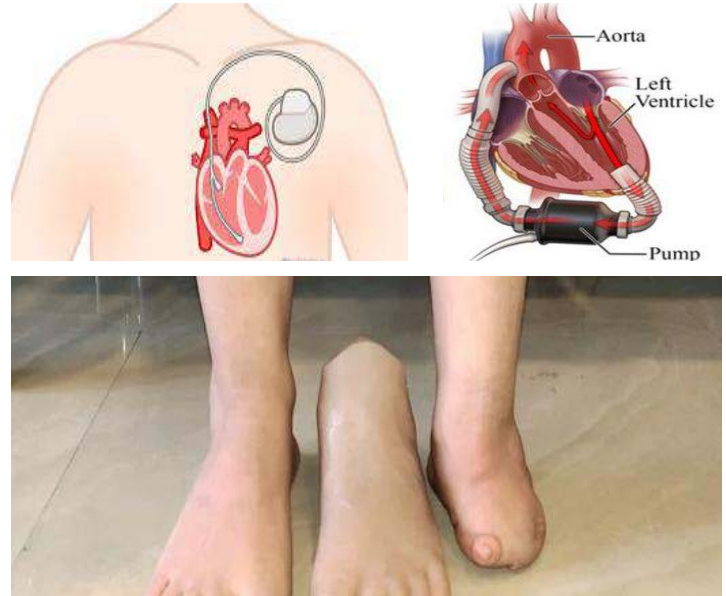
The number of connections that brain cells can make is given by the formula $M=2^{n(n-1)}$ [5].

This formula expresses how many "reflexive relations" can be made from a set of n elements. Here, M represents the number of relations that can be made, while n represents the approximate number of cells in the brain, which is 100 billion. This relation is a special monomorphism between neurons. In other words, it is a one-to-one transformation between neurons. Because the human brain has such a high connection power, it is seen that electronic brains (chips, computers) made by taking advantage of the brain's operating system are still many years away from approaching the brain.

Could the human brain be transformed into a machine? First, the human brain would need to be mathematically modeled, and this model would be processed onto silicon as a digital microelectronic circuit. Because this electronic brain on silicon is much faster than the human brain, it is stated that the new type of human (cyborg) using this brain would be a super-intelligent being [4]. But is this possible for now? This thesis does not seem possible for now. Because if the mathematical model of the human brain consists of millions of neurons, due to the above relationships, the computational complexity related to this brain, the number of operations for a single calculation, can exceed the number of electrons in the universe. Furthermore, since humans are social beings, their behavior requires a model of other people they interact with. This further expands the mathematical computational complexity. All of this shows that, for today, a computable mathematical model for the human brain cannot be established. Again, due to limitations on humans, experiments cannot be conducted on them for ethical reasons. Perhaps new life forms could be created in a limited way through synthetic biology (such as genetically modified organisms, GMOs).

Reverse Engineering and Augmented Reality

Scientists began reverse engineering by studying the complex structure of the human brain. Modeling the brain's interactions at the molecular level through reverse engineering is quite useful and necessary. Reverse engineering is the process of taking apart or analyzing a product, system, or software to understand how it works. Its main purpose is to understand the design, structure, operation, or code of something existing and to use this information for different purposes. Scientists have tried to create simple models of the basic functions of animal brains to better understand how they work. For this purpose, two robots were built to demonstrate theories of nervous systems. These robots were quite primitive at the time, but later these robots were improved and more functional robots were produced. Simple robots based on animal-like nervous systems and behaviors may seem like a novelty today, but their origins lie in the work that was the first precursor to robotics and artificial life. In the mid-20th century, a series of robots exhibiting great complexity were developed. These robots represented some of the first examples of autonomous robots and have been an inspiration for today's robotics technologies (Figure 2, [9]).



Pacemaker heart pump prosthetic leg

Figure 3: Integration of technological devices on humans

Scientists, through reverse engineering and bioengineering, have transformed humans into cybernetic organisms, meaning beings that possess both biological and mechanical/technological components. For example, people with pacemakers, those using bionic arms/legs, and those with smart implants placed in the eyes. This situation, where a biological organism is supported by a technological system, can also be seen as augmented reality (AR) on humans. Augmented reality is the addition of digital elements to something that already exists. AR does not completely change the real environment; it enriches it with digital elements. So, Augmented reality = Current situation (Real world) + Digital elements

Today, reverse engineering is being done on humans. That is, the design and characteristics of something that already exists are being examined. You look at the final product, try to understand how it was produced, and try to improve its features. This is called reverse engineering and augmented reality. In today's digital age, where the information society has arrived, people's existing state is being examined and its characteristics are being studied. How was it created? What elements are present? Could it be more intelligent? Could it live longer? The focus is on finding answers to questions like, "What can be done better?" In other words, its DNA is being examined and its structure is being altered. With advancing technology, scientists have transformed humanity from a biological (organic) process to a digital (mechanical) process. In short, they have created Humanity 2.0.

