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「本田・アニエリ両財団共催セミナートリノ1985」の講演抜粋

財団法人 本田財団

この講演抜粋は1985年９月26日～27日にイタリアのトリノ市で、本田財団及びアニエリ財団が共催したセミナーでの日本から参加された方々の講演をまとめたものです。

SEMINAR

Industrial automation and its socio-economic consequences

— 産業オートメーションとその社会的・経済的影響 —

THE HONDA FOUNDATION AND
THE G. AGNELLI FOUNDATION
Turin, 26-27 September 1985

Opening Session

Schedule

Thursday, September 26, 1985

15:00 Introduction to the seminar by Dr. Cesare ROMITI, Administrator of FIAT.
I Session: Advanced Industrial Automation
a) "Computer Integrated Manufacturing: State of the Art and Research Themes for Tomorrow"
- Prof. Gian Federico MICHELETTI, Vice-President of Turin Polytechnic

b) "Flexible Automation: the Industrial Situation today and the Prospects of Growth for the Sector"
- Ing. Franco SARTORIO, President of Prima Electronics, Turin

17:00 Coffee break

17:15 c) "Design Concepts for Technological Systems of Advanced Robots in Japan"
- Mr. Shuhei AIDA, Professor, University of Electro-Communications, Tokyo

18:00 Speaker: Mr. Ichiro HATTORI, President of SEIKO Instruments, Chairman of Japanese-Italian Technology Society

DISCUSSION

19:00 End of session

Mr. Shuhei AIDA

Mr. Shuji TAKASHINA

Friday, September 27, 1985

9:30 II Session: Culture, Education and Advanced Automation
a) "Informatics and Working Life Quality"
- Prof. Luciano GALLINO, University of Turin

b) "From Automaton to Robot – Its Socio-Psychological Backgrounds in Europe and Japan"
- Mr. Shuji TAKASHINA, University of Tokyo

11:00 Coffee break

11:15 c) "Automation, Business Management and Culture"
- Prof. Gian Maria GROS PIETRO, Professor of Industrial Economics, University of Turin

12:00 Speakers: Mrs. Momoko ITO, President of JAPAN ECD, Co., Ltd.
Mr. Hideo SUGIURA, Adviser of HONDA Motor Co., Ltd.

DISCUSSION

13:00 Lunch (in the premises of the G. Agnelli Foundation)

15:15 III Session: Economic and Social Consequences of Advanced Automation
a) "High Technology and the Receptiveness of Japanese Society"
- Mr. Reikichi SHIRANE, President of Telecommunications Science Foundation

b) "From Taylorism to Systems Management: New Jobs in the Shop Floor"
- Ing. Franco UBERTO, FIAT Auto, Turin

c) "Organizational Evolution, Technologies and Intellectual Work in the Firm"
- Dr. Giorgio FARDIN, President of Telos Management, Milan

17:00 Coffee break

17:15 Speaker: Mr. Shigeru SHINOMIYA, Adviser of HONDA Motor Co., Ltd.

DISCUSSION

18:30 Conclusions:
- Mr. Shuhei AIDA, University of Electro-Communications, Tokyo
- Dr. Marcello PACINI, Director of G. Agnelli Foundation
- Mr. Taizo UEDA, Managing Director of Honda Foundation

Mr. Reikichi SHIRANE

Mr. Taizo UEDA

Introduction

Professor Shuhei Aida
University of Electro-Communications

This report contains the papers presented by the Japanese speakers at "Industrial automation and its socio-economic consequences", an international symposium jointly sponsored by the Honda Foundation and the Agnelli Foundation.

The symposium was held on September 26 and 27, 1985, in the Italian industrial city of Torino. It was the third in a series that was inaugurated in Torino in 1983 and had its second meeting in Tokyo in May 1984.

The holding of such a binational event even once is by itself significant, but its regular continuation is even more so. As exemplified by its title, the symposium addresses topics of international concern, and as its program demonstrates, the symposium has brought about concrete, in-depth discussion, focusing significantly on technological and cultural ties between Japan and Italy.

At the third meeting, growing official interest in the symposium was expressed at the government level of both countries: the Japanese Ambassador to Italy, Mr. Seiya Nishida, and many prominent figures in the government and business communities of both nations heightened the international prestige of the proceedings.

The symposium was also attended by Chairman Ichiro Hattori of the Japanese-Italian Technology Society and several other members of the organization who contributed greatly to the lively discussion.

Everyone associated with the symposium is therefore very much looking forward to the fourth meeting, scheduled to be held this autumn in Tokyo.

Design Concepts for Technological Systems of Advanced Robots in Japan

Prof. Shuhei Aida
University of Electro-Communications

1. Looking at Advanced Robot Technology

Rapid advancement in microelectronics has brought about great innovation of robot technologies, affecting factory automation in individual workers as well as creating problems in social, economic and even in cultural contexts. Both physical and psychological maladjustment to robots among individual workers and groups of workers with different cultural backgrounds has caused growing concern. Expansion of factory automation, in particular, has reduced satisfaction with jobs and dignity of labor among people at work places and divided skilled workers from unskilled workers. These are some examples of growing gaps caused by the expansion of factory automation, which are being observed internationally both in industrially advanced and developing countries. Accurate understanding of these problems and their settlement are most needed for future development of robot technologies.

