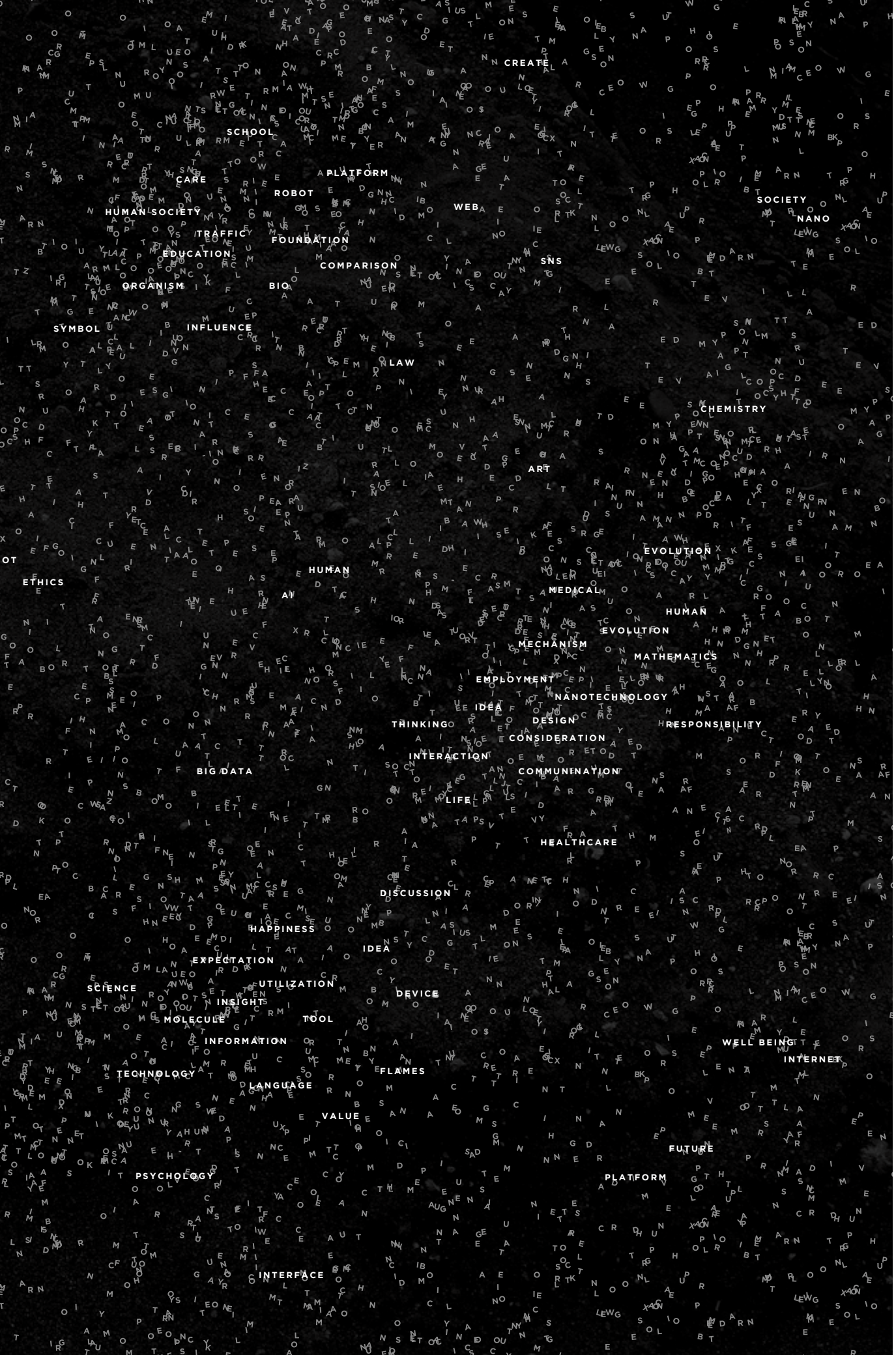

Human-Information Technology Ecosystem

Vol.01

HITE
Human
Information
Technology
Ecosystem

Message from the Program Supervisor

With regard to rapidly developing information technology, people have great hopes for the benefits that could be brought about, as well as a sense of uneasiness concerning the potential negative aspects. In particular, there are fears that even humankind's autonomy and leadership could be threatened by things such as machines' learning abilities, judging abilities, and (through robotic controls) executive abilities in the absence of human intervention. Combined with IoT, AI will have access to, and will have power to judge based on, vast amounts of data that include highly sensitive and personal data.

However, being vaguely uneasy will not resolve this issue. Investment in technologies will continue, fueled by the human desire for solutions to their problems. We cannot and should not, for example, stop the advances in caregiver robots and self-driving cars for the elderly. Similarly, we would very much like to see the elimination of world poverty through the improvement of productivity. To the greatest extent possible, we want to avoid obstructing efforts toward the progression of such technology. Much needed governance structure for technology should also be designed to promote the development of the technology for human benefit. We must turn the seemingly conflicting relationship between technological development and human control of machines, into a mutually reinforcing activity.

The basic belief of the "Human-Information Technology Ecosystem" area is that in order to eliminate the conflict, it is important for various stakeholders to understand the underlying social meaning while the development of this technology is still in the germinating stage if possible, and to communicate about the desired way for the technology to progress. We would like not to simply revise the technology side, but to make efforts so that people as well can further their understanding of technology and enhance their abilities in order to utilize the technology in a beneficial, safe fashion. That is to say, we desire not to simply design human-focused technology, but to create an ecosystem in which technology and people coevolve while interacting. The name of this area contains that very sentiment.

This area has various groups, including a group that seeks to create a model for the coevolution of technology and society while practicing specified technical development, a group that philosophically explores the main concepts that will become vital, a group that seeks to develop communication tools, a group that aims to form a diverse community of researchers, and so forth. However, the area as a whole is unified in its goal of creating a platform for the coevolution of technology and society, and each group is contributing through its respective pursuits.

Program Supervisor
Jiro Kokuryo

Jiro Kokuryo

Program Supervisor of "Human-Information Technology Ecosystem"
Professor of the Faculty of Policy Management, Keio University

Jiro Kokuryo graduated from the Faculty of Economics at the University of Tokyo in 1982, and then joined the Nippon Telegraph and Telephone Public Corporation. He obtained a Doctor of Business Administration at Harvard Business School in 1992. From 2003, he served in positions such as being a professor in the Faculty of Environment and Information Studies at Keio University, and in 2009, he became Executive Director of the Faculty of Policy Management. From 2005 to 2009, he also served as the Chief of the Keio Research Institute at SFC (Shonan-Fujisawa Campus). In 2013, he assumed the position of Vice-President at Keio University. His main authored works include Open Architecture Strategy(Diamond, Inc., 1999) and Business Strategy in an Onymous Economy (Nikkei Inc., 2013).

Human-Information Technology Ecosystem

"Human-Information Technology Ecosystem" is an R&D area promoted by the Research Institute of Science and Technology for Society (RISTEX) of the Japan Science and Technology Agency (JST). Recently, expectations have been growing for a more affluent, highly-efficient society due to rapid progress in AI using big data, robots, IOT, and other types of information technology. At the same time, some observers have begun to point out that information technology can cause various problems. To properly deal with these problems, this area aims to reconceive information technology from a human-centered perspective, promote R&D for achieving accommodative design of technologies and institutions based on community understanding, and realize a society which harmoniously integrates information technology and human beings.

