

Best Engine

Vol. 5



Special
Feature

What We Should Seek As Leaders

Best Engine

Vol. 5

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Cover photo by
Masataka Nakano

DEJIMA is a space for open innovation and collaborative creation, where meetings with customers to create new business ideas, various workshops, meetups and other gatherings are held. It has an environment on hand for the development of prototypes so that new ideas can be incorporated into business at an early stage.



The Job of a Conductor

While I have been making courtesy visits to everyone with New Year's greetings, we have reached the middle of February. Such is the speed of the passage of time that rather than saying "New Year," it is more appropriate to say, "We have now reached the point where there are now just over 10 months left of this year."

While I say this, from the nearly six years' experience I have as President, I feel that time still passes slowly from January to June, and then from the end of the general stockholders meeting it suddenly speeds up. Perhaps it's that time is more concentrated when it is packed with events.

The other day I met the conductor Ms. Tomomi Nishimoto as part of the plan for this edition of Best Engine. Her manners show a very charming personality. It seems that a conductor's job is the creation of invisible structures based on blueprints (the score) created several hundred years ago.

If an artist is "a person who creates a work that can move the hearts of the people who see or hear it," then a musician, especially an artist who engages in classical music, can be seen as having a different way of doing things to a painter or writer, even though they are all "artists."

Appreciative viewers can get a sense of works created by painters and writers, like paintings and novels, by seeing them firsthand. In contrast, classical music such as symphonies, which are works created by composers, are redefined by conductors. Then, orchestras actually create the sounds, and the audience hears them. They are multi-level structures.

Even the same Beethoven is experienced quite differently by the listeners if the conductor and orchestra are different. That's Furtwängler, that's Karajan, that's the Berliner Philharmoniker, that's the Vienna Philharmonic, you can say. I'm not necessarily able to tell the difference between different conductors, but on the other hand, I know that listening to a good live performance is one of the exceptional ways of enjoying music.

Now, we may be of entirely different worlds, but we can't say that our job and the business of music aren't similar. The manager of the orchestra, the "company" in this comparison, conducts. The setting is always live. In this case, surely the score, which is the blueprint, is the equivalent to an ideal or a management plan. Speaking of which, the season for summarizing management plans has gradually come nearer.

I hope that we are able to offer you all some sort of "discovery" this year too.



Satoshi Kikuchi

President and Chief Executive Officer
ITOCHU Techno-Solutions Corporation

Conversation between a world-class conductor leading a fledgling orchestra and the President of CTC.

Special
Feature

What We Should Seek As Leaders

Ms. Tomomi Nishimoto is a highly respected conductor within Japan and overseas, and receives invitations for work from 30 countries around the world. In 2012 she started the IlluminArt Philharmonic Orchestra (with an orchestra, opera, ballet, and chorus), and is expanding the potential of the arts. In that same year, Mr. Satoshi Kikuchi assumed the role of President of CTC, and began to take the helm of the company. Their fields may differ, but what is important to these two people who have come to lead these organizations? Ms. Nishimoto and Mr. Kikuchi talk about themselves as a musician and a manager respectively, and also what they think as leaders.

Coverage and text by Yuki Kondo

Tomomi Nishimoto

Artistic Director and Principal Conductor
of the IlluminArt Philharmonic Orchestra

Special Dialogue

Satoshi Kikuchi

President & CEO
ITOCHU Techno-Solutions Corporation





Tomomi Nishimoto

Tomomi Nishimoto is currently the Artistic Director and Principal Conductor of the IlluminArt Philharmonic Orchestra, and also serves as the Music Director and Principal Conductor of the Royal Chamber Orchestra. She is the Artistic Director of Kishiwada Namikiri Hall, a Visiting Professor at Osaka College of Music, and has received an honorary doctorate degree from Matsumoto Dental University. She was awarded the Fondazione Pro Musica e Arte Sacra Honor, the youngest ever recipient. She serves as an International Cultural Ambassador for Osaka, and an Honorary Ambassador for the city of Hirado in Nagasaki Prefecture. Each year, she is invited to opera houses, orchestras, and international music festivals in 30 countries worldwide.

Discoveries from conducting at the Vatican

Tomomi Nishimoto leads the IlluminArt Philharmonic Orchestra as Artistic Director and Principal Conductor, and is carrying out various experiments through this classical art form. In November 2017, she led a musical performance at the Vatican, having been invited for the fifth year running, and the IlluminArt Philharmonic Orchestra and Chorus were awarded the title of "Honorary Partners" from the Vatican's foundation, the Fondazione Pro Musica e Arte Sacra.

T. Nishimoto: I first received an invitation from the Vatican in the fall of 2013, the year after I had formed IlluminArt. The Vienna Philharmonic Orchestra participates each year as the host orchestra of the music festival, and orchestras and chorus groups representing countries around the world are invited. The IlluminArt was a fledgling orchestra, and so our

participation was finally confirmed after a review of the sound we generate. The IlluminArt has been invited every year since, and at the end of last year we followed the Vienna Philharmonic and were awarded the title of "Honorary Partner Orchestra and Chorus" by the Vatican's foundation, the Fondazione Pro Musica e Arte Sacra. It was a great privilege for whole team to be praised.

S. Kikuchi: That's amazing. The performances were held in impressive churches, weren't they?

T. Nishimoto: Yes. We performed at the International Music Festival and at the Holy Mass celebrated by his Eminence. The Music Festival took place at St. Paul Outside-the-Walls*¹, and we performed the Mass at St. Peter's Basilica, the headquarters of the Catholic Church. The performance at St. Paul Outside-the-Walls took place in front of around 4,000 people who gathered from around Europe, in a huge space that can hold more than 10,000

people, and we performed the Mass at St. Peter's Basilica in front of a limited number of people – a few hundred.

S. Kikuchi: The basilicas weren't originally built for musical performances though. In that case, I suppose the way the music echoes is very different from the halls where you normally perform?

T. Nishimoto: St. Peter's Basilica is so large that the echoes don't come back to us, so to the performers, who can't feel any reverberations, it's as if we're performing in a field. If you stand back a little and hear the performance, the sound really does reverberate, and the echoes blend together in the dome, which is pretty mysterious. You feel that this uncalculated phenomenon is one of Christ's miracles. Beethoven's Ninth Symphony, Verdi's Requiem*², Mozart's Requiem – the pieces we played this time were all generally performed in palaces or churches. By performing repeatedly at the Vatican, there was an instant where I felt close to the original sense of those geniuses who

Satoshi Kikuchi

Satoshi Kikuchi is the President and Chief Executive Officer of ITOCHU Techno-Solutions Corporation. After he joined ITOCHU Corporation in 1976, he was assigned to the Energy headquarters, London, and Oman, becoming head of the Corporate Planning & Administration Division for the Energy, Metals and Minerals Company, General Manager, Managing Director, President of the Forest Products & General Merchandise Company and the Chemicals Company, etc. He took up his present post in 2012.



created music that is brought to life in the echoes of a church.

Both music and IT are in fact jobs that create “invisible structures”

President Kikuchi, you conducted a chorus when you were at university, do you like classical music too?