Automation is primarily aimed at setting people free from painstaking and insignificant jobs as well as equally distributing benefits and wealth produced by modern technologies. Automation in the past were concerned with mass production of limited varieties of goods, thus lowering production costs and enabling a great majority of consumers to obtain lower-priced but better quality products. We can say it stemmed from the principle of "equalization." But this equalization has been steadily getting linked with "efficiency' with the economic

development and technological innovation as automation has shifted its importance in "factory oriented thinking" to efficiency combining people, goods and money. This has further pushed human alienation, raising interest in the development of more "human-oriented" automation technologies, applying advanced robots.

This has been brought about as natural consequence of our high technological age and therein lies the importance of looking for research subjects matching new philosophy of technologies. It is evident that dissemination of industrial robots will have a great impact on society as a whole as robots have come to possess the ability which could replace human workers in many job situations.

Historically, mechanization of human labor became a social problem for the first time in the early 19th century when British workers revolted in what was known as the Luddite Movement. In the movement, workers in the British weaving industry tried to prevent new machines from coming into their workplaces by destroying them in a demonstration of their objection to the mechanization of weaving machines. But such a violent anti-machine movement gave way as the principle of equalization gained popular support as mechanization was getting spread in general society, giving birth to industrially advanced countries as we see them today. Robot technologies has penetrated into manufacturing industries as well as agriculture and civil engineering in many countries.

Against this historical background, I try to look into robot technologies in social, cultural and individual contexts, and identify the meaning of the deployment of robot technologies and its development goals in each application fields. I will further discuss human nature, both as individuals and in groups, and social and cultural standards in relation to maladjustment of robot technologies, to assess far-reaching effects produced by robot technologies from a more global point of view, positively as well as negatively.

Deployment of automation technologies, particularly in a new age of information, is not confined to factories alone. The situation prompts us to recognize the importance of discussing the process of feedback, in a wider social and economic scope involving consumers, as the basis of automation technologies. Simply stated, it means reorganization of factory automation by introducing

advanced robots in response to what consumers want or desire, representing a departure from automation technologies in the past which were organized and operated solely in response to intentions of manufacturers. The automobile industry is special case in point where engineers should look at technologies with the awareness that consumers are designers as well. We are now entering into a new age of rapid progress of robot technologies in almost every aspect of industrial activities, and I am trying to look into how this should be organized to fit an expanded social and economic framework, presenting an outline of our goals to make this adjustable to general society, then consider the optimality of automation technologies by advanced robots.

2. R & D Projects for Advanced Robot Technology

In Japan, The Advanced Robot Research Association was established on February, 1984.

The Association includes 18 companies and 2 organizations. The main activity of the Association is to take part of the National Research and Development program, "Advanced Robot Technology" being promoted by the Agency of Industrial Science and Technology, MITI. Currently, the joint research program by the member companies and organization is underway with close relations to the National Research Laboratories and Universities.

The Association will also be expected to contribute to improve the technological standard of the member companies in the Robotics areas.

A major portion of our modern life and the security that we enjoy today is supported by human labor under demanding working conditions and fire fighting and rescue operations. This demand for extremely sophisticated operations which can only be done at this time by humans is increasing.

It is, however, necessary for healthy development of our society to liberate humans from jobs under such critical conditions, so as to provide jobs in safe and pleasant environment.

In view of the technology available today, it is impossible to replace all human jobs by machines. Development of advanced robot systems capable of operations illustrated above requires new technology.

This project reflects these circumstances and aims to research and develop advanced robot technology for the system that avoids the need for humans to work in critical environment.

Robots expected to be used in nuclear power plants, undersea operations, disaster prevention and fundamental technologies must work in large, complex and hazardous environments. Therefore, this type of robot will be required to be more versatile and more dexterous, when compared with industrial robots for the production process application. Also, elements for the robots system must be highly durable in the respective working environments.

An attempt to meet the above requirements may need a technological challenge to the working mechanisms of man and other animals. And the achievement of this goal will require to integrate the advanced fundamental technologies concerning electronics, communication, measurement, control, biology, and highly durable materials.

In consideration of such backgrounds, the 8 year research and development program has begun with the objective of carrying out research and development of technologies particular to the respective application fields as well as fundamental robot technologies. In this program the practical application technology for the advanced robot is intended to the established through fundamental experiments, conceptual and fundamental design, and evaluation processes.

The R & D program is underway in collaboration with related research organs in and outside Japan in order to understand the various issues pertaining to research and development, and to adapt to future demand, as well as to contribute to an international joint cooperation program.

3. The Related Fields of Application

3-1 Nuclear Power Plant Facilities

Robots in place of man capable of performing sophisticated work activities including maintenance and inspection and repair of primary equipment and facilities, such as equipment and facilities in nuclear power plants will be developed. High-level reliability, resistance to radiation, and environmental adaptation are the areas in which technology must be developed. The design concepts and advanced designs related to such types of technology will be drawn up, produced and subjected to experiments. Then, total evaluation will be performed. The robot technology required for the development of a total system technology for nuclear power plant applications will be established through these subprograms.

