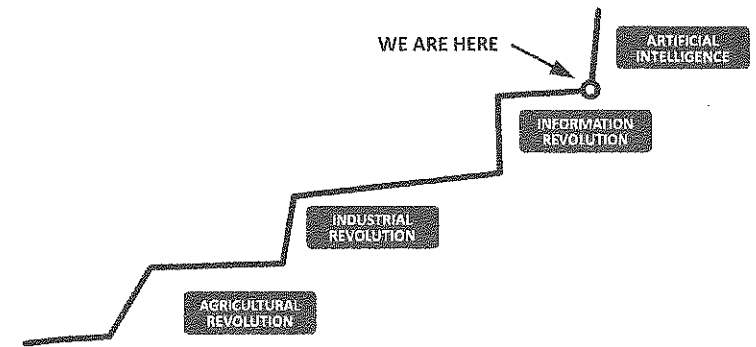


might be able to change our DNA.² We are at the threshold of the acceleration of the Digital Era Revolution.³

INTRODUCTION

(The Responsibility of Our Generation in
between Paradigms)

The viewpoint of this book is that since the development of AI, we can, and should, look at the last 40–50 years as just “foreplay” for the big changes that are about to occur in the coming years. Human cognition was the major factor that led to the development of humankind. Therefore, the ability of a machine to perform human cognition, and the ability of The Human-Machine Team to learn together and think together will create a new world.¹ This revolution creates a reality in which we can imagine a future in which people will talk about our lifetime as the beginning of a new level of *homo sapiens* (or whatever we will be called). Only decades from now – or even later – will human beings have the relevant perspective to understand these changes. In our generation, technology is not just technology that helps people; it is AI that changes people. It is AI that changes the idea of knowledge and communication. For the first time, it is not science fiction that we



The Human-Machine Team discusses how to lead nations and organizations at this threshold of the acceleration of the DE when AI is changing the basic rules. The examples in the book are from the experience and perspective of national security, but they are also relevant for other fields, including economics, healthcare, and personal security. Every country, national establishment, and discipline can consider the book’s point of view and apply it to its own field.

The book looks to follow a path that is both wide enough and narrow enough – wide enough to lead us to the future, and narrow enough to be relevant, realistic, and explain what we can and actually should do. The ideas, concepts, and practices that we build now will serve as the starting point for the next generation. Thus, a country or organization that wins the competition during this period will have the potential to define

and rule the future.⁴ This book is for leaders, high-ranking military officers, and high-level managers who want to lead their nations and organizations into the future, for national security officers and managers who want to put their finger on the challenges, risks, and opportunities for their organizations, and for anyone else who wants to understand AI, its potentials, and its applications.

A Brief History of the Future

One of the common ways to describe historical divisions is by reference to major revolutions. The three major revolutions are the Agricultural Revolution, the Industrial Revolution, and the Digital Revolution. This book was written from the point of view that we are currently at the beginning of the Digital Era Revolution. From a historical perspective, every revolution, and every level in each revolution, was bigger and faster and changed more issues than the preceding one.⁵

Up until the Agricultural Revolution, people lived as nomads and in small groups. As a result, humanity began to become more than the sum of all the people together and began to live in clans and villages. During the Industrial Revolution, new technologies emerged; this revolution introduced technologies that took center stage. People invented technologies that helped them improve themselves and their lives (machines, vehicles, media, etc.). For example, it is an accepted concept to say that the United States become truly *united* only when the Industrial Revolution introduced radio and vehicles. It was

then that Americans could communicate instantaneously and easily travel across the country. During the Industrial Revolution, the world organized itself with the modern concept of cities and nation-states as we know them today. Thanks to – and because of – technology, the idea of big cities and countries became a logical arrangement and turned into the main concept of living.⁶

The Digital Revolution brought with it a new, high-level paradigm. The world became a “flat world,”⁷ and humans were now able to communicate in ways never before imagined. The limited amount of actual data in the world developed into an explosion of information. The governments and private sectors that owned and controlled media (newspapers, radio, TV stations, and spokespersons) were joined by public social media that was used by everyone. An extreme example of communications in the DE is the “Internet of Things” (IoT) and the “Internet of Everything” (IoE).⁸ This new, high-level paradigm created a new world.⁹

Another common way to describe our time and historical divisions over the last 300 years is by the term “The Fourth Industrial Revolution.” This idea was coined by Klaus Schwab, a German engineer and economist best known as the founder and executive chairman of the World Economic Forum. In his book, *The Fourth Industrial Revolution*, he describes this as a technological revolution that blurs the lines between the physical, digital, and biological spheres. From this perspective, The First Industrial Revolution began in the middle of the eighteenth century in Europe and North America, and the foremost

invention that contributed to the revolution was the steam engine. It was a period when mostly agrarian, rural societies became industrial and urban. The iron and textile industries, along with the development of the steam engine, played central roles in this revolution, which also spawned the concept of big factories.