Website: http://ristex.jst.go.jp/hite/

Human-Information Technology Ecosystem

Special Tripartite Discussion

To the Future of People and Information Technology

Toward building a better relationship between technology and human society.

Toru Nishigaki

Professor Emeritus of the University of Tokyo and Professor of the Department of Communication at Tokyo Keizai University

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Arisa Ema

Assistant Professor, Science Interpreter Training Program, Komaba Organization for Educational Excellence, University of Tokyo

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Dominique Chen

IT entrepreneur & researcher

Date of interview: January 23, 2017

We are in an age of information technology where artificial intelligence (AI) evolves at an accelerating pace. What meaning and impact does technology have for human beings? The pioneers of the HITE community who continue to think about implementations of technologies in society and provide a venue for dialogue to tackle theoretical questions that do not have any answers were interviewed on how we can approach building a future society together.

Meaning and social influence of information technology

First, please tell me about your own activities and how you have been involved with HITE.

Dominique Chen (hereinafter referred to as Chen): I was originally a researcher in information studies, and I have been running an IT startup, Dividual Inc., since 2008 (*merged and acquired by Smartnews Inc. in January 2018) whose main purpose is the development of web and smart phone applications among other things. I am also involved in activities between Academia and private sectors, including as the director of a non-profit corporation, Commonsphere, which delivers what is known as the "Creative Commons License (commonly "CC")" which allows creators to have their own choice of copyrighting on the web.

Last year, I saw a public advertisement on the "Human Information Technology Ecosystem (hereafter referred to "HITE")" posted in Japan, and I still remember that it was so exciting to know that such efforts are finally being initiated in Japan. This is because I have seen overseas researchers and businesses get together to create a place to publicly discuss the social risks of advanced information technologies such as AI since several years ago. US non-profit organizations such as the Future of Life Institute and OpenAi have been the leaders of these activities. Being aware of the issue that Japan must also keep up with the trends in time, we launched "Development and Dissemination of Information Technology Guidelines for Promoting Japanese-style Wellbeing" together with Associate Professor Hideyuki Ando from Osaka University and PI, Dr. Junji Watanabe from NTT Communication Science Laboratory with whom I have been discussing the issue.

Arisa Ema (hereinafter referred as Ema): My research field is known as "STS" which refers to "Science, Technology and Society" or "Science and Technology Studies". I have been studying the relationship between science/technology and society, focusing on information technology, and especially on the social implications of surveillance technology. In 2014, there was an incident (*1) where the cover design of the Japanese Society for Artificial Intelligence raised a significant controversy. At that time, I noticed that there was no place to interact with other researchers who have been engaging in research on information technology, including myself, who have been studying the social impacts of information technology. Accordingly, my colleagues and I have launched a research group called "Acceptable Intelligence with Responsibility (AIR)" to discuss social implications of information technologies, including AI from interdisciplinal viewpoints. As for our research activities, AIR members visit fields such as a robot hotel, or farms where information technology had been introduced to investigate social implications of the technologies. We also carried out an oral history study at the second Artificial Intelligence Boom (*2) in the 1980s.

Toru Nishigaki (hereinafter referred to as Nishigaki): My current specialty is mainly philosophical studies of information society. But when I started my working career, I was engaged in designing a mathematical model of an OS of a mainframe computer in a big manufacturer. Since then, I have been concerned with computers for more than 40 years. In 1980, when I was studying abroad at Stanford University, we were going through the second AI boom, and knowledge engineering was very popular. Expert systems (*3), which aimed at substituting for human experts like lawyers and doctors, were especially being eagerly developed. Meanwhile, "STS" was also popular at Stanford University, and the impacts of science/technology on society were actively discussed. This gave me the chance to review my research from a social standpoint.

In the 80's, even in Japan, enormous budgets were injected to AI development, including the 5th generation computer, at many research institutions. I also joined the boom after returning to Japan by getting involved in the development of the 5th generation computer for a while. However, hard work at a factory site damaged my health, so I became a university teacher in the late 80s. Soon the AI boom ended and the "winter" period began for AI research. I think the biggest reason AI development failed in Japan was that the meaning and the social influence of AI had not been given enough consideration, and only intense technological efforts had been made. In other words, the philosophy and the ideas behind AI were mostly ignored during development.

For that reason, in the 80's, I independently started my research focusing on AI studies from philosophical viewpoint, especially based on French contemporary postmodern philosophy. After that, in 2000, the Graduate School of Interdisciplinary Information Studies (Interfaculty Initiative in Information Studies) at the University of Tokyo, which advocated "Integration of liberal arts and computer engineering", was launched. I joined it as one of the founding faculty staff members, and since then have been elaborating on new information theory termed "Fundamental Informatics" which originated in Japan.

Asking "questions" that opens discussions for everyone

Dr. Chen and Dr. Ema both uphold the theme of humans' subjectivity such as "well-being" and "various values".

Chen: In recent years, mainly in Silicon Valley in the US, a movement of attempting to find out the reproducibility of personal spirituality such as well-being and mindfulness using science has been increasingly gaining momentum. It has been considered to be merely human's subjectivity. Coincidentally, at the same time as the HITE announced public recruitment, with Dr. Watanabe, I was given the opportunity to supervise the translated version of the book "Positive Computing-Technology for Wellbeing and Human Potential" (MIT publication) which summarizes the trends of the time, and the book was published in January this

year as “ウェルビーイングの設計論-人がよりよく生きるための情報技術 (POSITIVE COMPUTING Technology for Wellbeing and Human Potential)” (BNN Shinsha).

However, “Well-being” in Western countries is considered to be the pursuit of magnification of an individual's happiness. Under this concept, the level of positive emotion is evaluated as a foundation of research, but I thought that such numerical values of individualism might not fit in with Japanese people who greatly value the importance of harmony with others. So, while making full use of information technology, it became our research theme to think about how we can build a concept of well-being that fits the local culture that nurtures Japanese values.

Ema: A question has come into my mind from what the interviewer said. Does “sense of values” really originate from individual subjectivity? I think “sense of values” can be fostered in a society and a community through interactions among people, goods, systems, environment, etc. And today, people's “values” have diversified at a fast pace, as well as becoming localized and marginalized. In current situation, I believe that it is very important to build a foundation for “dialogue” which provides opportunities for intensive discussion over various values. Rather than coming up with some “solutions,” creating “questions” which everyone can tackle will be essential. Creating “questions” with proper size and quality of interests for everyone is a challenge. That is one of the goals that our project would like to pursue.

In order to ask “questions that opens discussions for everyone”, there is also a need to eliminate the gaps between actual research and the images of AI and information technology disseminated in the media.