3-2 Support of Ocean Oil Exploitation

Robots in place of man capable of performing sophisticated work activities including maintenance and inspection and repair of primary equipment and facilities for submarine oil exploitation facilities will be developed. Position control technologies for submarine mobility, submarine vision technologies, submarine manipulation technologies, and supervisory control technologies must be developed. The design concepts and advanced designs for these types of technology will be drawn up, and subjected to experiments. Then, total evaluation will be performed. The robot technologies for submarine applications will be established through these subprograms.

3-3 Disaster Prevention

Advanced robots capable of performing sophisticated work actiivities including disaster prevention, prevention of the further spread of disasters and rescue operations during disasters. Durability technology, sensor technology, environmental adaptation technology must be developed. Advanced concepts and designs for such various types of technology will be drawn up, produced and subjected to experiments. Then, total evaluation will be performed. The robot technology required for the development of a total system technology for disaster prevention and applications will be established through these subprograms.

3-4 Fundamental Technologies

R & D for basic types of technology in demand by the 3 application fields; nuclear power plants, undersea and disaster prevention. Basic types of technology including mechanisms, control, and systems support technology, which are represented by sensor technology, actuator and power source technology, respectively. Robot language and evaluation methodologies are also important.

4. Factory Automation and New Concept of Systems

We have to look at factory automation field from the point of industrial application of advanced robot. With the diversification of parts and spread of automated production processes in the industries, jobs at the "preparation stage" are increasing both in terms of quality and quantity. Attempts to push the efficiency at the "production stage" adversely affect jobs at the preparation and "support stages." The production process using what is commonly known as the "Just-in-Time" production system has brought about delivery of parts according to a time-table and helped to get rid of storehouses in the factory compound. But it should be reminded that those auto parts are now being carried by trucks and the "moving storehouses" dominate on freeways. They often converge on parking areas simply to kill time for delivery of their loads right on the time-table. This also means that the most effective production process in a particular company situation affect public transportation systems and causes many social problems. Looking at the problem from a view-point of Japanese industries as a whole,the production process using the "Just-in-Time" production system means a change in the form of storing parts and products. With this in mind, we should be aware of the importance to draw up future scinario of factory automation by advanced robots. Especially, in the automobile industry, it is vital for us to examine the structure of automobiles themselves, and to promote reviewing the way of assembling automobiles and delivering them not to mention the number of parts.

A review of the contents of jobs on the preparation and support stages in factory automation enables them to encourage feedback among themselves to a certain degree and also to streamline the production process further. Needless to say, it is important for the automobile industry to carry on research and development projects to improve the efficiency of automobiles, but in view of its influences on general society, what is really important for the industry is to

evaluate its far-reaching effects on society and pursue new research subjects in technological system by advanced robots.

Japanese automobile industries have succeeded in improving the quality of their products by taking advantage of the fruit of advanced technologies. However, when we look at the magnitude of impact of the automobile industry on Japanese industries as a whole, the industry's initiative to make its advanced system technologies available publicly will provide means and ways of their survival and future prosperity. The automobile industry should promote factory automation in an expanded social framework with the help of basic philosophy as part of an attempt to get out the situation in which moving parts storehouses (trucks) more or less occupy freeways and service areas as its products roll on there, too.

Factory automation in a new age of information technologies aims at establishing production and distribution systems of the automobile industry toward the 21st century, getting hold of the trend at various levels through the way of thinking emerging when factory automation is placed in a global perspective.

In discussing artificial intelligence (AI), a popular topic these days, we should look at it not only from the viewpoint of advanced robot technology alone but also as a research subject of promoting intelligent substances in a more expanded framework. A good case in point will be the establishment of intelligent terminals in local regions as part of production and distribution systems with the aim of more active information transmission, comprehensive activation of "matter-energy-information," and then greater efficiency and prosperity of the automobile industry. In that sense, we can say activation of the automobile industry, as it goes along with the spread of factory automation, comes from technological philosophy through "Humane use of advanced robots" that should be the essential design concepts of technological systems.

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From Automaton to Robot – Its Socio-Psychological Backgrounds in Europe and Japan

Prof. Shuji Takashina
University of Tokyo

I

The hit musical My Fair Lady, starring Audrey Hepburn was based on George Bernard Shaw's 1912 play entitled Pygmalion. Set in pre-WWI London, the musical depicts the transformation, through education, of a poor flower girl into a duchess, but as is apparent from the title, the play is none other than a contemporary version of the ancient Greek and Roman tale, Pygmalion. According to the Pygmalion legend, a gifted sculptor falls in love with one of his works, a sculpture of a woman, and prays to Venus, the goddess of love, to instill it with life. Venus grants his wish, and the cold stone is converted into a beautiful, living woman named Galatea. The two are wed and live happily ever after.

In Shaw's play, Eliza, a flower girl, is the modern Galatea, and Professor Higgins, a phonetician who corrects Eliza's horrid London dialect and teaches her correct pronunciation, is Pygmalion. In the same way that the sculptor carves a beautiful sculpture from stone, Professor Higgins turns the flower girl into a duchess through education and guidance. Both women are the"masterpieces" of their makers.

The major difference between these two similar tales cannot be overlooked. That is, while the gifted sculptor Pygmalion was the creator of the beautiful

Galatea, he had to entreat the goddess Venus to endow it with life. In other words, super-human, divine intercession was necessary to instill life into simple matter. However, in the modern-day version of Pygmalion, Professor Higgins is able to create the duchess entirely by his own powers. Thus he performs both the roles of Pygmalion and Venus – and becomes a superhuman figure of sorts. Professor Higgins' attempt at molding a human being represented a fleeting challenge to the notion that man can create man without divine intermediation.