S. Kikuchi: I played an instrument before I went to university, so I could read music, but I had never sung. But straight after I entered university, I happened to see around 30 students of the choral club singing in the school, and I thought vaguely, “That sounds good.” That was the trigger, and I ended up joining the club. But two months later, when I was told that the club was doing Fauré’s Requiem in a big concert so I should get out there, I was baffled, as you’d expect.

T. Nishimoto: And so you became the conductor?

S. Kikuchi: When I’d been there for three years, the teacher who was the regular conductor suddenly said, “Try being the assistant conductor,” and that became an opportunity for me to take on the challenge. At the time, I desperately crammed ways of conducting and music theory, but mostly I just waved my hands. The more I conducted, the more I felt that conducting was difficult. After that, we sang the entirety of pieces such as Mozart’s Requiem in the chorus. If I ever get the chance, I’d like to join in on the end of a chorus that you conduct (laughs).

T. Nishimoto: Please do (laughs). This year we’re doing Verdi’s Requiem at the Vatican’s International Music Festival, so please join in!

S. Kikuchi: Ah, I think the Vatican might be a little much, after all (laughs). However, when I was able to read another interview of yours, you left an impression when you said that a conductor is a job that creates “invisible structures” based on the

“blueprints” of the score. That’s because when I’ve been asked “What is IT as a job?” I have actually replied, “It’s like the construction industry. It’s just that you can’t see what you’ve built with your eyes.”

T. Nishimoto: In other words, at first glance our fields are different, but at their roots they’re the same?

S. Kikuchi: The CTC Group builds various types of systems. We make up blueprints according to the customer’s requests, and create programs based on those. The programs we create aren’t visible to the eye, and music is similar, isn’t it? Only I think the difference is that in the case of the music that you create, you are performing your own interpretation of the blueprints - the score - that was written by someone several hundred years ago. You create your own new image while looking at the score.

T. Nishimoto: I originally majored in composition, so I start with a compositional analysis. It’s a similar

feeling to disassembling a watch, for example. I disassemble it, confirm the materials of each component one at a time, and understand how they interact with each other and make the second hand move. After that, I reassemble it in my own way. I do the same kind of thing to the pieces I conduct, and by doing that I make them my own music.

Becoming leaders who face every single person

After graduating from Osaka College of Music, Ms. Nishimoto studied abroad at the Saint Petersburg Conservatory in Russia, in the Opera & Symphony Conducting Department, and built up her career.

S. Kikuchi: I understand that you built up your career as a conductor at several orchestras, including in Russia, and now you're in a position to lead your own orchestra. What differences are there, even though you're still conducting?

T. Nishimoto: When you're invited as a guest conductor for performances with foreign orchestras, the work is one short-term project. On the other hand, when you're assigned a post, you focus on the medium and long-term goals of that organization. Plus, when it comes to my current position as the Artistic Director of IlluminArt, my role as an organizer is stronger. In order to conduct, I face the music in the same way as a single musician does, but my work outside of conducting has increased. For example, I make the final

decisions relating to the people who work with us, and that's a very difficult job.

S. Kikuchi: They say that if you have an organization with ten people in it, one will oppose you, two will think well of you, and seven won't care, and actually, if you try leading an organization you do get a sense of that. In view of this, I think that one of the important jobs at the top is showing which direction you're going in. In my case, I have to demonstrate where the company is going in three and five years' time. It's exactly the same as your medium and long-term plans. You have to make them clear, and there's trouble if you get it wrong.

And, in order to make those plans into reality, it's important to unite my ideas as President and the thinking of our employees. As well as making sure our employees understand our ideas, we have to make sure that they want to work in our company. In order to accomplish that, I concentrate on trying to speak directly to each individual employee as much as I can.

President Kikuchi, you talk about having held birthday parties for the employees of the company.

S. Kikuchi: Yes. We probably had around 2,500 people in total. In any given month we gathered people who had birthdays in that month, around 50 at a time, and we did that twice a month for two years. For management, the parties also served as another opportunity to talk, because when I



Photograph courtesy of Atsushi Yamaguchi

first joined the company as a new employee, I was almost never able to see the president. I clearly remember that making me uncomfortable. So, I felt that if I ever became president, I would make sure that all of our employees know what kind of person I am, and what I'm considering, and that I'd like to unite our thinking. And I thought that birthday parties might be good for that (laughs). When it comes to music, everyone has to face a performance with a united awareness, is that right?

T. Nishimoto: The birthday parties are wonderful. When we create a piece, it's important that we make sure our awareness is the same. Because both the conductor and the members of the orchestra are performing together, we are faced with each other's ways of working, but no matter what, I do get the feeling that our relationship is 1 vs. 100. I try to make sure that we have relationships where we can face each other one-on-one as much as possible, and understand each other's intentions. I'm aiming for an individual group that holds onto our clear musical pride – that each individual's music is more alive, and that each instrumentalist can spontaneously say, "I want to do it like this."

Breathing new life into things that already exist

Now, as leaders, with what kind of feelings do the two of you approach your jobs, and what are you aiming for in the future?

T. Nishimoto: My wish to devote myself to expression through art is growing year by year. From 2007 I was given opportunities to meet people from various fields in different countries, including at the Davos Meeting in Switzerland*³, and the idea of wanting to overcome my personal goals and contribute to society a little more became stronger.

Later on, the people I had worked with up to that point said that they wanted me to create an orchestra, and that was the beginning of the formation of IlluminArt. I was all at sea with the heavy responsibilities, but I felt even more strongly that I wanted to devote myself to this if it meant I could contribute to society through art and culture, and gained resolve.

If you're going to do it, then be internationally creative! That feeling became stronger, and so I embarked on the creation of a stage that functioned as a composite work of art, overcoming the framework of music. As classical music is my base, opera, ballet and orchestral work is our core, and we are actively trying out lots of new experiments as a group that creates composite art, with co-creation by people from many different fields, including the latest engineering and science*⁴.

S. Kikuchi: The CTC Group's mission is "Leveraging IT's potential to change future for the Global Good" and we are continuing to challenge ourselves with innovative





products while enhancing our presence in the ever-changing IT industry, and contributing to society. I feel that we share the feeling of aiming for composite art.

T. Nishimoto: That is truly innovation. Within the IlluminArt Philharmonic Orchestra, what is called the “INNOVATION OPERA” is focusing on the staging of “Stupa ~ Shin Sotoba Komachi ~.” The script is something I wrote myself, a dramatization based on the tale of *Sotoba Komachi**5. The subject is the classical text, richly colored with Buddhism, but while I was reading the original, I got a sense of overlapping teachings from different religions, including Christianity. I had the idea that if only the Japanese concept of *yugen* (a sense of ethereal profundity) could be “interpreted” as expression, it could be shared with the wider world. With that as my approach, I used European instruments, thinking that they might portray this Asian concept well. For example, in the West, instruments were improved based on the philosophy of playing with a more accurate sound, and music became polyphonic, expansive and large-scale, aiming for complex, interweaving harmonies. As for Japanese instruments, in the case of the shakuhachi (an end-blown flute), the width and size differ with each individual piece of raw bamboo. Another does not exist. With each breath, this flute expresses the spirit world, and

grants us a more internal world.