Chen: Since I am also an IT engineer, I feel that the regular “physical sensations” of engineers are not well communicated to society. If you speak subjectively about risk theory or optimism in the situation with no reality or understanding of the technology, it would be a pointless discussion, wouldn't it? As a breakthrough for that, I think that technology should be discussed based on evidences such as data known from many studies. It is very important to have domains of academia such as HITE to support such discussions. Since companies always follow the structure of pursuing short-term profits, there is no incentive for them to consider what technology means to human beings for the medium-to-long term.

Nishigaki: In any discussion, I believe what is most important is going back to the “principle” and thinking about the issue in question radically. For example, when arguing whether or not the Singularity Hypothesis is correct, the discussion will become confusing unless we consider carefully the standpoint of the discussant. The values are related to his/her social position. They are not merely subjective, but intersubjective, based on social systems and cultures. If we do not pay attention to such factors, problems cannot be solved appropriately. Even in HITE, I would like to emphasize that principles should be respected in order to deepen mutual understanding while avoiding divergent discussions on a project-by-project basis.

Ema: I think it is important returning to the discussion's basic argument. When implementing new technologies and systems in society, simply “replacing” new with existing technologies and systems is not enough. We are at the stage of going back to the principle, as Dr. Nishigaki mentioned, such as rethinking democracy, and what responsibility is for us. For instance, in a situation where there are multiple possibilities of what is considered to be “justice”, it is necessary to organize them first.

Nishigaki: I agree with you. In 2014, I wrote a book titled “ネット社会の『正義』とは何か 集合知と新しい民主主義 (What is ‘Justice’ in the Internet society? - Collective Intelligence and New Democracy)” (Kadokawa selection book). The final goal is to algorithmically establish the standards of such things as justice, safety, profits, etc., by connecting in some way the ideas of social science and public philosophy with decisions made by AI. For that purpose, I suggested that we should keep a balance, through a dialogue, between the utilitarian pursuit for the values of whole community, and the liberal consideration for basic rights of each community member.

To create a better relationship between information technology and society

How do you perceive a “society where people and information technology fit in” which is the goal of HITE?

Ema: The current information technology is good at moving towards the prioritization of optimization, creating efficiency and convenience. However, if optimization is carried out with today's sense of values, the disparity will gradually increase, and it may create a system in which only a specific group of people can enjoy the benefits. I assume that a guideline of “well-being” that Dr. Chen has been suggesting aims to apply the alternative ideas thoroughly which have a different purpose from such optimization into specific technologies.

Chen: Right. Computers surrounding us are built upon a single sense of value, which is being faster and more convenient. But there is not enough discussion as to whether that sense of value is right or wrong and whether it is meaningful or not. The risk of the trade-off that convenience deprives human beings of their independence and autonomy should also be taken into consideration, and if human beings lose the ability to ask questions, our uniqueness in comparison with machines will be increasingly lost.

Ema: Moreover, as machines penetrate into our lives without us knowing it, we could have the problem of not even noticing that “We have stopped questioning”.

Chen: I agree. The Internet has its pros and cons. Before we started using Google on a daily basis, we needed time and effort to read books by going to the library in order to obtain knowledge. But now, we can easily lookup words we do not know in Wikipedia and we can immediately understand them. I have a feeling that this convenience and rapid process of obtaining knowledge may be generating some trade-offs concerning the qualities and effectiveness of experiences which knowledge is obtained from. I think we must demonstrate these kinds of things steadily in social science research.

However, in the present age, problems are

becoming more complicated, meaning we cannot work them out by the fusion of different fields and interdisciplinary movements. It seems to me that the degree of difficulty of setting up “principle” is getting higher. I understand that the process of Dr. Ema's dialogue method is to first discover common protocols and then to extract structural patterns such as consensus prototypes from there. That reminds me of the methods used by the international organization "Internet Engineering Task Force" which establishes standards for the technologies related to the Internet. This organization supported the dawn of the Internet era. Their idea is to share consensus even in a broad sense while everyone has been developing working codes, in other words, while establishing moving systems.

Ema: At first, we would like to develop a rough consensus within a small network, through trial and error. What I care about in this process is “Reflexiveness”, “Locality”, and “Transparency”. Reflexiveness refers to constantly checking our own standing position, values, and expertise in the changing reality. Locality refers to observation of what is actually going on the site right now. In STS, it is also called “Local Knowledge”. It is important to have communication with people who are actually facing the problems, and who are working at the site, including recognizing what our point of view is and what we can observe from that point of view. And the Transparency refers to a record keeping of the process.

Chen: Due to the different realities that each site is facing, the discussions and principles will transform into something different. In a traditional modernistic and rationalistic way of thinking, someone may say that it is self-contradictory and merely a theory. But I believe it is necessary to build a theory that is also contradictory, and perhaps, even science in general may have come to the point of facing a greater transformation.

Nishigaki: The “Information” tends to be defined on logical absolutism, so it is usually seen as something non-living and mechanical. Therefore a relative point of view has not entered into the current information education. But from now on, we must consider that information often reflects individuality. In addition, we must admit the fact that not only human beings, but also animals like dogs, cats, and even insects, are actually watching the world with their own eyes. It is worth directing our attention to the diverse “umwelt (environmental world)”.

Nevertheless, the current direction of AI optimization is the other way around, and I am afraid the technology would advance to the point of being completely out of control if left alone. Many writers and artists raise alarms about such a future. But just expressing their anxieties in their works is merely of use for letting off steam. Those who are engaged in the technological development need to think about the issues thoroughly from the inside. To that end, I would like HITE to incorporate not only the viewpoints of AI researchers in academia, but also those of engineers actually involved in development projects. The problem is, however, hard workers in the midst of development have little time to think about the social effects of their products. With regards to this, Dr. Chen, you are a rare researcher in Japan who spans across both the academic field and being on site. I think it is important to keep thinking of social effects simultaneously, while implementing the technologies.

Ema: There are variety of the “the site.” In addition to those who are developing technology, the experts using the technology while developing it are also important. For instance, if you ask doctors about a remote medical system, there are so many things they have to be arranged in order to implement the system, including usability of the interface, insurance applications, maintenance and technical training, etc., etc.

At the same time, they are the people who actually reconfigure the systems based upon the fundamental question of what medical service should be. I would like to value the process of organizing and recording the interactions with such sites.

Chen: What I have been thinking recently is how we can overcome the worship of usefulness, and incorporate irrational activities in system thinking. Recently, it became widely known that Google has adopted the idea of mindfulness in the company and is creating time for the employees to meditate. These activities show outcomes in team building, so that middle managers can become a better leader. However, for engineers who are dealing with a flood of work every day, and for ordinary people as well, encouraging them to use a method to practice meditation to calm their minds would be difficult. If we can present evidence of its usefulness, such as the fact that practicing meditation will lower your blood sugar level for example, it will become a strong force when we try to spread this method throughout society. I would like to believe that we need to provide an exquisite prescription corresponding with what state the human mind is in, but should be careful to avoid creating a so-called transient boom or bad pop science.

Ema: It is also important to pay attention to the easy-usage of the word "fit in" in society. It is, of course, important for society to fit in with the technologies, but if we fit in too well with them, it will become invisible. It is necessary to incorporate a mechanism to see things reflexively to prevent the generation of a new stereotype as a result of the familiarity which would exclude new technologies.