George Bernard Shaw was not the first person to take up this question. In fact, Shaw's Pygmalion represented the last of a number of Western literary works on the Pygmalion theme, in the nineteenth century. I would like to discuss a few such examples to clarify the socio-psychological background of that age.

First I would like to mention Balzac's novelette, The Unknown Masterpiece. The work, which first appeared in 1831 in magazine form before being published in an authorized version in 1837, also takes up the theme of man creating man strictly through his own power. Balzac termed Frenhofer, the main character in his novelette, "new Pygmalion." The artist is a genius, to such a point that he borders on derangement. His lifelong desire is to pour all of his talents and power into creating the paragon of beauty – the ideal figure of a woman. He applies himself for ten years to achieve this goal. The woman on canvas not only has the same texture as a living woman, but seems to breathe and cast smiles at the painter – or so he believes. Nonetheless, when the painter, who is convinced that he has completed his masterpiece, is told by friends that it is "nothing but confused masses of color and a multitude of fanatical lines," he is driven to despair, burns his masterpiece and commits suicide.

The American novelist Edgar Allen Poe deals with the same theme in The Oval Portrait (definitive version 1845). The story describes a genial painter who takes his beautiful young wife as a model. Through the artist's painstaking endeavors, the painting begins to become as life-like as his model. With the finishing brush stroke, the portrait comes to life. The painter shouts with joy that this indeed is life itself, but he then turns to find his wife dead.

Emile Zola takes up an identical theme in his 1886 work, The Masterpiece. The main character, Claude Lantier, is a gifted artist who takes ten years to paint a portrait of a beautiful nude. He gradually becomes so physically attracted to his

work that one night while he and his wife are asleep in their bedroom, the painted woman calls him to his studio, where he hangs himself.

Another work written in the vein of "giving life to paintings" is Oscar Wilde's 1891 novel, The Picture of Dorian Gray. In this work, the model of the portrait, Dorian Gray, does not age a bit. Instead, his portrait reflects the passage of time. In other words, the picture is living, and the human being is nothing more than its shadow. Dorian Gray finally regains his true form and figure only when he breathes his last breath before the portrait.

This series of 19th century Western works dealing with "new Pygmalion" themes may have slightly different plots, but their central theme is consistent. They all take the following two stands in regard to the notion that man can create human beings without divine intervention:

First, artists are closest to the gods in terms of creative capacities. In the ancient version, Pygmalion was only capable of shaping the figure of a human – he could not endow it with life. The Pygmalions of the 19th century, however, had the power to instill life into matter. This notion is a reflection of the romanticism which viewed art as a gift from the gods, and artists as mystic possessors of creativity far surpassing the ordinary person. In ancient times and the middle ages, artists were merely craftsmen or manual laborers. It was not until after the Renaissance that artists finally rose to a status comparable to scholars and literati, and eventually to a standing that allowed them entrance into the royal courts. In the age of romanticism, artists first took on a special status comparable to that of the divine. The twist in the 19th century Pygmalion stories is undoubtedly due to these factors.

These contemporary works are also consistent in that despite, or more accurately, because of their superlative creative powers rivaling the divine, the main character is bound to a tragic fate. While the film version of G.B. Shaw's Pygmalion ends happily, the original work hints at a tragic conclusion – that is, creative persons who try to rival the gods are imposing in the realm of divinity and justly deserve punishment for their insolent ambition.

Icarus, the character from ancient Greek mythology who flew too close to the sun, fell to his death when the wax in his wings melted. In ancient Greece, hubris, or arrogance, was the greatest sin and attempts to rival the gods were severely punished.

According to Christian doctrine, man, like all other earthly things, was created by God. This fact prevents man from easily intruding into the realm of the gods. This notion is precisely what prevented these new Pygmalions from achieving success.

II

The appearance of this multitude of new Pygmalions with the power to create man by their own hand reflects a drastic change in Western values in the nineteenth century. Religion no longer held ultimate sway over the people. The power of the divine had diminished to the point that artists were considered creative rivals. At the same time, man had been deprived of God's blessings. The order which clearly separated God from man and man from matter had begun to crumble, and ideological chaos resulted. The glory and tragedy of these new Pygmalions can be accounted for by this ideological chaos.

The history of automatons offers a number of illuminating examples that provide further perspective on the matter. If Galatea represented the ideal vision for the sculptors, then the doll capable of human movements must have certainly represented the ideal vision for the engineers – as seen by the long history of attempts to create such toys.

Sculptures capable of motion date from ancient Egypt, and Heron of Alexandria is credited with designing an ingenious theater employing automatons. Nonetheless, the greatest fruits of automaton technology came to bear during the 18th century Age of Reason, and in the 19th century automaton rapidly declined.

The leading name in the field during the 18th century was the Frenchman Jacques de Vaucanson. He devised a famous flute-playing automaton in 1738, followed by a mechanical duck and drummer the following year. It is said that the flute-player, designed not only to move its fingers, but to change the position of its lips and tongue, and to regulate its breath as well, could play 12 different melodies.

The duck was said to be capable of quacking and flapping its wings, in addition to drinking water and eating, digesting, and voiding feed.