S. Kikuchi: In the world of IT, the phrase “open innovation” flies around, and in many Japanese companies, organization after organization is being started up bearing the word “innovation.” Everyone is thinking about what new things they can do using the IoT*6 and artificial intelligence.

Yet originally innovation was not the creation of something completely new, as if by magic. Innovation is dismantling something that already exists, adding new technology or perspectives, and reconstructing it. In that sense, your production is truly innovation, and I feel that this kind of work, which focuses strongly on something that was created before, and breathes new life into it, is becoming very important.

“Happiness” is more important than anything

T. Nishimoto: Today, I’ve really empathized with what you’ve said. I think that it is because our reality is one where science and technology change with incredible speed, and new things are created one after another, that the way we take our next steps may change by reviewing and resurrecting the wonderful things of our predecessors.

S. Kikuchi: This is an age where new things are desired, but, speaking from the perspective of company business, the largest part of our

sales is basically our conventional business. As far as the CTC Group is concerned, we construct systems based on customer commissions, and sell and maintain hardware and software. But, within those areas it is definitely important to focus on new things, and we are always aware of the introduction of cutting-edge items and innovation. However, I think this is also due to the fact that we firmly hold onto a base of conventional business. Furthermore, firstly, earning a proper income and making sure that our employees and their families are happy is more important than anything. I believe that carrying out that responsibility with surety is the most important mission I am charged with as leader of the company. Ms. Nishimoto, for you, tirelessly performing classical pieces is your foundation, I think?

T. Nishimoto: Yes. My base is the classics. And regarding IlluminArt, just as you've said, I am very aware of firstly making a group where the members are happy being able to perform, and working to make sure their families and the people around them are also happy. Without that base, I don't think we would be able to create good music and new arts.

S. Kikuchi: Saying "happiness" is a little bit embarrassing, but I do believe that happiness is what we should seek.

T. Nishimoto: I agree. Concentrating on the moment and creating something in that moment – it is



when I immerse myself in such work that I am aware of my own existence.

S. Kikuchi: Orchestras can create good music precisely because everyone combines their abilities. The person who enables this to happen is the conductor. A company president is the same. By having everyone combine their abilities, work that one person alone cannot accomplish becomes possible. People can feel extremely happy when they have somehow accomplished that work, and we, as leaders of organizations, want to continue our work, which enables us and our companions to feel happiness.

*1 The Basilica of St. Paul Outside-the-Walls; Italian: San Paolo Fuori Le Mura. This is a Catholic church directly controlled by the Vatican within the city of Rome.

*2 Requiem: music used for a mass for the dead in the Catholic Church. Many composers have written requiems, and the works by Fauré, Mozart, and Verdi in particular are called the three great requiems.

*3 Refers to the World Economic Forum Annual Meeting that takes place in Davos in Switzerland. It has become a place where the top leaders of each field in each country gather and discuss various issues. Ms. Nishimoto participated in 2007 when she was selected as a Young Global Leader.

*4 Ms. Nishimoto frequently performs with the singers Koji Tamaki and Toshihiko Takamizawa. In addition, neuroscientist Nobuko Nakano took part in a series of concerts that attempted to explicate music scientifically.

*5 *Sotoba Komachi*: A Noh play by Kan'ami; Ono no Komachi, called a peerless beauty, grows older and looks back on her life.

*6 IoT: Abbreviation of "Internet of Things." The Internet of Things (IoT) is the network of Internet-connected devices, which can include anything from furniture and home appliances to industrial machinery. It is a mechanism that makes information exchange and the control of connected devices possible through a network.

Latest AI Utilization Trends in the Pharmaceutical Industry

Since the arrival of the third artificial intelligence (AI) boom around 2010, a wide variety of AI technologies have been developed, with their use spreading among broad-ranging industries. That trend is now starting to be seen in the pharmaceutical industry. The utilization of AI is attracting attention as a method to bring about a paradigm shift in conventional pharmaceutical development, which requires an immense amount of development time. Here, we will take a look at the latest trend in AI utilization as seen among Japanese pharmaceutical companies.



Engineering Development Department
Life Science Division
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Tetsuya Chiba (On left)
Expert Engineers

Taro Ishibashi (On right)

Expectations Toward AI Utilization Increases as New Drug Development Falters

Today's Japanese pharmaceutical companies are facing a severe environment in regard to the development of new drugs. The number of pharmaceutical agent-related patents disclosed by Japanese pharmaceutical companies has been decreasing each year for the past 15 years*¹, and the same can be said for the number of approved pharmaceutical products in Japan*². A major factor for the increased difficulty of new drug discovery is the fact that the development of small-molecule drugs*³ has been exhausted, and new candidate compounds have dwindled. It is probably not an exaggeration to say that there are now no pharmaceutical companies that advance research and development using only internal resources. They have shifted to the development of biopharmaceuticals, open innovation and alliances or M&A with venture companies possessing new technology.

Whether it is R&D carried out internally or through an alliance with an external partner, swift decision-making based on a thorough understanding of the massive amounts of information that arise on a daily basis has become important. It includes accumulated data and information, such as scientific papers, patented technology, medical big data, clinical trial trends of competitors, and information on venture firms that could become alliance partners. But we are now in an age in which we can no longer survive

such information warfare through manual information collection and analysis.

For these reasons, attention is now being focused on drug discovery that utilizes AI, which can reliably learn and analyze massive amounts of information. Another expectation toward AI is its capability to generate ideas that go beyond human intelligence.

AI Utilization Trends in the Pharmaceutical Industry

In various industries, AI technology has advanced beyond the point of consideration for use and is now being actively utilized. One of the major reasons for this is the faster processing speed enabled through evolution of the machine-learning approach—including deep learning—and advancement in hardware, like GPU servers.

In the pharmaceutical industry, AI started to be utilized in relation to medical representative (MR) and call center tasks. The use of AI is now expanding into all areas of development including manufacturing, sales, clinical trials and pharmacovigilance. Cases of the use of AI for the shortening of development time and reduction of costs is increasing particularly among overseas pharmaceutical companies. Examples include its use to enhance the quality of or to streamline clinical trial plans and manufacturing operations, to formulate MR activity plans, and to strengthen marketing strategies. There are also cases in which services have been rolled out by merging the Internet of Things (IoT), mobile and other technologies to AI.

One of the trends is the increase in the number of pharmaceutical companies that are boosting their services toward customers after a drug is launched—for example, by providing mobile apps for smartphones that make it easy for patients to easily track the therapeutic effect that follows being administered a drug or of drug adherence.