Chen: On the other hand, we can also say that the people who work on site are really seeking fundamental ideas. At a work site, the specifications are determined on a hit-or-miss basis and the outcome often becomes a system that nobody desires in a large size company. For example, sales reps and technical workers who have different points of view often cannot come to an agreement because they do not share the same protocol. If they can establish a way of reliably sharing their visions and protocols within the team, I think they would be able to build a system without any obstacles.

Ema: Trust is important for everything. The AIR research group spent one year to build trust with people from completely different cultures. If we tried to proceed with discussions without establishing a trust, it would almost certainly have failed. With trust, agenda setting and decision making will be carried out more appropriately.

Incorporating Humor as a Trigger for Dialogue

Chen: In 2016, two researchers from Machine Learning at Shanghai Jiao Tong University published a paper stating that crime incidence rate can be determined from facial recognition. This would be used to determine crime rates by analyzing photographs of faces, making AI study face recognition data of criminals. In response to that, Data Scientists in the US argued that the human process of identifying criminals contain social and racial biases to begin with, and that it is nothing more than this distortion being expanded into AI. They also argued that it is always necessary to be skeptical as to whether the data given to AI is not biased by human beings.

Ema: I think that the researchers have been studying with “goodwill” to detect criminals. Our projects at HITE do not aims to point out the biases in a straightforward way, but to create an opportunity

for people to notice that there are different ideas out there. For example, there are artists engaging in activities to escape the eyes of surveillance cameras by asymmetric makeup and styles. Their activities make people notice "If criminals do the same thing, they cannot be tracked. Isn't trying to track criminals with these surveillance cameras useless to begin with?" I think that there is also a way to get attention using humor in art, in such ways as this.

Chen: I agree that activism and art will be playing a more important role from now on. These acts of the activists who wear such makeup are also a type of speculative design (design to create a question or to spark discussion) which casts questions from a standpoint different from the common perception of society, and is one of the social functions performed by art, I think. I have personal experience that leads me to believe that dialogue is born from the agitation of art. I have my head up for hope on this.

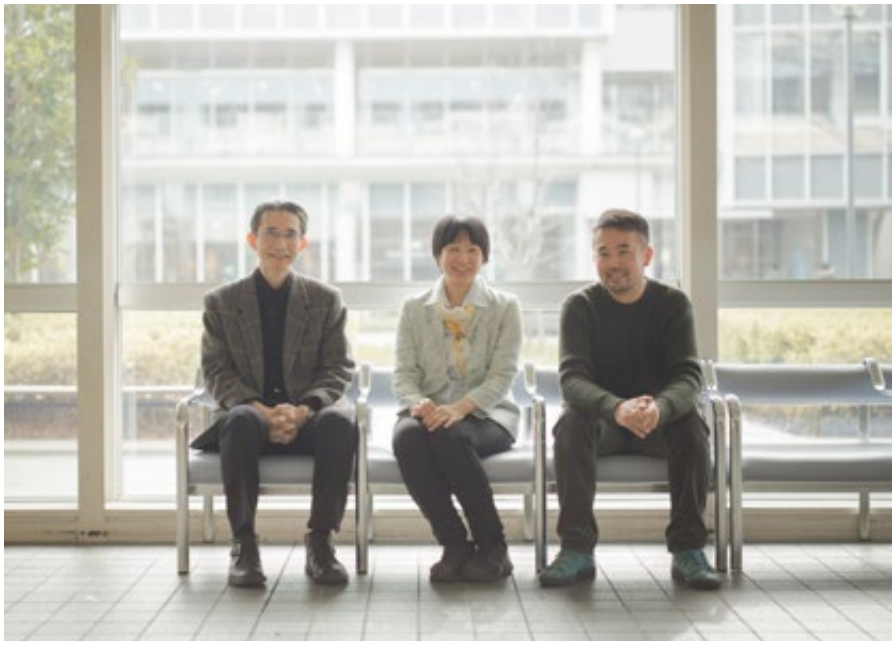
Ema: I think addressing the issue by saying "Let's talk about disadvantages and ethics of society" is sometimes a "top down attitude", which is too formal and only interested people comes. I would like to know what people are thinking. That's why we go to field studies. I am interested in places where people gather naturally to talk happily through the use of art and humor.

What kinds of activities do you plan to conduct for HITE's three-year project?

Chen: I would like to establish a platform to solve problems in information technology and society for which the solutions have not been introduced so far, and build the basic discussions that are a guideline in order to establish the platform. There, I was not sure who would be the proper people from the various fields to be the members of the project. However, I would be encouraged if someone like Dr. Ema who is specialized in dialogue methods can join us.

Ema: I am also looking forward to learning from you! The AIR research group does not have a leader. If someone comes out with an interesting idea, we form a new team to work on it. For us, dialogue is not a purpose but a tool. Through dialogue, we can look back on the past, and arrange the present to build networks, and make a small step toward the future.

Nishigaki: Personally my goal is to investigate the principle and universality of information technology while respecting relative values and liberalism. In HITE, as a researcher, I hope to continue my information studies by way of communicating with people who are working on actual sites.



Toru Nishigaki
HITE Advisor. Born in Tokyo in 1948. Graduated from the Department of Mathematical Engineering and Information Physics, School of Engineering, the University of Tokyo. Joined Hitachi, Ltd. Engaged in the research and development of computer software. Stayed temporarily as a visiting scholar at Stanford University. Currently Professor Emeritus of the University of Tokyo and Professor of the Department of Communication at Tokyo Keizai University, after working as a Professor of Graduate School of Interdisciplinary Information Studies (Interfaculty Initiative in Information Studies) at the University of Tokyo. Doctor of Engineering. Specializes in Informatics and Media Theory.