In 1741 Vaucanson presented a blueprint to the Royal Society of Lyon of an automaton complete with the physiological functions of a human being – including circulation, respiration, digestion, muscular movement, and a nervous system. Although the project was not materialized, this was, needless to say, a clear attempt to create a human being by human hands.

Jacques de Vaucanson's attempts were followed by those of Jaquet-Droz, who designed the highly acclaimed "mechanical boy that writes" in the late 18th century. The boy sat at a desk, dipped a quill pen into the inkwell, and actually wrote various letters. It has been preserved and is now at an art museum in Neuchâtel. The history of automaton technology went no further, however. For some reason, in the 19th century the automaton remained in the form of show things or toys, with no new developments to speak of. The question is why the trend came to a sudden halt.

Eighteenth-century automatons employed complex assemblies of gears and springs. Nineteenth-century technology was certainly more advanced than that used in 18th-century; it would have been surely possible for 19th-century engineers to create far more advanced automatons than those of Jacques de Vaucanson, if they had wished. The reason for the decline in automatons in the 19th century must be attributed to the breakdown in the spiritual underpinnings of the age.

Vaucanson certainly did not create his automaton simply as a plaything. He commented that his motive for creating the automatons was "to create a figure truer to life than that found in nature." In other words, his automatons were not machines imitating human actions, they were creations manifesting the very essence of the human. This train of thought reflects the notion that human movement is, in reality, identical to that of machines. In other words, human movement and substance are nothing more than one type of mechanical movement. This concept had already been taken up in Descartes' mechanistic theory of life but was deepened in the 18th century, as reflected in L'Homme-machine (Man-machine), written by J. de la Mettrie, a contemporary of Vaucanson. Indeed, the underlying belief that man's body and substance were

identical to those of machines enabled Vaucanson to devote himself to the creation of an automaton more realistic than a natural human being. With the advent of the romantic movement, however, this type of rationalism was overtaken by the notion that man possesses an irrational, mystic, and ominous element as well, and automatons were relegated to the lowly realm of children's playthings. The link between man and machine (matter) was cut, order disintegrated, and both man and machine began to follow their ways separately.

Significantly, it was a novelist who clearly perceived this trend, : in fact, by Mary Shelley's work, Frankenstein, appeared in 1817, that is, about the time the romantic movement made its first appearance.

Dr. Frankenstein's monster, mechanically perfect, but endowed with an evil mind, symbolized the end of the age of automatons. The disintegration of common order and theory between man and machine (matter) led to the opposition and ultimate revolt of the machines against their creators. In other words, the Galateas created by new Pygmalions took the lives of others in order to gain the one aspect which they lacked – life itself.

This separation of man and machine (matter) continued into the 20th century. In the 20th century man again attempted to create human life through machines, but unlike the Vaucanson age, men no longer felt trust or solidarity with the nature.

Twentieth-century engineers, in fact, were not interested in creating "a complete human, truer to life than that found in nature," but instead pursued machines which could replace man on a partial basis. Needless to say, this is the role served by robots.

The term "robot" originated in Czech novelist Karel Capek's fictional novel, Rossam Universal Robot. The word "Rossam" refers to the names of the creators (an uncle-nephew team) of the robot in the story, and means "reason," or "logos." The word"robot" was coined from a Czech word meaning "let work." In other words, robots were created by human reason merely to be put to work. Thus, unlike the automatons of Vaucanson's day, which shared identical functions with humans, robots were explicitly distinct from humans, and stood on equal footing with them only in the realm of work. True, the robot envisioned by Capek had

human features. But in reality, unlike the automatons, in the 20th century it was not considered necessary for robots to have human features. This further underscored the decisive break between man and machine.

Thus, it is perhaps only natural for us to feel as though robots are an ominous presence -- particularly as they become more and more elaborate and the split between them and humans widens – which will take them outside the bounds of human control. Thus modern-day robots are continually overshadowed by the ghost of Dr. Frankenstein's monster. Deep in the Western subconsciousness there is a continual fear and dread that the Frankenstein monster will be resurrected. This premise is backed by the multitude of science fiction novels which take up the revolt of machines against their maker, man. Indeed, this notion is a major source of psychological resistance and the basis for rejection of the introduction of robots into daily manufacturing activities in the West.

III

This resistance and rejection to the introduction of robots is not encountered as much in Japan. The Japanese tend to view these machines not so much as separate entities but as associates of sorts. Robots, one of the products of modern scientific technology imported from the West, are also manufactured in Japan.

According to the Japanese way of thinking, the realms of gods, humans, and matter are not disjunct, but rather all three are bound into one. Shinto, the oldest form of Japanese belief, which is based on nature and ancestor worship, does not have a set doctrine as such, but still holds much influence over the Japanese today. The "kami" associated with Shinto are usually translated as "gods," but this does not refer to the divine, omnipotent creator of life, as in Christian teaching, but rather to the spirits of nature, such as the spirits dwelling in the sun, mountains, and trees, etc. These "gods" are a familiar part of our everyday experience.

In a temporal sense as well, we are bound to the realm of the gods. Through worship of ancestors (gods), we are linked to the world of the gods. In this sense, Buddhism, which was introduced into Japan at a later date, was easily adapted into the Japanese mentality. This is because the almighty figure in Buddhist teaching was originally a human being himself.