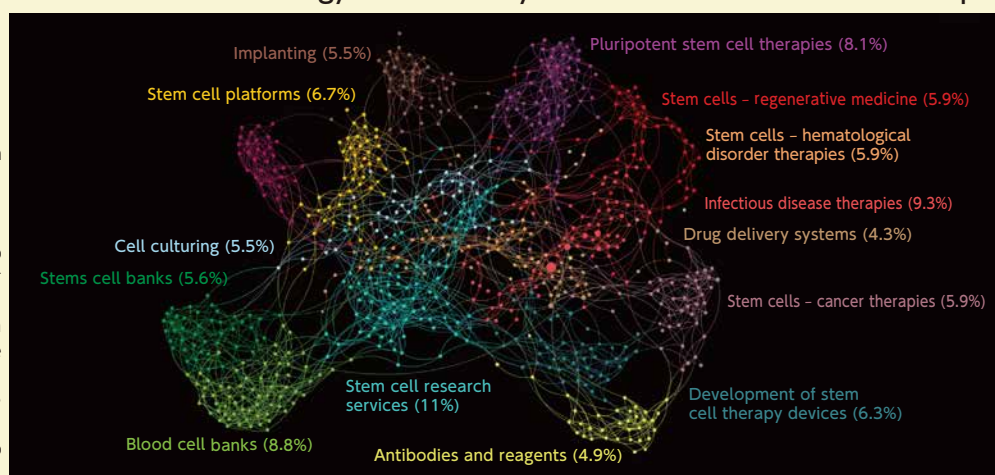
However, there are still many issues that remain for the construction of a practical AI system. For example, the performance of an AI system that has been built is dependent on the quality and quantity of learning data. For this reason, an important point that needs to be recognized is that the processes of collecting and selecting appropriate learning data as well as learning massive amounts of data require substantial manpower. The current state of the utilization of AI in the pharmaceutical industry is that AI-based drug discovery is not progressing because even though they have massive amounts of scientific data in the early stages of research, they do not know how to utilize AI toward that data.

Participation in the Life Intelligence Consortium (LINC)

The Life Intelligence Consortium (LINC)*⁴ was established in November 2016 as a means to provide a breakthrough for the aforementioned issues related to the utilization of AI in drug discovery. It was launched with Professor Yasushi Okuno of Kyoto University / RIKEN, who is a proponent in Japan of AI drug discovery, at

Example of the utilization of AI technology for text analysis and visualization with Quid Opus

This is the result of a search using Quid Opus for alliance-candidate companies that hold the latest technology related to stem cells^{*7}, including their creation and R&D in stem-cell drugs; the search was made using a database containing 17 million companies. The candidate companies were automatically classified into technology categories.



the center. LINC is a business-academia collaboration composed of 89 bodies (as of October 24, 2017), including universities and life sciences and IT companies. LINC members will bring together their respective ideas, knowledge and technologies to develop a practical technology base for AI drug discovery by 2020. The objective is to contribute to the development of life sciences industries.

CTC is participating in LINC with the objective of contributing to superior new drug creation through the development of AI technology. The first project that CTC is taking part in is "Biologics-related AI." This is a project to build an AI system that predicts antibody^{*5} epitopes (part of an antigen recognized by antibodies). In recent years, shares of antibody drugs have been increasing, primarily as an effective anti-cancer agent. This is because antibody drugs tend to have less side effects than small-molecule drugs in the treatment of cancer—a field with low patient satisfaction. The hope is that the results of this project will encourage research and development of antibody drugs and contribute to the enhancement of patients' quality of life (QOL).

In the second project, "Crystalline Morphology and Drug Formulation-related AI," the goal is to reduce labor time and costs in manufacturing operations. Devices for powder and granular materials must undergo visual inspection by an operator to inspect and manually remove powder that

has adhered in its interior. The aim of this project is to streamline this process by utilizing an AI engine that correctly detects the state of powder adherence using video shot of the device interior.

Quid Opus, an Ultimate Trend Spotter

It is said that more than 80 percent of the world's data is in the form of text. There is a growing need for the cognitive analysis^{*6} of text-based information. For example, consider the case of investigating companies with the objective of finding a possible business alliance partner. Information on a company and the patents it holds and related literature as well as news and blogs related to a company are all text-based information. If it is possible to grasp the content of all of such massive amounts of text, draw the connection between the text and express it visually, it may be possible for us humans to gain new insight intuitively. Quid Opus is a solution provided by Quid, a startup in San Francisco, U.S., that realizes the task. It utilizes AI technology to make it possible to express massive amounts of text-based information visually. Pharmaceutical companies have recently begun utilizing Quid Opus for various uses—for example, in market research to learn the kinds of opinions held by healthcare professionals and patients toward a company's own pharmaceutical products. Other uses include: to analyze the trends at a competitor, to search for key opinion leaders (KOL), to list up alliance candidates,

and to understand trends at conferences. Many actual cases of use have been reported. CTC will launch a service that utilizes Quid Opus to assist companies in finding out the things they want to know.

*1 JPMA Office of Pharmaceutical Industry Research "Kokunai Seiyaku-kigyo no Teibunshi Kagobutsu Tokkyo no Kokai Kensu no Suii" (Changes in the number of disclosed low-molecular compound patents among Japanese pharmaceutical companies) http://www.jpma.or.jp/about/issue/gratis/newsletter/archive_after2014/73pc.pdf

*2 JPMA DATA BOOK 2017, "Iyakuhin no Shoninn Hinmoku Su" (The number of approved pharmaceutical products) <http://www.jpma.or.jp/about/issue/gratis/databook/2017/table.php?page=p42>

*3 Small-molecule drugs: Drugs with low molecular weight. Used to distinguish it from high-molecule drugs, like antibody drugs, with high molecular weight.

*4 Life Intelligence Consortium (LINC) <https://rc.riken.jp/life-intelligence-consortium/>

*5 Antibody: Also known as an immunoglobulin, it is a type of protein that is created by the immune system to latch on to a foreign substance that enters the body and is known as an antigen. An antibody latches on to the antigen to remove it. The antibody that is created binds specifically to the particular antigen that has entered the body.

*6 Cognitive analysis: Analysis in which a computer system learns from a massive amount of data and supports better assessments and decision-making by humans.

*7 Stem cell: A cell that has the ability to give rise to more cells of the same type through cell division. It can also differentiate into another type of cell. Expectation for the use of stem cells are primarily held toward its application in regenerative medicine (i.e., treatment that aims to recover the function of tissues and organs that were lost through disease, trauma, etc.)

The Crux of RPA Adoption

The use of RPA, or robotic process automation, is spreading rapidly as a possible solution that enables reforms of working styles or deals with a shortage of labor. Here, we will take a look at such topics as trends in the RPA market, effects of adoption, and the crux of adoption.



Masamitsu Sugae

Deputy General Manager
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What Is RPA?

Robotic process automation, or RPA, is a software "robot" that will accurately and speedily carry out PC operation on your behalf without complaint for as many hours as needed. The operation can be carried out across various applications, from Excel to web browsers, and in core systems and even clouds. RPA excels in repetitive business processing in which personal computers are sequentially operated on the basis of certain judgments. It is also highly adaptable to tasks that require some flexibility. The task to be carried out can be changed as the situation demands, so it contains the possibility of being adaptable to a wide range of tasks.

RPA is currently primarily in the focus as technology that will contribute to raising business efficiency by taking over back-office tasks. However, some state-of-the-art companies are beginning to undertake efforts for the use of RPA to strengthen their competitive edge, such as by using it to promote e-commerce site sales or to analyze competitors.

RPA is generally said to be capable of handling the work of three to five humans per robot. Having robots take over tasks that were previously considered only able to be dealt with by humans makes it possible for humans to shift to creative work that requires more complex (intuitive) judgment or expertise (i.e., RPA realizes increased productivity and improved management).