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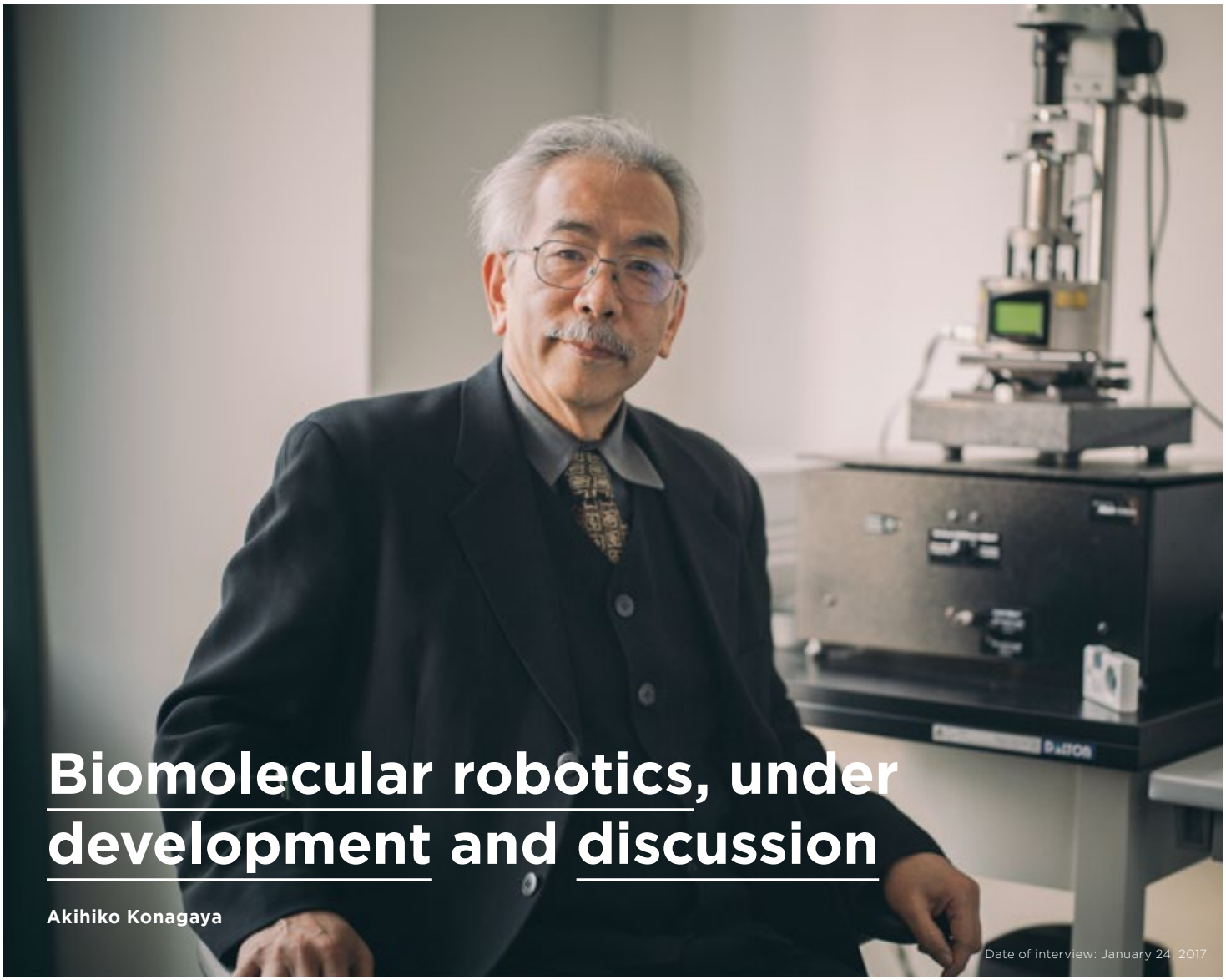
***1 / Japanese Society for Artificial Intelligence cover flames incident.** In 2014, an incident where a major debate was invoked on SNS in which the illustration on the cover of the Japanese Society for Artificial Intelligence led to discrimination against women. A visual image of a "female type android robot" was criticized for being an image of an out-of-date female figure, AI, and robots. AIR members wrote an article on the incident ("Ethics and Social Responsibility: Case Study of a Journal Cover Design Under Fire." CHI-2015) ***2 / First, second and the third booms of AI.** In 1956, since the term "Artificial Intelligence" was first used, AI has seen a boom three times while its technologies have been developing. The first boom was in the 1960s when reasoning and search by computer became possible, the second boom was in the 1980s when the expert system (later described) became a reality. The current third boom is greatly contributed to by machine learning that focuses on learning by simulating functions such as pattern recognition, perception, and vision, and logic to a lesser extent. Eventually the advancement of deep machine learning has contributed greatly to this as well. ***3 / Expert systems** Approach to making AI solve real and complicated problems by making a computer emulate the knowledge and decision-making ability of experts.



Biomolecular robotics, under development and discussion

Akihiko Konagaya

Date of interview: January 24, 2017

A biomolecular robot with intelligence and senses that is being developed while nanobiotechnology and AI robot technology are being fused is about to open the door to the unknown. In order to spread this technology into society, we talked to Professor Akihiko Konagaya, who launched a platform to promote appropriate discussions from the viewpoint of ethics, law, economy, and education.

Give Intelligence to a Molecular Robot that Moves in the Body of an Organism

What is the molecular robot that you, Prof. Konagaya, are specialized in?

In a word, it is a "molecule sized robot with senses and intelligence". The purpose of molecular robotics is to provide a mechanism for molecular robots that works by giving them senses and intelligence so that they can get around inside the human body. An organism originally has the ability to create complex systems by combining biomolecules. By carrying out self-assembly and interacting with each other, biomolecules, such as DNA, can produce cells and organisms which move autonomously. We are learning the structures and the systems of these organisms, and trying to control the movement of a self-assembled molecular robot based on the design principle at the molecular level.

In 2016, the amoeba-robot team succeeded in developing several ameba-type molecular robots in the Grant-in-Aid for Scientific Research on Innovative Areas "Molecular Robotics". For the molecular robot created by Tohoku University, the kinesin motor and microtubule proteins, which will be a molecular actuator, is put into a liposome (bilayer membrane made of lipid molecules) with a diameter of about 20 micrometers which is slightly smaller than the bacteria cells. And a DNA fragment, which carries a signal, features a DNA clutch to control power transmission. When the DNA fragment which is carrying the signal attaches onto the DNA clutch in the liposome, the clutch turns on, then the microtubule moves resulting in deformation of the molecular robot. When the DNA fragment detaches from the DNA clutch, the clutch turns off and the deformation will not be carried out. Molecular robots using DNA fragments

have been developed since the beginning of the year 2000, but these robots moved only randomly. Our ameba-type robot is the first molecular robot in the world that can control its own movement.

What is the current stage of molecular robotics research?

We are currently at the stage where elemental technologies and methodologies are established and being made ready to be used in various ways. Since the early 1990's, the research of DNA computers that process information using a large number of DNA fragments which form partial double helixes has advanced. By using this technology, and by realizing computer logic circuits using DNA fragments, it became available as "intelligence" of a molecular robot. In fact, the research group of the Tokyo Institute of Technology has succeeded in increasing the number of DNA fragments by 1,000 times in 30 minutes by inputting a DNA fragment as a signal into a molecular robot. Also, different DNA fragments can be grown from a single DNA fragment with a time difference, allowing it to have a function similar to a computer clock signal. Our future task is to enhance the types of molecular robot parts such as clutches and amplifier circuits which operate under the same conditions.

If we can develop molecules which are applicable for cancer diagnosis, antibody medicine, drug delivery systems etc. into molecular robots in the future, we will be able to have a tremendous impact on medical treatments and drug discovery. Students studying this field now are expanding their imaginations for things such as a molecular robot acting as an artificial antibody, and a molecular robot which is capable of photosynthesis.

Toward Molecular Robots Applications in society

It sounds like molecular robots feature considerably advanced technologies. What do you think about future utilization of such robots in society?

Although researchers have been thinking on a daily basis about the fabrication of molecular robots and the possibilities of their use, they do not have many points of view as to what kinds of impacts these technologies to be developed, or those which have already been developed, will have in society in terms of ethical, social and economic implications. We are concerned about compliance with ethical standards, in particular. So, we tend to be vigilant about exchanging opinions with non-professional people.