"Buddha was at one time a man, like us.
And we, too, can eventually become buddhas."

This popular song from the middle ages clearly underscores this sentiment.

Just as Japanese tie the world of the gods to that of man, the Japanese do not consider the material world separate from their own. Even today, the Japanese consider not only flora and fauna, but also material things, such as the tools used in daily life, as animate beings possessing a spirit.

An example of this sentiment is found in the memorial services for used sewing needles, which have been conducted from old throughout the country. This service is to show thanks to old, broken or otherwise unusable needles for their long years of service to mothers, wives and daughters. While the service itself takes various forms in different areas, in general the needles are stuck into tofu or konnyaku, or are tossed into a river to be washed away. The needles are given a final resting place in the extremely soft tofu and konnyaku as a token of thanks for the long years of service in which they were continually stuck through tightly knit, tough cloth for our sake. In other words, the needles are not simple tools, but rather are animate beings, which toil and tire like humans.

Another such example is the tombs set aside for used calligraphy brushes or pens. The Japanese view these essential tools of daily life as animate beings, and therefore honor the "deceased" tools with a final resting place.

From the viewpoint of Western rationalism, the Japanese sentiment may appear to be no more than a relic of primitive, animistic thought. Westerners undoubtedly consider making a grave for used writing utensils to be totally meaningless. Used tools are simply discarded in the West. This type of Western rationalism created a superlative scientific technology, but it is not able to surmount the unconscious fears and anxieties regarding the latent possibility of a new Frankenstein.

In contrast, the Japanese approach, be it, as it may, a relic of ancient, primitive, animism, is highly receptive to the introduction of new scientific technology. And the introduction of robots into the Japanese manufacturing sector has led to desirable results. Japanese workers do not see the robots as an intrusion by a "foreign" element, but rather consider them comrades. The robots are often

decorated with hats and ribbons, and given nicknames. While much of this is done in jest, these actions reflect the Japanese traditional view that, like needles and used pens, these tools are animate things. A view such as this makes Japanese society more receptive to the introduction of robots.

Advances in automation in the fields of manufacturing and services are inevitable. As these fields expand, greater importance will be placed on our socio-psychological view of mechanization and machines. Japan's active utilization of robots and its historical and cultural approach to tools and machines can certainly provide food for thought in dealing with the mechanization-intensive society that is on the horizon.

High Technology and the Receptiveness of Japanese Society

Reikichi Shirane
President
Telecommunications Science Foundation

1. The two faces of technology

The majority of the high technologies developed in the latter half of the 20th century have originated in the United States. These include nuclear power, aeronautics, space technology, ocean development, computers, electronics and biotechnology. In each of these fields, the U.S. has led the rest of the world.

Not only the advanced industrialized nations, but the newly industrializing ones as well, have shown great interest in these high technologies. There has been intense competition among these countries in the race to catch up to the U.S. Needless to say, Japan is one of the nations that has made the most intense efforts in this regard. Now that these efforts have met with some success and Japan has reached the level of the U.S. in several of these sectors, a number of important characteristics of Japanese technological development have come to light.

First, Japanese high technologies have been developed primarily to meet private demand. In the period following World War II, policy on science and technology was linked with industrial policy to promote economic reconstruction. Unlike the other advanced industrialized nations, whose science and technology policies are essentially geared to military requirements and preserving the nation's prestige in the realm of international competition and are therefore separated

from their industrial policies, Japan has been endeavoring for a long time to introduce and adapt high technology at the private enterprise level. This difference in policy orientation accounts for Japan's success in developing industrial technologies.

Since many of today's high technologies have developed as offshoots of military projects, Japan's more than thirty years of experience in developing technology primarily for private consumers has indeed been a rare example.

Second, Japan's experience has created the awareness that Westernization alone is not enough to bring about industrialization and modernization.

As I have mentioned, most of the modern high technologies that have served as the base for Westernization have been developed in the United States. The history of the U.S., a country with vast land and abundant natural resources, has been a history of the frontier spirit, searching for the most effective ways to exploit the space and the resources that the country enjoys.

Technologies that augment man's capacity for work and locomotion have been developed one after the other. Machinery for agriculture and for civil engineering projects; facilities for mass producing automobiles, a system of highways, and the air traffic networks that link the cities – all of these are aspects of the continental frontier-development pattern found in the United States. Another aspect of the expansion of human capabilities is the telecommunication and radio-television networks and the advanced use of computers, which have served as vital support systems in the information field.

At first, Japan faithfully pursued this continental development model, although the country's conditions -- insularity, a dense population, and limited land -- were vastly different from those of the U.S. It was therefore inevitable that Japan would be confronted with a formidable barrier in the form of such problems as environmental disruption, pollution, and scarce resources. Fortunately, such steps as the development of pollution-free plants and limitations on automobile exhaust have produced notable results in overcoming this barrier. Through this painful learning experience, Japan has come to be aware that modern high technologies have two contradictory faces.

2. Technologies adapted to each society

The principles of natural science are universal. The high technologies that are direct extensions of the natural sciences are also chararcterized by universality. This impression is enhanced by the fact that industrial facilities such as airports, power plants and petrochemical complexes, which are products of modern technology, present the same universal landscape regardless of where they may be located. They are therefore seen to have the undesirable impact of destroying the individuality of cultures.