In relation to artificial intelligence (AI), RPA

excels in repetitive tasks that are carried out on the basis of certain judgment. Meanwhile, AI is good at tasks that require complex judgment to be made on the basis of massive amounts of information. They are both technologies that will support working style reforms as well as the shift of humans to creative tasks.

The RPA Market and the Future

The adoption of RPA began in the late 2010s and progressed in some industries like financial services and insurance. However, with heightened interest in working style reforms that deals with the recent decrease in the workforce, the expansion of product choices, the appearance of RPA that can be used by onsite workers with little IT expertise, and other reasons, there has been a sharp increase of companies in various industries that are taking the bold course of adopting the use of RPA. (A leading Japanese advertising agency has disclosed that it automated 400 business processes, which already resulted in freeing up more than 10,000 hours in a single month.)

Technologically speaking, RPA adoption used to be focused around the automation of tasks utilizing a personal computer. However, it is evolving rapidly, such as the appearance of RPA products that can realize automation on a company-wide level. In the near future, linkage and fusion with other technologies, such as AI, IoT and big data, will progress, realizing the automation of even more advanced and complex tasks.

The Beneficial Effects and Risks of RPA Adoption [Beneficial Effects of Adoption]

- A shift of the work force to operations that require advanced judgement and can only be carried out by humans
- The leveling of personnel structures in operations for which there are seasonal differences in needs, and the enhancement of work quality
- Earlier return on investment (ROI) through the reduction of system development costs
- Easier trial and error method as compared with system development
- Shortening of operational lead times (Can run 24-hours a day)
- Enables the visualization, leveling and streamlining of small-quantity, large-variety tasks dependent on humans

[Risks of Adoption]

- Risk of the occurrence of malfunctions, stoppage and drop in precision arising from the upgrading of the system for operation or changes in data for processing
- Risk of the suspension of business due to RPA failures
- Risk of the non-detection of erroneous processing or drop in precision
- Black-boxing of operational processes and decline in awareness toward executing operational improvements
- Risk of information leakage arising from unauthorized access to the RPA

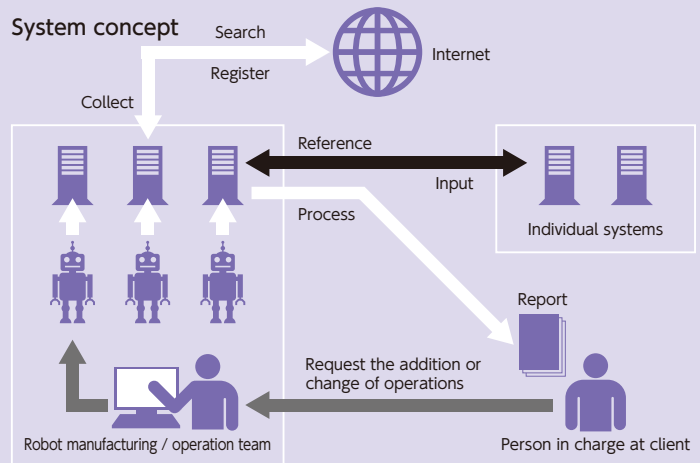
The Crux and Pitfalls of RPA Adoption

① Tool selection

The first step in RPA adoption is the

■ Typical Functions of RPA Software

Read inputs <small>(Precondition is that it is in the form of electronic data)</small>
Search / extract
Tabulate / process
Check / make judgement
Refer to / utilize services
Input / register
Prepare / output forms



selection of a tool that is appropriate for the company. While choices in products have suddenly increased over this past year, a problem that is starting to arise among companies opting to adopt RPA is how to go about selecting the optimal tool. One solution to this that is said to be effective is utilize the knowledge possessed by system integrators and consulting companies that understand the characteristics of various products.

[Selection Criteria]

- Segregation of system development and RPA adoption
- Selection of product according to the scope of application (individuals, departments, company-wide) / work load / rollout plan
- Selection according to the roles of RPA and humans (selection of semi-automated RPA or fully automated RPA)
- Serviceability of robot based on the characteristics of the system for operation or frequency in the implementation of changes
- Product selection that meets the IT skill-level of the person promoting adoption
- Support structure of the manufacturer or reseller

② Internal awareness-building

Changing the mindset of people within the company is a major point in the promotion of the use of RPA. There is a chance that employees will harbor a negative feeling toward RPA adoption—that their work will be taken over by RPA. Because of this, it is important you give them an idea of what their work will be like after RPA adoption.

- Present what the work will be like after RPA adoption for persons currently in charge of a task and obtain their agreement
- Instill the awareness that persons in charge on site are the main characters of the adoption of RPA
- Management, those on site and the IT department must collaborate and position the adoption of RPA as a company-wide undertaking (e.g., working style reform for the whole company)
- ③ Preparation of internal rules and regulations toward RPA adoption
 - Based on an awareness that the "robot" is a new "employee" with two aspects—that of working like a human, and that of working as a system—there will be a need to develop new rules to build (educate) it appropriately as well as to operate it safely (the promotion of safe operations in accordance with its role).
- Consider how RPA will be rolled out in the company as well as the structure to be implemented (development of core personnel → assignment on site and personnel rotation)
- Formulate guidelines for constructing and managing the robot (RPA system) (e.g., which operational robot is going to be executed when? Impact of upgrading the system for RPA adoption, change control of robots, etc.)
- Make rules related to the robot's account and authorization
- Consider the burden on the internal system and network (load placed through high-speed mass operation)

CTC's Undertakings

CTC has been providing a cloud-based outsourcing service called eAssist since 2014, before the word RPA became commonly known. It has verified many RPA tools and utilized RPA as a foundation of the service.

CTC provides RPA solutions that can be applied to various operations by combining its knowledge of a number of RPA tools, expertise, and operational knowledge nurtured through its experience of many years in the construction and operation of business applications.

1. Support for the selection of RPA products (cloud-based, on-premises or hybrid)
2. Support for the selection of operations for which RPA is to be adopted
3. Support for establishing proof of concept (PoC)
4. RPA robot construction
5. Operational support

Going forward, CTC will promote the strengthening of its RPA undertakings as well as link them to business process management systems (BPMS)*, AI, business intelligence (BI) and business analytics (BA). By doing so, CTC will provide an even wider range of solutions that will contribute to enhancement of the corporate value of client firms by way of working style reforms and the sophistication of operations.

* BPMS: Systems that manage overall business processes that are composed of work carried out by humans, business applications, RPA and AI.



This issue's theme is...

【 Network Coding 】

With today's sharp increase in data transmission volume, the preparation of network environments is a pressing issue. As infrastructure enhancements, such as the utilization of optical fiber, progress to deal with this issue, another method for approaching the issue of transmission volume is network coding. This is a technology that tackles the issue from the aspect of network theory. Here is a look at its principle, challenges toward its practical application and future possibilities.