However, I believe that it is still necessary to discuss ethical considerations and other issues from the earliest stage of development. For example, we sometimes use microtubules taken from readily available bovine brains for experiments, but when we attempt to convert them to a different use for pharmaceuticals, our research efforts may be discarded because the bovine cells may be considered to be a risk of BSE. In this case, we have to restart the research from scratch starting from selection of the materials. In addition, one study conducted in Japan has developed an epoch-making therapeutic drug which strengthens the immune system by acting on the surface of cancer molecules. However, it is currently an extremely expensive treatment. Some people expressed concern that it may lead to a surge in medical costs. I believe that such issues are only one example of what happens when an idea which comes from the technology development side alone does not spread successfully to society.

If we can predict that there are dangerous traps in the future like this case, it is necessary to change the course at the early stages of research & development. Now, Japan is the world leader in the development of molecular robots. Therefore, we should not base our research solely on the initial concepts, but should also include human beings who actually use these robots from the very beginning stages of research. I would like to incorporate the viewpoints of, for example, what happens if we place a robot into a human body, and what we do about the development costs, and how we distribute and dispose of it. I would like to consider these issues from the very beginning.

Is that the reason you applied for HITE?

Yes, it is. Immediately after the launch of molecular robotics research, I participated in the "Molecular Programming Project" conference that was funded by the US National Foundation of Science. It was eye opening for me that the ethics experts have been participating in this project to provide an estimation of what will happen when new technology enters our society. The researchers have been reflecting these estimations into their research. After I returned to Japan, we tried to look for ethics experts, but we could not find common ground easily. However, at the AI ethics session of the Japan Society for Artificial Intelligence in 2016, I heard some details concerning the launch of HITE. I applied for the position with an expectation of meeting experts in the fields of ethics, social acceptance and scientific communication who may be able to cooperate with our research.

What kinds of activities are you planning to pursue at HITE in the future?

In HITE, I would like to highlight the issues from the viewpoint of laws, ethics and economy related to molecular robotics. In addition, I also would like to establish an educational system that integrates these areas and molecular robotics.

Currently, in collaboration with the group of Mr. Ryuma Shineha, Associate Professor, School of Mass Communication Studies, Department of Literature, Seijo University) with their goal of "Platform of Co-Creation and Communication for Real-Time Technology Assessment on Information Technology (CoRTTA)" within the HITE, we have been building a discussion platform called, "NutShell". This is a mechanism that allows stakeholders from various fields to participate in closed discussions. We have completed establishing a foundation for conducting interviews regarding molecular robots, as well as holding sessions on ethics and social acceptance in an international symposium of the molecular robot study groups. We believe that we will be able to connect both communities of molecular robots and scientific communication more effectively in the future.

Also, it would be wonderful if a community was created that would lead to the creation of a platform used throughout the HITE Project to promote knowledge sharing and dissemination of information. I, myself, have also have been advocating the idea of a "knowledge grid (Fount of knowledge)" that is a source of new knowledge by widely sharing knowledge through computer networks. I am thrilled with the expectation of establishing such a place at this point.

Prof. Akihiko Konagaya
Principal Investigator, "Socio-technical approach to molecular robotics from the viewpoints of legality, ethics, economics and education", HITE Adopted Project Planning Survey. Professor, School of Computing, Tokyo Institute of Technology. Specializes in Molecular robotics which is the integration of Informatics and Life Sciences, and Intelligent Informatics.

Developing a Philosophy of 'Responsibility' for the Information Society

Date of interview:
January 31, 2017

Kazuya Matsuura

In today's world, ethical issues involving information technology continue to surface in areas such as automatic driving using artificial intelligence (AI).
The philosophers and humanities scholars who study humanity and society have begun to search for answers to the as yet unsolved problems of modern society. Dr. Kazuya Matsuura, an expert in Greek natural philosophy, has initiated a project which attempts to clarify the concept of "responsibility". What is the nature of this project?

Dr. Matsuura, we've heard you are an expert in Greek philosophy. Can you tell more specific about your research?

My specialty is Greek philosophy—the natural philosophy of Aristotle in particular. Aristotle thought the sublunary world is made up of 4 elements: fire, air, water, and earth. Of course, we cannot apply the natural philosophy of Aristotle, the "science" of his time, to modern science without modification. However, I believe the trial-and-error intellectual struggles of Greek natural philosophers and their process of thought have value even for the present day. This is because we have inherited that process and its results as our "way of thinking".

If we simply read the writings of past philosophers, we cannot determine how far the content is original to the author, and whether the author is reusing ideas of his philosophical predecessors, or reflecting the era in which he lived. My research aims to highlight the features of the "science" born in ancient Greece by unravelling organic relationships in the historical background of each philosopher. If we can successfully describe these characteristic features, I think that re-examining the roots of modern scientific thinking will provide hints of new possibilities.

Thinking about "responsibility" based on ideas and culture

Why did you submit a proposal to HITE with the theme "consideration and suggestion on the concept of responsibility in the sophisticated information society"?

As developments such as automatic driving using AI have become technically feasible, new ethical problems have come to the fore—such as judgment in case of an emergency, and attribution of responsibility. For example, if a self-driving car causes a traffic accident, who is responsible? The developer? The user? Or the AI itself?

Such problems may, of course, be approached based on the theory of responsibility in political theory or the legal system. But perhaps there is another approach—the viewpoint of the ethics—according to which the aim is greater human happiness. How can disputes be settled when new technology is implemented in society, and that technology causes some harm? Perhaps we can find concepts or a balance to ensure optimal peace of mind for both developers and users.

When I heard about the call for grant proposals by HITE, I felt that beyond the problem of how to establish laws and ethical codes for academic societies, there is a deeper issue, i.e., how to position information technology within the culture of society. If my feeling is correct, then the humanities scholars who preserve and reproduce culture should actively participate in this project. We philosophers will need to act as a bridge between experts and citizens while offering new ways of thinking about the problems people will face in connection with technology. To achieve that, I proposed a research project with the theme of "consideration and suggestion on the concept of responsibility in the sophisticated information society".

Why did you focus on the issue of "responsibility"?

It is a profound question in the humanities how the word and concept of "responsibility" came into being and has been understood by people. For example, there is no word in Greek directly equivalent to "responsibility". The closest word is "aitia", which is translated as "cause", although some scholars today translate it as "explanatory factor". If this translation is valid, the concept of "aitia" and our current notion of "responsibility" both share the concept of "explanation", and include the premise that to say a person is "aitios" or "aitia" means that he or she can explain the reason for an event or his or her judgement. In contemporary Japan, the term "accountability" (responsibility to explain) is often used, and we say "the responsible person must provide an explanation in case of an emergency". That is, we use the term "responsibility" interchangeably with "accountability", as the Greeks did.

However, according to the experts in Indian philosophy participating in our project, there is no word corresponding to "responsibility" in Indian philosophy. Their dominant idea is that whatever happens in the world, it is determined by "karma" from our previous life. In addition, "responsibility" in Japanese has quite diverse elements. As I mentioned, there is some overlap with the English word "responsibility", but Japanese people also have a samurai-like "responsibility" culture of throwing away their life for loyalty. It seems to me that the concept "responsibility" contains a mixture of many elements since the media often refers to "joint responsibility" and "individual responsibility".