However, we cannot deny that whether technologies are created by a country or introduced from the outside, they clearly reflect the history, tradition and environmental conditions of the society in which they are found.

This is true in Japan's experience. Japan acquired advanced technologies from the West, but these technologies have taken root in Japan. Through this process of Japanization, they have come to have a distinct identity.

It is assumed that today's newly industrializing countries (NICs), too, will soon follow the same pattern, achieving Koreanization, Mexicanization, and so on.

When we view the technologies of various countries from the viewpoint of "technologies adapted to each society," we must be ready to answer the question of what characterizes Japanese technologies and what role they must play from a global perspective.

A traditional characteristic of Japanese society is the sense of moderation. In the recent process of modernization, the Japanese themselves have tended to lose sight of this virtue. Nonetheless, this is an important basic philosophy that ought to be restored to our technological society. Now is the time when we must conduct a basic reassessment of the technological civilizations that waste natural resources and disrupt our environment, which are found almost exclusively among the advanced economies. As the term "Space Ship Earth" suggests, the earth is a little island afloat in the universe, and the conditions which have almost miraculously enabled living things to exist are extremely delicate.

The recognition of the limits of our resources and the environment proposed by the Club of Rome is an important bit of universal wisdom for the Japanese people, who live in a highly congested island society where a sense of moderation has traditionally been an important virtue.

"Technologies adapted to each society" is the antithesis of the idea of one giant technology of the frontier development kind. At the same time, it has another significance for the future of technology-oriented civilizations. This viewpoint, as a matter of fact, was one of the basic ideas of the concept committee of the Tsukuba Science Expo '85. In particular, it has a great relevance to the fact that the exhibits from developing nations emphasized their culture and traditional technologies.

3. Internal renovation of Japanese society

Throughout much of Japan's modern history, the recognition of inferiority, or the distance between Japan and the most advanced nation in a particular field in a particular era, has served as the inspiration for efforts to remove that disparity.

This is true with every field – politics, economics, culture and religion. A commentator once referred to Japan as a "theater state," explaining that it was adept at staging a play by borrowing a good script and production methods from other countries.

In the series of experiences spanning the defeat in World War II, postwar reconstruction, and economic growth, Japan has acted out its role as a "theater state" to the hilt. In particular, her performance as a former student eager to catch up with her mentor, the United States, may be said to have continued until today.

Japanese society has gone through a series of metamorphoses since the beginning of its history. Through these dramatic changes, two things have been consistent: the nation actively imported foreign things, and all persons concerned with a particular field devoted their collective effort to achieving a particular objective. This is the pattern of effective renovation peculiar to Japan. It is a pattern of behavior that may be described as social invention.

We can discern boom phenomena of this pattern in some of Japan's postwar efforts toward becoming an economically advanced nation. One example is the boom phenomenon of the quality control system employed by corporations. Another is the management information system (MIS), featuring the introduction of the computer, which triggered a major movement enveloping the political, business and official world of Japan.

Still another is the futurist boom that spawned the concept of an information society in the latter half of the 1960s. Then came the anti-pollution drive and the movement to correct environmental disruption.

The response to the oil shocks of the 1970s was still another. In the present decade, office automation (OA) and the new media information society form the second futurist boom. Then there is the more recent liberalization drive in the telecommunication industry, which has been spurred by administrative reform and trade friction. All these are typical examples of the Japanese-type boom phenomenon.

Unlike other advanced nations, Japan has no big projects on which to stake national prestige nor is it involved in the armaments competition. In Japan the private-sector vitality in the intensely competitive free market has often played a principal role in carrying forward booms as social phenomena. The fusion of this intense energy and wisdom has helped to overcome a series of difficult problems.

I am not, however, unreservedly recommending this Japanese mode of social reform. It has a serious defect in that these Japanese booms have been almost entirely dependent on private-sector vitality.

Projects by corporations, for instance, are exclusively oriented toward the solution of given problems, and the targets tend to be limited to the items that can produce results in the short term. Meanwhile, the types of problems that ought to be tackled for the good of society, at the expense of long-term investment deficits, are often neglected.

4. Characteristics of Japanese culture

One of the characteristics of Japanese culture is its basis in mass, or citizen, culture. In the West, the prevailing pattern of culture is the "descending" type, in which a numerically small ruling class or elite preserves a high level of culture, which is then spread through citizen education.

The true nature of Japanese culture, on the other hand, is of the type that develops within the masses and is then handed down through generations and refined over a long period of time. The source of Japanese social vitality in the contemporary industrialized society is therefore the ordinary citizen rather than the private-sector enterprise.

A second trait is the tendency to set great store by sustained "involvement." This is observed not only among human beings but also between man and nature and man and technology. This attitude is based on the pattern of thinking that perceives such involvement as a total continuum rather than mere instances of confrontation.

These two traits of Japanese culture have been amply illustrated in the building of the modern industrial society. An outstanding illustration of the first characteristic is the QC circle organized at factories, where workers themselves offer ways to improve operations and contribute to the improvement of the quality of industrial products. Out of this has come the organization theory based on the Japanese formula of "total participation."

The second characteristic, that of valuing "involvement," is significant in relation to intra-organizational revitalization in Japan. Japanese organizations in general are characterized by groupism, the seniority system and lifetime employment. This has given rise to the misunderstanding that, under this system, the lower components of an organization respond with high motivation when given orders from the top.