Text by Yuki Kondo

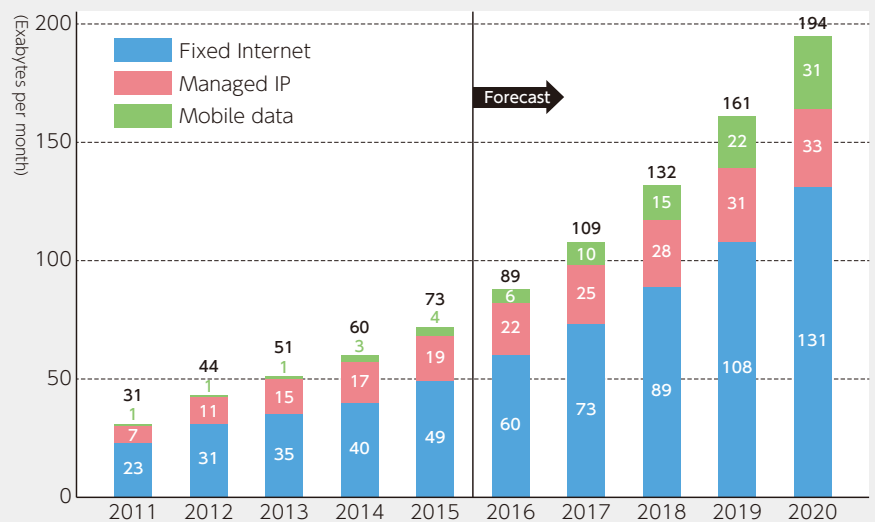
A New Communication Technology Compatible with the Age of IoT

Transmission volume (traffic) continues to increase at a rapid pace with recent changes, such as the spread of smartphone and tablet use, the development of high-speed wireless communications like the LTE standard, and the birth of many new services and apps.

According to Cisco, a leading American manufacturer of telecommunication equipment, global data transmission traffic is expected to grow by about 2.7 times in the five years between 2015 and 2020 (average annual growth of 22%). Global mobile data is expected to grow even more—about 7.8 times during the same five-year period (average annual growth rate of 53%). (See Fig. 1)

To deal with the explosive increase in data transmission traffic, R&D for the enhancement of network facilities is progressing. It includes development of optical fiber for use in networks, with its capability to handle large volumes of data. However, once a full-scale age of IoT arrives going forward, various things around us will become connected to the Internet, with data exchange taking place between them. There is a possibility that data transmission traffic will increase in a way

Fig. 1 Changes in Global Data Traffic and Forecasts (By traffic type)



Source: Cisco VNI Mobile (Graph published in the Ministry of Internal Affairs and Communications' 2017 White Paper on Information and Communications in Japan)

that massively exceeds current forecasts.

If that occurs, the reinforcement of infrastructure as a continuation of current technologies will not be enough to deal with the increased traffic. It is said that there will be a need to change communications methods that are more efficient than they are at current. Research in network coding is currently being carried out to deal with such an age.

Combining Information at a Node

In today's data transmissions, information travels to the recipient by way of multiple relay points (nodes) in a network. In this

case, the role played by the nodes is to simply receive information and forward it to the next node. However, network nodes take on a new role under network coding. That is, a number of different information that comes to a node is combined and converted (i.e., coded) into a different batch of information. Forwarding the newly created information enables significant savings in data traffic.

Let's say that a node receives three different batches of information (X, Y and Z) at a certain time. In existing communications technology, that information will be forwarded one by one

to the next node. Think of it as three different batches being sent side-by-side on a communication line. This is the same as three cars moving side-by-side on a road. It should be easy to imagine that if data traffic increases, there will be a “congestion” just like on roads.

Under network coding, information X, Y and Z are combined at the node and forwarded as a single batch of information, or A. Congestion can be suppressed in the communication line that follows the node because the number of information batches have been reduced to one. Meanwhile, the destinations of X, Y and Z information receives “A,” and so, each recipient must restore (i.e., decode) A to the respective original batches of information (X, Y and Z). However, it is possible to carry out decoding that makes only the data intended for the recipient visible to the recipient.

This is a very simplified explanation, but it is the principle behind network coding, which makes it possible to reduce data transmission traffic.

Has Large Potential but Challenges Remain

Network coding was first announced as a theory in 2000. Before then, it was thought impossible to combine information at a node, but this theory showed that it was possible to do so.

Claude Shannon, known as “the father of information theory,” showed in 1956 that there was a theoretical ceiling to the amount of information that could be transmitted over a network in the same unit of time. Under existing communications methods, data transmission traffic cannot be increased up to that upper limit. However, it is said that data transmission traffic can be increased to the upper limit if more efficient data transmission is carried out through network coding. Furthermore,

there are expectations that this can be applied to various other new technologies. It includes not only for large-capacity data transmission and higher-speeds but also the enhancement of information security during transmission. That is why it is in the limelight as a new field of research in network theory, with research commencing from every quarter.

However, network coding is still a new theory and there are more than a few theoretical issues that must be overcome for its practical application. For example, to combine multiple batches of information and later restore them to the original information, there is a need to wait for the necessary information to arrive, which takes time. Another complex issue is figuring out the timing and method of combining information—what would be optimal?

What’s more, implementing network coding in current networks, which use fixed base stations as nodes, contains the realistic difficulty of having to introduce facilities for carrying out the coding at each base station.

To Become an Essential Technology Together with Ad-hoc Networks

On the other hand, there is a new type of network in which network coding can be implemented with relative ease if theoretical issues can be overcome. This is the ad-hoc network.

In ad-hoc networks, telecommunication terminals, such as smartphones, form a network directly without having to go through a base station. An example of an ad-hoc network is when two online game consoles play against each other. If a large ad-hoc network can be created by connecting a large number of terminals in this way, it would become possible to transmit information from one arbitrary terminal in close proximity to another,

which is repeated until it is delivered to the destination. The characteristic of an ad-hoc network is that transmission is possible regardless of whether there is a nearby base station.

At present, there are still technical issues if trying to create an ad-hoc network with three or more terminals, so it has not yet been put to practical use. However, it is essential that it be realized if a full-fledged age of IoT is to commence going forward. This is because the true value of IoT can be exhibited only when things are able to connect directly to each other anywhere without going through a base station, and under any circumstances.

There will be an explosive increase in data transmission traffic when anything is able to communicate with anything else through an ad-hoc network. When that happens, it will also probably be necessary to implement network coding at the same time. However, as mentioned, that hurdle should not be as difficult to overcome as compared to current networks. This is because coding would be carried out in such cases using terminals like a smartphone as a node. Therefore, new facilities would not have to be introduced because it could be implemented simply by installing an app on each terminal.

We do not know yet when the practical application of network coding will become possible. However, with the age of IoT just around the corner, networks are entering a new era of reform. In regard to networks with base stations, there is a full-on movement toward adoption of 5G (5th generation wireless systems). This would mean even larger-capacity transmissions and higher speeds. Network coding is technology that can be thought of as being essential going forward. It may become a term that you will rapidly start to see very often.



Creating Business Together with Customers in Silicon Valley



Takashi Akiyama

Business Development Associate
ITOCHU Techno-Solutions America, Inc.

Mr. Akiyama is based in Silicon Valley, where he conducts business development with advanced technology startups and trend surveys on North American telecommunication carriers and OTT.