The reason why our project focuses on "responsibility" is this: we believe that to connect various social concepts with information technology, a good approach is to estimate the value of information technology based on the concept of "responsibility", which is polysemous but indispensable for our society. In other words, breaking down and analyzing the diversity latent in the concept of responsibility seems to be one approach for smoothly introducing future information technology into society.

Humanities in the future, connecting to society

What approach will you adopt for this project?

First, to develop an initial understanding of the concept of responsibility, we would like to collect cases in which someone "blames" someone else from various sources, such as law, economics, education, philosophy and the literature of the past. Then, we will abstract away specific background details such as culture and history, extract the concepts pertaining to "blaming others" and "responsibility", and categorize actual cases of appropriate conditioning.

Furthermore, in order to identify the ethical issues which experts in information technology have been facing, and explore potential applications of the responsibility concepts classified in this research, we have invited experts in information technology to our project. Through these interactions, we will deepen our understanding of information technology by, for example, holding public discussions on themes such as "intelligence and machinery".

What is your vision for future activities?

Great philosophers have brought new ways of thinking into the world, and opened up pathways for new thinking in society. Aristotle studied at a school called the Academy, established by Plato, and among the activities at this school, the philosophers helped to solve problems in the polis at the time. I would like to make efforts to play the same role in my generation, and exploit our knowledge to solve social problems. I believe HITE's efforts will provide a forum for proposing—to the community of researchers—practical examples of using knowledge from the humanities in society.

We would also like to contribute to moral education in elementary, junior high and high schools. The children who will take charge of society in the future need flexible moral education to manage a new society with information technology. If we appropriately incorporate the topic of machine accidents—e.g., what we do when an automatically-driven vehicle has an accident or a robot hurts a person—into moral education, children may develop knowledge to better relate to information technology.

I believe that if everyone is capable of talking about information technology, then information technology will "adapt" to our society. It is probably our role to create a foundation on which people from diverse backgrounds can pursue mutual understanding.

Kazuya Matsuura
Current positions: Principal Investigator of the HITE project "Consideration on the concept of "responsibility" between autonomous machines and citizenries"
Associate Professor, Faculty of Letters, Toyo University
Positions at time of interview: Principal Investigator of the HITE project planning study "Consideration and suggestion on the concept of responsibility in the sophisticated information society" Full-Time Lecturer, Faculty of Teacher Education, Shumei University, specializing in Philosophy

PROJECTS OF HUMAN-INFORMATION TECHNOLOGY ECOSYSTEM

01

Acceptable Intelligence with Responsibility - Values Awareness Support (AIR-VAS)

Silos have been formed by the diversified values of people. When people and communities with different values meet, unanticipated conflicts and flame-wars arise. To prevent flaming, we are constructing a scheme and interface that can overcome silos by focusing on shared values.

We consider that elucidating the different nuances in values through feedback from interdisciplinary dialogue will encourage research founded on fresh ideas. Including learning from the past, we are setting agendas to be discussed by visiting various fields that are introducing AI/robotics and conducting surveys. Also, we aim to construct an interdisciplinary and bottom-up platform that will remain free of the biases created by the profit motive (business) or policy predispositions. Ad-hoc networks involving various stakeholders and experts are created by interesting topics.

Arisa Ema
Assistant Professor, Policy Alternatives Research Institute, The University of Tokyo
Science, technology and society

02

Development and Dissemination of Information Technology Guidelines for Promoting Japanese-style Wellbeing

It is pointed out that while information technology makes human intellectual tasks more efficient, it also has negative effects on the psychological state of users. Thus, guidelines for designing mind-enriching information technology are being sought from a different standpoint than that of mere efficiency.

This Project focuses on Japan-specific value systems (i.e., the values generated from human relationships vis-à-vis the group one belongs to or one processes as objective), rather than just focusing on the subjective happiness of individuals, a view that is dominant in Western individualistic culture.

We will establish and disseminate information technology guidelines with an emphasis on how we can introduce such Japan-specific value systems of wellbeing into information technology and how information technology can approach Japan-specific problems. And, through such efforts, we will aim to build a platform that will enable the creation and the development of information technology truly fitting with modern society.

The long-term vision of this Project is to build a model of information technology better fitted to the sense of values specific to Japanese society by implementing Japanese-style wellbeing that will complement Western-style wellbeing, and to make Japan-originated proposals that can contribute to the development of international discussion on wellbeing.

To this end, we will establish information technology guidelines that will help any developer promote wellbeing through a transparent administration process in which a broad variety of entities can take part, and concretely discuss how we should reconcile them with social systems such as laws and policies. By doing this, we hope to see a coherent relationship take shape between human beings and technology.

Hideyuki Ando
Associate professor, Graduate school of Information Science & Technology, Osaka University
Computer Science

03

Proposals from health care on “transition of self through introspection and dialogue”

In the society in which artificial intelligence and IoT spread into our daily life, individuals may choose and design their own life while always carrying accurate and detailed information based on objective grounds. On the other hand, although the more information people have, they cannot necessarily make reasonable choices and become happy. However, in not only a few cases, they will be disorientated by information and eventually choose a way of living that makes them lose their own sense of values. Let us take an example. Information on health risks will become increasingly uncertain, the more detailed and accurate it is. Information containing uncertainties will often make individuals uneasy. When we think about the "society where humans and technology fit together," we believe that it is necessary to clarify the "mechanism of the mind" on how individuals adopt information, recognize it based on the schema and sense of values they have, and make decisions while experiencing emotional turmoil.

In this Project, we will consider the health care field as a microcosm of the future information society and clarify how the exchange of information in that field will affect the recognition and sense of values of people, as well as their sentiment. We will also clarify the roles of experts as decision-making supporters, and how communication between clients and experts should be. Then, we will suggest how humans, as the "individuals continuing to be transformed through introspection and dialogue," should face and use such information, and live a life by reflecting such information in their sense of values, in terms of the state of mind, and ways of thinking and coping with it. In particular, we will position the uneasiness as a reaction that will rise up when a change is going to occur in the mind of an individual, and make concrete suggestions on how individuals should cope with the uneasiness and reflect it in their thoughts and actions.

Seiji Bito
Director, Division of Clinical Epidemiology, National Hospital Organization Tokyo Medical Center Clinical Research Center
Medicine

04

Scenario generation of socio-technology problems in the information technology area by using the foresight method

We will prepare several scenarios of changes in the information society in Japan that extend to around 2040, and clarify information society technology problems that are anticipated to occur at each point of time. By using the “scanning methods,” we will prepare the future scenarios with discontinuous social changes that we have found it difficult to identify with conventional Delphi or technical roadmap methods.

Based on those scenarios, we will extract issues with technologies, social systems and corporate strategies in developing artificial intelligence, IoT technologies and robots and applying them in the marketing practice, and raise questions to solve those issues effectively. More specifically, we will verify to what extent the marketing process can be substituted by new information technologies in and after 2025, and examine how the practical manners of marketing will change and what kinds of difficulties and uneasiness those concerned may have.