In reality, however, this does not work that way. High motivation becomes observable when each member of an organization first recognizes the purposes of the company as a social entity and then fully understands its surrounding social fabric as well as their own role in it. This "involvement" society is believed to

account for the fact that the members of a company, from new recruits to top managers, share the same corporate interests, joys and anxieties. The concept of total quality control (TQC), which is a product of American society, seems to have taken root in Japan with better results because of Japan's "involvement" culture.

The high level of citizen vitality mentioned earlier and the sustained importance attached to "involvement" have provided a suitable environment for accepting alien ideas from outside the country and for pushing ahead social reformation. Much of the mystery of the "depth of the bosom" – the great capacity to accept and receive things from the outside – may be unraveled by these two characteristics.

5. Tasks for the 21st century

Japanese history has been delineated essentially in terms of the effort to catch up with the advanced foreign civilizations. Now that Japan has joined the world's leading nations in certain fields, her role and ability to compete in the 21st century are being questioned anew.

The first of the tests will be whether Japan can build a new kind of "advanced information society" on an infrastructure of the various new electronic media.

It has been said that there have hardly been any notable achievements by Japan in the area of the social sciences. Therefore, it was unusual for Japan to have postulated in 1963 that the future society would be an "information society." It was indeed a rare made-in-Japan social theory.

At that time, color television was sweeping the country. This social theory may be said to have been spawned against such a background.

The latter half of the 1960s saw the eruption of such problems as pollution and environmental disruption. Then came the oil shocks of the 1970s, compounding the difficulties that confronted Japan and bringing the futurist debate to a temporary halt. Yet, during these years, high technologies in the field of information made rapid progress. In the 1980s many new media have been brought forth, again stimulating debate on the information society.

These new media include office automation (OA) of the Japanese model, introduction of the Value Added Network, and experiments with the digital communications complex called INS (information network system). Innovations like these in information technology will create drastic changes in corporate and social activities in Japan in the next five to 10 years, and will vastly accelerate the "advanced information society," for which there is no model for Japan to emulate.

The most prominent characteristic of an advanced information society is that it tolerates the coexistence of a variety of values. In an industrialized society, which places top priority on the improvement of material productivity, both individuals and groups have often been restrained by a single value. An advanced information society, in which intellectual productivity has the dominant role in development, however, enables individuals to strive independently for the creation of a variety of values.

Such a trend will be found in the economic, social and cultural aspects of the future society. We can anticipate seeing individuals seeking their own distinctive values in a process of transition from concentration to dispersion and from the pyramid-shaped social structure to a non-hierarchical and horizontal one. The trend will be observed in the selection of occupations, the building of organizations and the development of communities.

There is no model for achieving such an advanced information society. Japan herself will have to be the playwright of an original scenario, and produce and act in the drama that challenges the unknown by mapping her own way. Whether such an adventure will succeed is certain to become clear by the middle of the 21st century.

Ringraziamento

Taizo Ueda
Managing Director
Honda Foundation

Dottor Pacini

Signori e Signore,

Con molto piacere ho accettato di partecipare a questo Seminario come delegato della Fondazione Honda.

Due anni fa discutemmo in questa stessa occasione sul tema : tecnologia e trasformazione sociale.

L'anno passato a Tokyo trattammo un altro importante argomento: Futurama e Creatività industriale.

Ora siamo giunti con impegno e soddisfazione alla terza edizione di questa importante iniziativa, e consentitemi ancora una volta di esprimere qualche considerazione sul significato di questa manifestazione.

E ormai opinione diffusa che la società giapponese è molto diversa da quella occidentale. Io non la penso proprio in questo modo, anzi ritengo che ci siano in fondo molte più analogie che differenze. Ieri e oggi abbiamo riesaminato vari

problemi sull'automazione e le diverse conseguenze socio-economiche sui nostri rispettivi paesi.

Ebbene, dopo quanto analizzato, sono ancora più convinto che esistono molteplici elementi comuni nella tecnologia e società. Naturalmente non si possono negare le differenze di cultura tra i due paesi e proprio per questo il senso di creatività e collaborazione puo essere sviluppato attraverso lo scambio e la volontà di apprendere.

Fin dal primo seminario molti italiani sono venuti a visitare la mia Fondazione. Questi contatti sono stati molto proficui per entrambi i paesi.

L'anno scorso abbiamo costituito una nuova associazione giapponese-italiana così chiamata--Technology Society. Molte persone importanti sono membri di questa associazione e tra essi figurano noti professori, alti dirigenti ed ingegneri. Sign. Hattori è presidente di questa associazione.

Entrambe le nostre organizzazioni: Fondazione Honda nel settore della cultura tecnologica, e Technology Society nel settore della cooperazione industriale, sono a vostra disposizione per rafforzare l'amicizia e la cultura tra i due paesi.

All'ultimo vorrei esprimere i piu sinceri ringraziamenti al Dr. Umberto Agnelli, Dr. Cesare Romiti, e particolarmente Dr. Marcello Pacini ed a tutto il personale della Fondazione Agnelli per gli sforzi compiuti nell'organizzare questo seminario con grande successo e con profondo senso di ospitalità.

Il prossimo seminario sarà organizzato a Tokyo e spero di riveder Vi ancora in Giappone.

Grazie, e Arrivederci.

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