An Increasing Number of Japanese Companies Want to Link with Startups

The number of Japanese companies with an office in the Bay Area (the general term for the coastal area in the north of the State of California in the United States, which includes San Francisco and Silicon Valley) has been increasing in recent years. The number of companies increased from 547 companies in March 2010 to 770 companies in March 2016, meaning that approximately 40 companies are establishing new offices in the area each year.*

Many companies are currently working on digital transformation by utilizing IT. For example, startups are being established one after the other to provide IT solutions tailored for a specific industry, and LOB (Line of Business) solutions for departments other than IT departments, such as delivery solutions using drones and robots, personnel solutions using AI. Many Japanese companies aim to create new businesses by entering Silicon Valley to collect information on cutting-edge technologies and enter partnerships with local startups.

Assisting the Local Business Development of Japanese Companies

For companies that do not have an office in Silicon Valley, it is no simple task to establish a new office and dispatch employees there. They need to arrange visas, develop various systems, secure office space, and follow the necessary international procedures. In our efforts to assist such customers with startup surveys and operation tests, we often hear that the customer wants to dispatch their own employees to Silicon Valley to develop their business locally.

With IT playing a more and more important role for companies, in November 2017, ITOCHU Techno-Solutions America opened a new "Open Innovation Lab" in Santa Clara, California, where our head office is located. The Open Innovation Lab provides the following functions as a place to create new businesses with our customers.

- A "co-working space" for Japanese companies without an office in Silicon Valley
- Assistance for information gathering and business development in Silicon Valley

At ITOCHU Techno-Solutions America, we use our more than 30 years of experience discovering / surveying local startup companies, procuring cutting-edge IT, and building systems, etc. in Silicon Valley to support the business development of our customers in the United States.

Connecting Our Customers in Japan to Silicon Valley via DEJIMA

CTC provides the "CTC Future Factory" platform for generating ideas by enabling companies and local governments, etc. in Japan that are involved in open innovation to link with venture companies. CTC also offers a dedicated space called "DEJIMA" to provide an opportunity to hold ideathons and hackathons and assist the examination of joint research and commercialization. DEJIMA provides a prototype development environment for swiftly incorporating new ideas in business. ITOCHU Techno-Solutions America introduces startups and partners in Silicon Valley to customers in Japan to assist the creation of new business via the Open Innovation Lab and DEJIMA.

Overview of DEJIMA

- 360° presentation equipment
- Project rooms
- Group workshop space
- Remote connections with the Open Innovation Lab



*Source: Survey of Japanese Companies in the Bay Area (2016) by the Japanese Chamber of Commerce of Northern California and JETRO San Francisco

News Pickup

Here is information on solutions and services, selected from CTC news releases, that are in the limelight.

AI

Providing a New Platform for Utilizing AI

CTC has started providing the “CTC Integrated AI Platform Stack” hybrid cloud environment for AI utilization, which systemizes the IT infrastructure technology required for AI development, such as data preparation, learning, and application development. This platform has been verified with a combination of servers and storage, public cloud services, and an AI framework, based on our long years of knowledge. The environment has also been deployed at our “Technical Solution Center” to provide multi-vendor verification according to customer objectives.

FinTech

Invested in Joint Venture for Digital Currency Financial Services

CTC has invested in the DeCurret Inc. joint venture that provides a financial service business for digital currency transactions and payments, which was established by Internet Initiative Japan Inc. on January 10, 2018. CTC works towards safer, high-speed, and low-cost blockchains and their application, and the synergy that arises from collaboration with DeCurret to contribute to the realization of a cashless society.

Corporate Assistance

Corporate Venture Capital Fund Established for Creating New Businesses

CTC established the “CTC Innovation Partners” corporate venture capital fund for the purpose of assisting startup companies and joint ventures with customers. This fund aims to provide funding and participate in business to assist the growth of promising startup companies and expand fields of business via co-creation with customers. The fund also links with “CTC Future Factory” to implement business participatory investment.

Cloud

AWS Premier Consulting Partner Certification Obtained

CTC obtained AWS Premier Consulting Partner certification, which is the top tier of the AWS Partner Network partner program for Amazon Web Services. This rated our experience providing consulting for AWS adoption and support services for environment construction and operation. We will continue to focus on further cultivating AWS engineers and expand new functions and services utilizing AWS to provide total support for customer system adoption.

Cloud

Providing a Multi-Vendor Test Environment via the Cloud

CTC started a cloud-based verification service that utilizes the CloudShell software from QualiSystems Ltd. to provide integrated control of physical IT devices and virtual machines and automatic configuration of the servers, storage, and networks, etc. required for verification. CloudShell has been adopted at our Technical Solution Center that enables integrated tests in multi-vendor environments, to provide remote operations relating to test environment construction and large-scale verification from various regions.

Global

Joint Venture in Thailand Made into a Subsidiary and Changed to “CTC Global (Thailand)”

In order to further enhance our business in the Kingdom of Thailand and Southeast Asia, we have made our Netband Consulting Co., Ltd. joint venture in Thailand into a subsidiary and changed its name to CTC Global (Thailand) Ltd. in order to actively promote our business with the CTC brand. We aim to expand the application development and SI service business by linking group companies in the ASEAN region including Thailand with group companies in Japan to provide optimal IT services to our customers at both local companies and Japanese companies.

Please visit the following for further details.

<http://www.ctc-g.co.jp/news/>



Golf Digest Editorial
**Practical Golf Theory
for Mental Toughness**

(With the cooperation of Team Serizawa Golf Academy)

Nobuo Serizawa

Born 1959; age 58. A lifetime record of five Japan Golf Tour wins, including the Japan PGA Match-Play Championship (1996). One Japan PGA Senior Tour win marked since becoming eligible. Currently heads Team Serizawa, which he formed with professional golfers Hiroyuki Fujita and Katsumasa Miyamoto. Opened a golf academy at the Daihakone Country Club. Has many fans and followers and is known for his easy-to-understand golf lessons.



Experience with other sports and our daily lifestyles provide hints for improvement

Many people think that they do not have a natural ability for golf because they seem to not be able to improve, no matter how much they practice. However, although practice is of course important for improvement, we can also use our experience with other sports and gain the feeling and rhythm of golf swings in our daily lifestyles. Let us take a look at some hints for improving our golf game that do not require us to swing a club.

Strokes of genius and epiphanies that cannot be reproduced are merely coincidence

Many amateur golfers have trouble improving their score despite practicing as hard as they can. Some may still hit slices and duffed shots like a beginner, even though they have been playing golf for years. How can these people get better at golf despite their slow improvement speed?

I often hear of golfers having suddenly experiencing a stroke of genius or an epiphany that enables them to immediately improve their game. However, in my experience, I have never got better at doing something so suddenly. For example, it is common for amateurs to make a shot that feels great while practicing

and think that they have found a trick. If they are able to repeatedly recreate a similar shot the next time that they are playing or in the next round, then they really may have had a stroke of genius. However, in reality, that feeling is usually gone by the next time they practice or even after practice that same day. A stroke of genius that cannot be recreated is, for lack of a better word, just a coincidence. Just being able to do something once does not guarantee that it will happen again.