Conclusions and Recommendations

1) With the development of technology, especially the introduction of digital technologies into our lives, the social order, communication methods, and interactions of people have changed. The digital age, which has become an anthropological study, raises the question: Is it a danger or an advantage for humanity?

2) Could humans become more intelligent in the future by implanting chips with millions of neurons in appropriate areas of the brain? If this happens, the human brain could possess all the features of digital devices. It could speak multiple languages and learn all information instantly in its brain. In other words, it would not need digital devices.

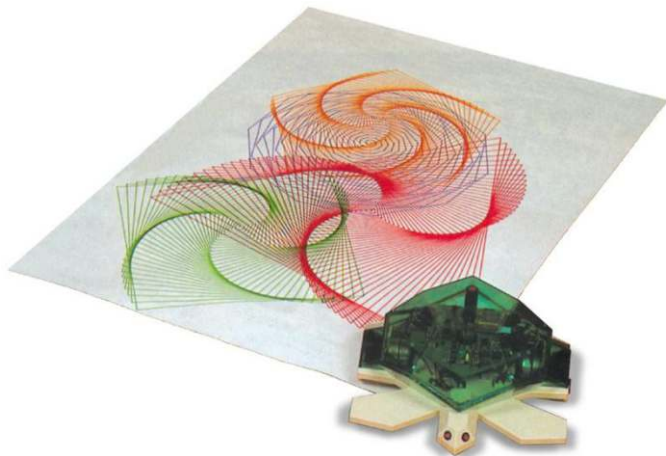


Figure 2. Turtle (robot)

Humans, who alter the DNA structure of their own food and plants, have now begun to alter their own DNA structure. To this end, scientists have developed and begun to use CRISPR (Clustered Regularly Interspaced Short Palindromic Repeats), a mechanism of a natural immune system found in bacteria and archaea, as a gene editing tool. CRISPR technology has made it possible to make very precise changes to DNA (Deoxyribonucleic acid), a chemical structure containing human genetic codes (information). This has formed the basis for transforming humans from biological bodies to bionic bodies [10].

In today's developing technologies, machines have been replaced by digital technologies of nanometer size (1 nanometer = 10^{-9} meter). These technologies have also had significant effects on humans. For example, pacemakers, heart pumps, and prostheses (Figure 3, [6]).e time, but later these robots were improved and more functional robots were produced. Simple robots based on animal-like nervous systems and behaviors may seem like a novelty today, but their origins lie in the work that was the first precursor to robotics and artificial life. In the mid-20th century, a series of robots exhibiting great complexity were developed. These robots represented some of the first examples of autonomous robots and have been an inspiration for today's robotics technologies (Figure 2, [9]).

3) Could humans become half-human, half-machine (cyborgs) in the future? This question should be discussed.

4) Because humans are social beings, they need to belong to something or to be connected. Due to the rapid changes and developments in technology, it is observed that digital technologies today do not provide much opportunity for the close relationships and socialization that humans need.

5) The transition from an agricultural to an industrial society, and the resulting migrations, intense work schedules, and economic hardships are causing people to increasingly undergo different changes and become isolated. Unable to meet their most basic needs, people turn to other things that provide temporary happiness to fill this void. However, after a while, these pursuits can lead to another obsession, a kind of addiction. Digital devices appear to be the biggest addiction of our time. Restrictions and solutions must be implemented to address this addiction, which often begins at an early age.

6) In today's world, many people who feel increasingly lonely and try to overcome this loneliness have become addicted to digital technology. The question may arise: are digital technologies isolating people, or are they becoming addicted to digital technology because they are lonely? Answering this question seems quite difficult. However, it is evident that today, digital technologies are causing people to become even more lonely by distancing them from real relationships, socialization, communication, and interaction.

7) With the advancement of technology, artificial organs represent a field that could revolutionize human biology. Thanks to digital technology, artificial intelligence, and synthetic biology, it is now possible not only to prolong life but also to improve and personalize it. This is what we call Humanity 2.0.

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