Yuichi Washida
Professor, Graduate School of Commerce and Management,
Hitotsubashi University
Marketing discipline /
Innovation diffusion research

05

Trans-disciplinary Research Project on Co-designing Social Systems (Law, Economics and Management) and AI/Robot Technologies

Research subjects are expected to expand to those associated with “new services” and “changes in social infrastructures” for which artificial intelligence (AI) is utilized. In order to predict the possible effects of rapid technical development on society and discuss social systems, it is desirable to set up evaluation axes from interdisciplinary and diversified standpoints. In Japan, however, no one has attempted to systematically study the effects of AI and robotics on society, and preparations for social system construction in anticipation of technical development, such as new laws, economic systems, and management strategies, are not enough.

Amid the third AI boom, certain new problems occurring at the points of contact between technology and society, such as technical unemployment, have been emphasized. AI and robotics are highly versatile, and the existing social frameworks and rules established by humans do not necessarily conform to social frameworks and rules based on the use and application of AI and robotics. While they contain many potential issues, it is difficult to briefly predict problems that may occur in the future. Therefore, a "society where information technology and humans fit together" can be considered a culture in which problems and risks that are expected to occur can be avoided, and the sense of values desired is reflected.

The purpose of this study is to collaboratively create how future technology and society should be through dialogue between researchers in the following fields: AI and robotics, law, ethics, economics and management relating to social systems, and various stakeholders, such as Japanese companies leading the use and application of AI and robotics. In addition, we will aim to suggest systems necessary to build cutting-edge rules and social infrastructures as a global hub.

Fumio Shimpo
Professor, Faculty of Policy Management,
Keio University
Information Law

06

Socio-technical approach to molecular robotics from the viewpoints of legality, ethics, economics and education

"Molecular robotics," which is positioned in the interdisciplinary fields of AI, robots and nanobiotechnology, is opening the previously unknown door of biomolecular robots with intelligence and sensibility. In spite of the rapid development of molecular robotics, there have never been sufficient discussions from the standpoint of social technology.

In this Project, we will extract issues to be solved to enable molecular robots to be accepted by society, and investigate approaches to discuss them from the standpoint of ethics, law, economy and education.

Akihiko Konagaya
Professor, School of Computing,
Tokyo Institute of Technology
Intelligent Informatics

PROJECTS OF
HUMAN-INFORMATION
TECHNOLOGY
ECOSYSTEM

07

Coevolutionary Project Management Promoting Interaction between Social System and Information Systems

Aiming to optimize road transportation on city scale, planning and investigations will be conducted in management of social experiment projects in which social systems and information systems underlying as a part of social infrastructures interact.

They say Japan has some weak fields in research and developssment of information systems underlying social infrastructures; as the saying goes, "Japanese enterprises win by technology, but lose by business." Looking back at ITS (Intelligent Transport Systems) activities, the weakness relates to the field to create new frameworks and new services that will involve transformations in society and behavior of people, as well as changes in the sense of values. How we can overcome the weakness of ITS would depend on how development of the two systems, i.e., social system (people) and information system, should be handled under the concept of coevolution. Additionally, what we are in need of is the body of knowledge (BoK) that will include the two system development methodologies. We will aim to build up a methodology of social project management from the standpoint of interactions of the two systems, namely, the process of coevolution (social experiment phase) and its chronological process path that will extend the well-known project management body of knowledge (PMBoK) and pursuing a small-sized social experiment for an actual measure or implementation. As a result, we can expect promotion of the coevolution of the two systems by enabling stakeholders of project to appropriately share the understanding of positioning and state of processes (social experiment).

Following a current research phase of project planning and investigations, in order to implement research and development projects for coevolution-type social experiment project management of social systems and information systems , it is necessary to build and improve:

- Concept of coevolution-type social experiment project management
- Social system objects to be observed
- Information system objects to be observed
- Settings of (temporary) metrics of social experiments and means of observation
- Studies of the relevance of metrics

In this planning and investigation, we will improve the above and organize a framework necessary for research and development activities by taking the initiative to introduce a digital infrastructure of road transportation or a road-traffic dynamic map) that will become the social infrastructure to optimize city-scale road transportation into Toyota City as an example.

Shigeharu Teshima
Designated Professor, Institutes of Innovation for Future Society, Nagoya University
Software engineering

08

Building co-creation community ALife Lab. for co-evolution of people and information technology

Benefits the information society has brought to humankind are immeasurable. On the other hand, it has produced new issues that will require intelligence and creativity to be dealt with. While artificial intelligence (AI) enables automation and efficiency in tasks from "pattern identification," artificial life (Alife) technology is characterized by "pattern generation."

In this Project, focusing on IAAL* supporting human creative activities, we will utilize ALife's pattern generation technology to complement and amplify intelligence, and build up a co-creation community that will continually create ideas and produce prototypes. We will deliver our findings and accomplishments to society, while aiming to create a new culture produced by humans and information technologies.

*IAAL: Intelligence Amplifier by Artificial Life

Oka Mizuki
Associate professor, Faculty of Engineering, Information and Systems, University of Tsukuba
Web science

09

Preliminary research for the development of robots for supporting education and childcare involving a variety of stakeholders

Research and development of robotics that are designed to support education and childcare are becoming active all over the world. This is against a backdrop in the increase of double-income families, the strong need for improving the education environment, and growing expectations for robotics. On the other hand, anxiety and risks regarding the participation of robots in education and childcare and ethical concerns have continually been pointed out by education and other fields.

In this project's planning and investigations, we will investigate methods for development of education and childcare supporting robot technology that humans can use without feeling uneasy. We will also learn how various stakeholders can become involved in it and can conduct human-centric technical development.

Fumihide Tanaka
Associate Professor, Faculty of Engineering, Information and Systems, University of Tsukuba
Information system science

10

Consideration and suggestion on the concept of "responsibility" in the sophisticated information society

If a certain person's judgment has caused damage or harm to others and society, it is natural to blame her/him. If, however, artificial intelligence (AI)'s judgment has caused damage or harm, who is the one whom we should blame? The developers? The users? AI itself? Or, in the case of AI, is it inappropriate for us to blame anyone?

In order to give a persuasive answer to this question, we aim to offer suitable concepts of responsibility, which will act as the foundational concept in the sophisticated information society, even based on the traditional and cultural understanding of responsibility. More specifically, we will shed light on the diversity of the concept(s) of responsibility formed in current laws and education as well as in the history of ideas and culture, and from this light we will capture the present state of AI development and society.

Kazuya Matsuura
Associate Professor, Faculty of Letters, Toyo University
Philosophy

11

Platform of Co-Creation and Communication for Real-Time Technology Assessment on Information Technology (CoRTTA)

In this Project, we conduct real-time investigations into various ethical, legal and social effects of utilization of information technologies, such as IoT and point of care through data analysis, as well as the locus of social interest in them, by integrating expert knowledge and collective knowledge, and aim to build up a communication platform (NutShell) on which novel agendas are discovered and deliberated.

In preparation to this, we will (1) build up a platform for co-creation of agendas in which experts and other various stakeholders will participate, and prototype real-time technology assessment systems in the context of modern society; and (2) develop methodological discussions for extracting agendas on information technology by means of media analysis and horizon scanning.

Through these analyses, we will suggest a better agenda-building and deliberation process for emerging science and technology, and visualize co-creation of public agendas on information technology by various stakeholders and citizens to be appropriately connected with policy agendas.

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