Every sport holds hints applicable to golf swings

Practice can only make you better if you repeat the correct moves. Although you may become able to

repeat an inefficient move that you have designed yourself via a huge amount of practice, you will never be as good as someone who has practiced a lot with a sensible method. People that are trying hard to practice but do not improve may not be correctly thinking about what kind of swings can efficiently send a ball flying straight and far.

Another problem can be that the ideal swing that someone has in their head is completely different from how they are actually moving their body. If such people have experience with sports other than golf, they can use that experience to immediately correct their swing. I have experienced this myself many times in pro-am tournaments. For example, as

soon as I tell someone who has experience with baseball to swing the ball so that it will be pulled to the left, their slice is immediately corrected. Another example is telling them that a right hit is the worst type of hit in golf, which enables them to immediately understand the meaning behind their bad movement and correct it themselves.

Experience with ping-pong or tennis can also be of great help in terms of club face control. Although it can be hard to think of the “face” of a golf club because the shaft is long, the principle of orienting the face in the direction that one wants to hit the ball is the same as in ping-pong and tennis. People with experience in soccer have also been increasing in recent times, and even that experience can be utilized in golf. The principle of performing a place kick to curve the ball is the same as an intentional hook or slice and an in-front kick (kicking the ball straight on with the toes) to kick the ball low or high is similar to how the ball height is controlled in golf.

To put it simply, people with experience in sports other than golf understand swing movements and have the ability to recreate those movements with their body.



Hitting balls at a batting practice center to learn pacing and rhythm

For people that do not have experience with sports other than golf and are concerned that they are not improving, it can be good to visit a batting center, for example, to try and hit moving balls. Reacting to a ball flying towards you makes you react and move. This method is good because it teaches you the rhythm of taking a stance, drawing back, and then swinging. Many people who make mistakes in golf almost invariably have poor swing rhythm, and when they make consecutive mistakes it is usually because of a disturbance in their rhythm that caused it to go slower or faster.

The key to maintaining rhythm during a round of golf is to have a constant walking speed. When watching amateurs play golf, I see many people suddenly start to walk faster after they make a mistake. Others may feel down when they make a mistake and start walking a lot slower. Neither of these is good if one is to prevent making another mistake. Maintaining a constant walking speed equates to creating a rhythm of one's own accord. Paying attention to maintaining a constant walking speed in your daily life can help you to maintain your rhythm while playing golf.

Finally, I would like to teach you a practice technique that you can do at home that will certainly lead to an improvement if you do it every day. Simply swing around a soft object like a rubber hose with good rhythm. Alternatively, tie up the end of a bath towel and swing that around. This technique enables you to naturally learn the basic fundamental of golf swings, which is relaxing your upper body and moving from your lower body.

Message from Hikari Fujita,

a Female Professional Golfer
Supported by CTC

Hello, my name is Hikari Fujita. It has been cold recently, but are you all enjoying golf? Today I would like to give you some advice about playing in winter.

A simple method for warming up your body before starting is jumping up and down. This also helps warm up your body from the inside better than wearing warm clothing. It is also good to walk around briskly instead of riding the golf cart while playing. Make sure to keep moving and move your lower body in particular.

Since driver shafts become harder in cold weather, it is easier to make successful shots if you use a soft and light shaft, and this also helps prevent you from swinging too hard. When making iron shots, use a higher number iron until your body gets warmed up, and make quarter swings. I recommend low running approach shots. When using a wedge to clear hazards, etc., a low bounce wedge can prevent chunk shots when the turf is sparse around the lie. When putting, even if the green is heavy in the morning because it is frozen or wet, it can suddenly dry up and become fast if it is sunny in the afternoon. Therefore, take care with distances.

When playing in the winter, you can improve your score by understanding the conditions and playing carefully.



Hikari Fujita—born 1994. Started playing golf from age 3 with her father as her teacher. Passed the JLPGA pro test in 2013. First win as a pro was the JLPGA Kaga Electronics Rookies Cup. Achieved her long-sought win in a regular tournament in 2015.



Akihiko Mori
Science Writer

Writes articles relating to emerging science and technology for various media. Interested in the fields of AI, robotics, and outer space development, etc.

This issue's number is...

Approx. **37** trillion yen
The scope of the entire outer space industry

In 1969, the Apollo 11 mission landed humans on the moon for the first time, and the command module of that mission was called "Columbia."

Astronaut Neil Armstrong says that the name "Columbia" came from the fictional spaceship featured in a story by historical science fiction writer Jules Verne. That story was written approximately 100 years before the great achievement of Apollo 11.

Today, mankind is aiming to travel to Mars, half a century after the moon landing. What's more, these efforts for outer space development are being privately funded.

The outer space industry, with a market scope of approximately 339.1 billion dollars (approximately 37 trillion Japanese yen*), is reaching a turning point. Traditionally, outer space development was led by national governments and heavy industry companies were the major players in the industry, but now private companies are entering the market one after the other. The major figure at the center of this trend is Elon Musk, leader of the space exploration venture company called SpaceX.

In March 2017, Mr. Musk achieved a historical milestone. His company successfully launched a commercial satellite via a reusable rocket. Despite rocket development consuming a huge amount of money, the greater part of a rocket is traditionally disposable. A reusable rocket dramatically reduces launch costs and greatly lowers the hurdles to outer space exploration.

A large number of private venture companies in Japan also aim for space exploration. The concept of Axelspace Corporation, which develops microsatellites, is to provide "big data for the entire globe" via satellite photos.

This company plans to achieve a global observation network by capturing approximately half of the Earth's land (corresponding to almost all the land where humans conduct economic activities) once a day. There is a market for utilizing

the big data obtained from the satellite photos in area marketing, etc. for surveying the flow of people and traffic around locations where large-scale commercial facilities are scheduled to be built.

Analyzing big data with AI is currently enabling business and urban planning to obtain useful information that cannot be ascertained with conventional analytic and statistical methods. There is great potential value in the future information that will be obtained by using AI to analyze the big data derived from various land-based sensors and artificial satellites.

Space exploration company "ispace," which develops original unmanned exploration vessels and landers and aims to achieve the first private moon exploration in the world, made news by raising record largest series A funding of 10.15 billion yen in December 2017. This was the largest funding for a Japanese startup company in Japan and the largest funding in the outer space industry in the world. This company, which was established in 2010, predicts that 1,000 people will live on the moon by the year 2040, and is developing a business for building outer space infrastructure based on the water resources on the moon.

Outer space exploration, which was only a story 150 years ago, is now a giant industry that is looking to take the next step forward in the history of mankind.

*Market scope in 2016 according to the "State of the Satellite Industry Report" of the Satellite Industry Association. Figures in Japanese yen calculated based on the exchange rate current as of February 2018.

[References]

Scott, David Meerman and Jurek, Richard. *Marketing the Moon: The Selling of the Apollo Lunar Program*. The MIT Press.
Ishida, Masayasu. *Introduction to the Outer Space Business; The Full Picture of the New Space Revolution*. Nikkei Business Publications. (Japanese only)
<http://techon.nikkeibp.co.jp/atcl/column/15/417245/04100022/?rt=nocnt>
<https://www.axelspace.com/axelglobe/>
<https://ispace-inc.com/jpn/news/?p=499>
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▶ *Challenging Tomorrow's Changes*