The Second Industrial Revolution, which began in the second half of the nineteenth century, lasted until World War I. It was a period of growth for pre-existing industries and the expansion of new ones, such as steel, oil, and electricity. This revolution used electric power to enable mass production. Major technological advances during this era included the telephone, light bulb, phonograph, and internal combustion engine. The Third Industrial Revolution, which began in the middle of the twentieth century, is the Digital Revolution. It refers to the advancement of technology from analog electronic and mechanical devices to the digital technology available today. Advancements during the Third Industrial Revolution include the personal computer, the internet, and communications technology.

The Fourth Industrial Revolution describes the era we live in, and builds on the Digital Revolution; it represents new ways in which technology becomes embedded within societies and even within the human body. This revolution provides increasingly faster breakthroughs in a number of fields, including robotics, artificial intelligence, nanotechnology, quantum computing, biotechnology, the Internet of Things (IoT), 3-D printing, and autonomous vehicles. Clearly, the Fourth Industrial

Revolution is marked by emerging technology that continues to discover the digital code of the real world.

We do not aspire to describe an exact future, because this is obviously impossible; moreover, the future depends on us as well (as Abraham Lincoln so aptly put it, "The best way to predict the future is to create it."). Therefore, this is just a view looking forward, to think about the potential risks and potential opportunities. There are new threats, continual threats, and hybrid threats that are constantly changing due to the DE. The rules regulating the reality of our lives during this development of artificial intelligence are not the same as they were before our era. Today we live in a world in which it is difficult to hide secrets, in which data companies such as Google already have more knowledge and insight about the population than Stalin ever did about his population. This reality represents a challenge for our freedom and human rights, and opens the question about the relationship between liberty and security. Finally, it is not a fantasy to think about "Digital Countries" as a new concept of world organization.

One example of the big changes to come is how to use Gross Domestic Product (GDP). Currently, the basis for evaluating the economic situation of a country is the potential GDP, which is a way to discover the financial status of a country per year. Potential GDP is the value and productivity of the workforce. Every review and analysis of a country's economic situation begins with the workforce and its productivity. Furthermore, the potential of the GDP, which is the basis for understanding the economic situation and the basis on which to build an

economic plan, is workforce multiplied by productivity. In our lifetime, when there is machine-learning and smart robots, the potential of the workforce is infinite, and its productivity also has the potential to be infinite.¹⁰

The Main Characteristics of the Digital Revolution (Definitions)¹¹

There are various ways to discuss and to describe our era. Information revolution, digital era, internet, network of networks, etc. – are all terms to describe the current revolution. These ideas refer to a new world when science and society will have merged. Data science, social media, artificial intelligence, neural networks, cyberspace – are all words to describe the combination of science and society that met each other, merged, and changed the course of history. *Network of networks* is a concept that describes the new world, where all people, regardless of religion, race, gender, or age, can communicate 24/7 without limits. *Cyberspace* is the domain that includes the staggering number of computers, their human users, and the networks connect them. This idea also includes the concept of a “cyber war” between computers.¹² *Internet* is the name of the platform of this network between computers. The Internet is one of the main things that accelerated big data. The *Information Revolution* (sometimes called *Information Age*) is a revolution during our lifetime, in which a lack of data transformed into today’s reality of (seemingly) infinite data and information.¹³

Machine-Learning is a new potential for dealing with big

data using machine power and the ability to learn and draw conclusions from big data to make predictions. This concept includes the ability to deal with big data in a way that humans could not address without machine-learning.¹⁴ *Deep Learning* is the ability to use technology to perform activities that trace and simulate some of the functions of the human brain through *Artificial Neural Networks*, which is the ability to convert various kinds of information to artificial neurons and then build machine-learning.¹⁵ *Artificial intelligence* is based on the previous revolutions and innovations; it is the ability of a machine to perform (part of) human cognition and to “think”¹⁶ and give feedback to itself.¹⁷

Digital – is the ability to bring our lives together using bits. It is the ability of people to represent, arrange, and process the real world through bits. The great jolt that changes our lives is the ability to take different kinds of data and digitize them into binary digits. This revolution enables the realization of new concepts. For example, when a picture can be digitized into bits, a machine has the potential to learn about the picture and compare it with other digital pictures. Digital also gave us the option to store the bits using clouds.

The *Digital Era* is a historic perspective that describes our own period, when a major revolution is taking place, one in which human beings can understand, influence, and empower life experiences by using digital bits.¹⁸ Over the last few decades, computers have moved from being located and used in a designated room to being a part of the human body itself. They began as machines that needed large rooms, and people used

the computer for its power of calculation. It continued as an essential part of peoples' desks, and integral parts of many jobs. The next step was when the computer became a smartphone in people's pockets, and smart watches on their wrists – and it is now literally becoming part of our flesh. Nowadays computers are a crucial part of peoples' lives.¹⁹

In the DE, we can discuss at least five different internal revolutions. The first is the ability to communicate instantaneously with all of the people (as well as many devices) all over the world. The second is the Data Revolution, which took us from the days in the past when we didn't have enough data, to the current reality of an infinite amount of data. The third is the ability to keep all this data stored and, specifically, the ability to store it in the cloud. The infiniteness of data, and the ability to store and organize it, created the potential for the next step of Deep Learning from big data. The fourth is high-performance computing to deal with great amounts of data, and fifth is the Artificial Intelligence Revolution.²⁰

“You May Say I’m a Dreamer, But I’m Not the Only One”²¹

Many books have been written about humankind in the DE. The babies who were born and raised with smartphones in their hands are not the same children that we were. For years, humans and machines have been a kind of team and have had a type of working relationship. Today, machines are different and can perform human cognitive activities. People are also not the same; therefore, the relationship between humans and

machines is different and has new potentials.²²

Artificial intelligence is a potential game changer. AI is going to address big challenges in novel and varied ways that we could not have even imagined years ago. It has the potential to improve healthcare, national security, personal security, and other vital aspects of our lives. The problems that humans didn't know how to solve in the past, AI has the potential to solve in the future. Challenges that people did not even know how to address years ago can now be examined with AI.²³

Imagine a world in which more than 30% of the population is over age 75. Imagine a world without cancer. Imagine a world where it is difficult to hide the truth. Imagine a world in which more and more of the workforce is comprised of machines. Our culture is changing, and the machines and the robots are changing as well. Over the last few decades, the major change was to improve the efficiency of manufacturing. Pre-AI robots helped improve factories and increase productivity. Machines and robots increasingly replace the classic workforce – which is comprised of people. The Information Revolution, data science, the capabilities of Deep Learning, machine-learning, and AI together, create a situation in which robots and machines can do things that people cannot. Machines and robots do not just do the same things greater, faster, and on a larger scale; we are talking about new things that people absolutely could not do before. It is the first time that machines have begun to perform human cognition and to “think.” The actuality that machines can “think” was only realized decades after the concept was first discussed. AI has changed the rules.²⁴

'In Between:' To Discover the Responsibility of Our Generation

In his book *The Structure of Scientific Revolutions*, Thomas Kuhn claims that the great revolutions of humanity arose from crises. He similarly describes the phenomenon of paradigm shifts, in which a prior paradigm gradually fills up with holes like a sieve, becoming less and less relevant, but continues to exist. At the same time, alternative paradigms develop beside it until the previous paradigm is almost eliminated and new paradigms remain. Kuhn views the interim period as a "crisis period" that usually emerges as such only in retrospect.

The ground on which we have been walking while writing this book, the streets we have wandered throughout our journey, and indeed the whole world, are all nothing but a corridor to discover "what we need to do in between the paradigms."²⁵ The biggest challenge is to lead our nations and organizations to fulfill these potentials. Our generation is in between revolutions and in between paradigms. Over the next few years, the merger of human and artificial intelligence will be another growth engine. The crux of our journey together with The Human-Machine Team is to discover the specific relevant steps to take our nations and organizations to the future that has already become the present. We must create our Plan of Action for "in between," which is meant to crystallize strategic action trends so we can mitigate the risks and realize the opportunities that are hidden in the future.

I wrote this book during a year of study at the National

Defense University in Washington, D.C. It was an amazing and unique "in-between" time in my career. This book is also a bit "in-between," because it is in between theory and the realm of putting into practice, and in-between history and futurism. In between the Fourth Industrial Revolution and the next generation of revolutions. In between paradigms. In between the science of technology and leadership, and executive management. In between human intelligence and artificial intelligence. The book gives birth to ideas of merging that are taking place "in between."

Don't Ask "What Does AI Mean?" Ask "What Does AI Mean for Us?"

I have been asked thousands of times "What is AI?" or "When you say AI, what does it mean, and what does it include?" This is the main issue as a basis for this book. However, the "punchline" – and the most important question – is "What does AI mean for us, and who are we in this era?" For example, is AI a new domain for us? Is AI just a new emerging technology like other new technologies? Is AI a new weapon? AI can be an opportunity to empower the information efforts and influence military power, a new paradigm to rule the economic market, and also a new technology in the innovation system.²⁶ Russia, China, and the U.S. are choosing different frameworks to answer these questions.²⁷ Artificial intelligence has different potentials, meanings, and concepts for each organization. Therefore, the first step that every organization must take is to ask, "What is AI for our nation or organization, and how do we choose to deal with this new concept?" There are

several definitions for AI, but in order to lead transformation, the challenging question is to look in the mirror and ask your organization, “What is AI for us and who are we in this era?”²⁸

The path we take for this book puts the focus on what we can and must do in the next few years. There are three main sections: The first is a discussion of the idea of synergic learning between humans and machines that creates super-cognition (The Human-Machine Team); the second discusses how to guide nations and organizations to build their FAST (foundations, accelerations, and singularity time) to realize the idea of The Human-Machine Team; and the third deals with the “Plan of Action” – that is, how to fulfill the responsibility of our generation and build the next paradigm.

PART 1

The Human-Machine Team